Extracts from References cited in Report by Phil Crowcroft titled Proposed housing development adjacent to Dix Pit Landfill, Stanton Harcourt, dated June 2017

Number	Reference
1	Environment Agency, Dix Pit Odour Complaints Summary, July 2007;
2	British Geological Survey, Geology of Britain Viewer, http://mapapps.bgs.ac.uk/geologyofbritain/home.html, 2017;
3	Environment Agency email, reference folder of reports and data on Dix Pit, 2017;
4	FCC Environment, Dix Pit Landfill Annual Environmental Summary Report, 2012;
5	FCC Environment, Dix Pit Landfill Annual Environmental Summary Report, 2014;
6	FCC Environment, Dix Pit Landfill Annual Environmental Summary Report, 2016;
7	Department for Communities and Local Government, National Planning Policy Framework, 2012, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/6077/2116950.pdf ;
8	Department for Communities and Local Government, Planning Practice Guidance, 2016;
9	Vale of White Horse District Council, Planning Decision note, Refusal of Planning Permission at Christ Church Hobbyhorse Lane Sutton Courtenay ABINGDON OX14 4BB, Ref P16/V2306/O , 2016;
10	Department of the Environment, Waste Management Paper No 27, Landfill Gas: A Technical Memorandum Providing Guidance on the Monitoring and Control of Landfill Gas, 2nd Edition, 1991
11	http://www.ourloscoe.co.uk/history.asp Landfill gas explosion, 1986
12	BBC News, Gorebridge homes to be demolished after carbon dioxide gas leak, 2014 http://www.bbc.co.uk/news/uk-scotland-edinburgh-east-fife-27905611
13	The Incident Team (Central and Eastern Cheshire NHS, Vale Royal Borough Council and the HPA), Report into the circumstances around two cases of Acute Myeloid Leukaemia, 2008
14	The Independent, Chemical dump village faces total disintegration, 2000, http://www.independent.co.uk/environment/chemical-dump-village-faces-total-disintegration-710457.html
15	Manchester Evening News, Timeline for the old Hancock tip in Boothstown, 2011, http://www.manchestereveningnews.co.uk/news/greater-manchester-news/timeline-for-the-old-hancock-tip-in-boothstown-867421

Reference 1

Environment Agency, Dix Pit Odour Complaints Summary, July 2007;

Dix Pit Odour Complaints Summary
Last updated on 11 July 07

Date reported	Time reported	Time noticed	Location	Intensity (out of 10)	NIRS Ref
21-Mar-07	21:40	Last 8 weeks	Linch Hill Cottages	7/10	478749
04-Apr-07	16:19	Last 2 days	Black Ditch		482563
11-Apr-07	12:05	07:00 that morning and 21:30 last night	Steadys Lane	10/10	484278
25-Apr-07	09:26	Last 2 weeks but especially on 16-Apr, 21-Apr, 22-Apr, 23-Apr	The Green	10/10 on 22-Apr pm	489312
14-May-07	22:31	13:00, 18:00	Linch Hill Cottages	4/10 and 5/10	494894
22-May-07	23:03	At the time	Main Road, Stanton Harcourt	10/10	496948
25-May-07	11:34	Tues/Wed/ Thurs/Fri	Linch Hill Cottages	9/10	497730
25-May-07	11:56	Day 5/10, evening 9/10	Linch Hill Cottages	5/10 – 9/10	497742
03-Jun-07	08:32	31 May, 2 June, 3 June	The Green	"Very strong"	499759
11-Jun-07	22:36	22:30	The Green	-	502274
11-Jun-07	22:41	22:41	Main Road	"Strong"	502275
12-Jun-07	09:39	08:45-09:00	The Green	7/10	502328
12-Jun-07	09:40	06:15	The Green	8/10	502327
12-Jun-07	09:59	Last night, this morning	The Green	10/10 last night, 3/10 this morning	502342
15-Jun-07	20:25	At present	The Green	Strong/ gassy	504101
26-Jun-07	10:29	Wed 20th at 12:00 Sun 24th at 09:00	The Green	"Smell"	507848
28-Jun-07	07:44	07:30	The Green	Very strong	508596

Reference 2

British Geological Survey, Geology of Britain Viewer, http://mapapps.bgs.ac.uk/geologyofbritain/home.html, 2017;


Sutton
Sutton Lane
Cogges Lane
Stanton
Harcourt
Main Road
Stanton Harcourt, Oxfordshire
Lakeside
Industrial
Estate

Reference 3

Environment Agency email, reference folder of reports and data on Dix Pit, 2017;

Hector Camm

From: Enquiries_THM <enquiries_THM@environment-agency.gov.uk>
Sent: 04 May 2017 11:16
To: Phil Crowcroft
Subject: RE: Dix Pit, Stanton Harcourt, Oxfordshire
Attachments: Pollution incidents with 2 km radius of centre of site.xlsx

Dear Mr Crowcroft

Thank you for your request for information on Dix Pit Landfill, Stanton Harcourt, Oxon.

Please find attached the pollution incidents within the area of the landfill recorded on our Nation Incident Reporting System.

We have retrieved the documents pertaining to the landfill over the past ten years from our public register. The documents have been uploaded to the Sharefile link below. **Please be aware that the link is only accessible for 30 days**.

https://ea.sharefile.com/d-s1cc9615aaf240859

I hope that we have correctly interpreted your request. Please refer to our Open Government Licence to see how you may use the supplied data: http://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/

Did you know that many of our datasets are available online? Simply visit environment.data.gov.uk

We respond to requests for recorded information that we hold under the Freedom of Information Act 2000 (FOIA) and the associated Environmental Information Regulations 2004 (EIR).

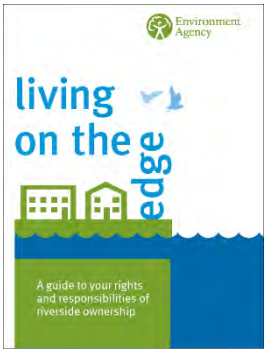
Please get in touch if you have any further queries or contact us within two months if you would like us to review the information we have sent.

Kind regards

Julia Hewitt
Customers and Engagement Officer

Customers and Engagement
Environment Planning and Engagement
Environment Agency
Thames Area
Red Kite House, Howbery Park, Wallingford, OX10 8BD

Telephone: 020302 59673



Do you use the Living on the Edge booklet?

We are reviewing the document and would love to know what you think!

Please take a few minutes to **take the survey** before **30th April 2017**.

From: Phil Crowcroft [mailto:Phil.Crowcroft@erm.com]
Sent: 05 April 2017 11:48
To: Enquiries_THM <enquiries_THM@environment-agency.gov.uk>
Subject: Dix Pit, Stanton Harcourt, Oxfordshire

Dear EA
I am retained by Stanton Harcourt Parish Council to assess the issues associated with proposed development of land for housing immediately adjoining an actively gassing landfill. I would be grateful for provision of the following information related to the landfill operated by FCC Environment known as Dix Pit landfill, Stanton Harcourt, and shown on the attached drawing:

1. The most recent version of the Environmental Permit for operation of the landfill
2. Details of the landfill gas and leachate control systems at the site as currently operating.
3. Monitoring data from boreholes at the edge of the site along the northern and northeastern boundary of the landfill, where it adjoins the proposed housing development site, shown edged red on the attached drawing, if possible covering the last ten years.
4. Records of any breeches of the permit over the last ten years
5. Records of complaints of odour or gas migration related to the landfill over the last ten years.

I appreciate that this request may involve significant amounts of data, and would be grateful if there are any problems providing the data, that you call me to discuss what is feasible. I can best be contacted on 07795 395088.

The proposed housing development will be the subject of a Local Plan Inquiry in mid May, so I would be grateful for the information to be provided as soon as reasonably practical.
Please don't hesitate to call or email if you need to discuss
Many thanks in anticipation
Phil

Phil Crowcroft

Partner and Technical Fellow

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T +44 131 221 6801 │**M** +447795 395088
E phil.crowcroft@erm.com │ **W** www.erm.com

Reference 4

FCC Environment, Dix Pit Landfill Annual Environmental Summary Report, 2012;

DIX PIT LANDFILL SITE

Permit BV7214IR
Variation XP3032UG

ANNUAL ENVIRONMENTAL SUMMARY REPORT

January to December 2012

March 2013

FCC Environment
Appleford Sidings
Sutton Courtenay
Abingdon
OX14 4PW

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Appendices

APPENDIX A	Dix Pit Site Plan
APPENDIX B	Perimeter Gas Data
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APPENDIX E	Trace Gas Composition Data
APPENDIX F	Engine Emissions Data
APPENDIX G	Leachate Quality Data
APPENDIX H	Leachate Level Data
APPENDIX I	Groundwater Quality Data
APPENDIX J	Groundwater Level Data
APPENDIX K	Surface Water Quality Data

1.0 Introduction

This annual environmental monitoring report for Dix Pit has been produced in accordance with condition 4.2.1a of the Environmental Permit (BV7214IR, Variation XP303UG) and considers the results of environmental monitoring at Dix Pit landfill site undertaken between 1 January 2012 and 31 December 2012.

The environmental report includes:

- A background summary of the site and its environmental setting.
- A summary of the environmental monitoring data obtained.

This annual report looks at monitoring data in comparison to trigger levels specified in the permit and its impact on the surrounding environment.

2.0 Background

Dix Pit landfill site is located south of Stanton Harcourt village, Oxfordshire (SP 414 048), 10 miles from the centre of Oxford City. It has been an operational landfill site since 1985, formerly a gravel pit operated by Hanson. Oxfordshire County Council granted a waste disposal licence in 1985. Planning permission W2/84 was granted on 27 June 1985 for the disposal of commercial, industrial and domestic wastes to restore the quarry void. The landfill is engineered as a containment system with associated leachate and landfill gas management. An environmental monitoring plan of Dix Pit is provided in Appendix A.

3.0 Landfill Gas

3.1 Perimeter Boreholes

Landfill gas monitoring was undertaken on a monthly basis throughout 2012 at 31 boreholes. The gas data reviewed in this report is data collected during scheduled monthly monitoring; any additional monitoring carried out is not included. At each borehole the following parameters were measured; methane (%v/v), carbon dioxide (%v/v) and oxygen (%v/v) along with on site weather conditions.

Appendix B details all perimeter gas data for 2012.

3.1.1 Methane Concentrations

Table 3.1 shows monthly methane compliance for the perimeter boreholes. Average methane compliance in the perimeter boreholes for 2012 was 99.5%, slightly up on the previous year.

Table 3.1 Monthly methane compliance for perimeter boreholes

Month	Methane (% compliance)
January	100
February	100
March	100
April	100
May	96.8
June	100
July	100
August	100
September	100
October	100
November	96.8
December	100
January – December 2012 (average)	**99.5**

Methane was detected at greater than the trigger level of 1%v/v in just one borehole, G18, this occurred in May 2012. The maximum concentration detected in borehole G18 was 19.6%v/v on 10th May. Figure 3.1 shows methane and carbon dioxide concentrations in borehole G18 throughout 2012. Methane peaked in May and November, while declining and remaining below the trigger level throughout the rest of 2012.

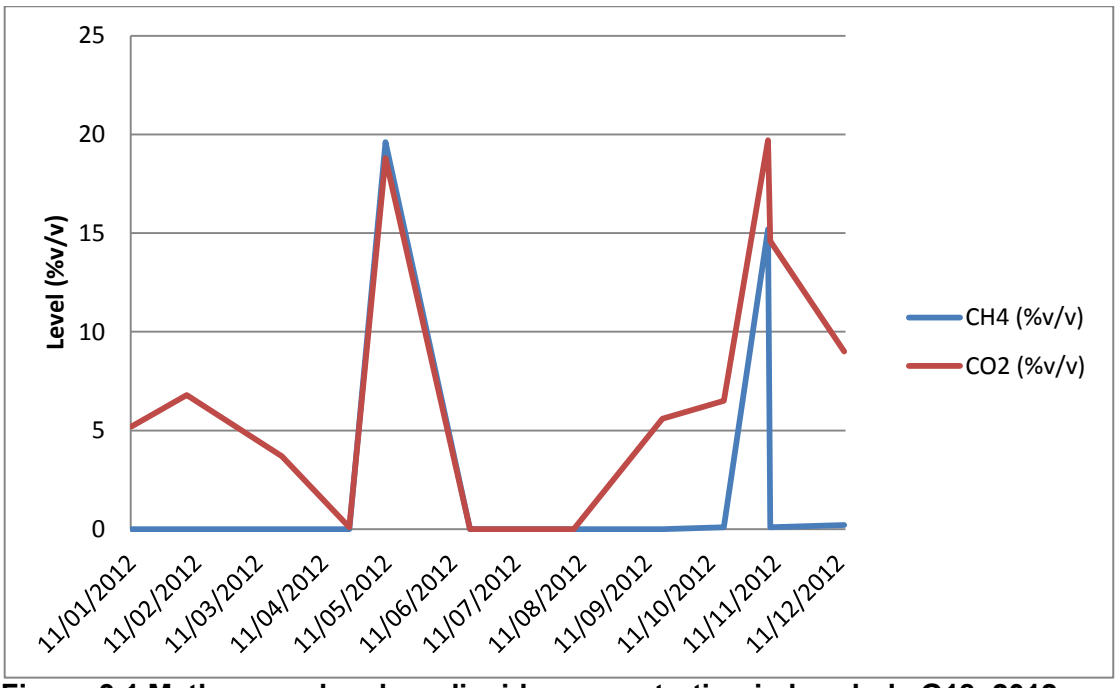

Figure 3.1 Methane and carbon dioxide concentration in borehole G18, 2012

3.1.2 Carbon Dioxide concentrations

Table 3.2 shows the monthly compliance for carbon dioxide for the perimeter boreholes. The average carbon dioxide compliance for 2012 was 96.5%, a deterioration of 1.6% on 2011. Trigger levels for carbon dioxide are set at 1.5%v/v above agreed background concentrations. Seven boreholes in total exceeded their triggers for carbon dioxide during the year; G18, G36, G43 and GBH14, GBH39, GBH40 and GBH42. The maximum carbon dioxide concentration was detected in borehole G18 at 19.7%v/v during routine monitoring in November.

Table 3.2 Monthly carbon dioxide compliance for perimeter boreholes

Month	Carbon Dioxide (% compliance)
January	96.8
February	96.8
March	100
April	100
May	96.8
June	100
July	100
August	97.7
September	93
October	93
November	90.7
December	93
January – December 2012 (average)	**96.5**

3.2 Surface emissions

An FID survey of all capped areas of site was carried out in June 2012. This survey showed that all points were within the EA standards. Please note that Cell 3J and 3K is temporarily capped and will have an FID and Flux boxed in summer 2013. The results of the FID surveys are presented in Appendix C.

3.3 Gas extraction wells

Landfill gas is controlled by an active gas extraction system, which creates an inward pressure gradient across the landfill to minimise potential off site migration. There is a power generation system located on site, which consists of two Jenbacher 320 engines, each with a capacity of 1.065 MW. As a back up there is a Hasse high temperature flare. Gas wells are monitored monthly as a minimum. Data is presented in Appendix D.

3.4 Gas extraction system

Trace gas analysis for Dix Pit gas extraction system was carried out on 22nd February 2012 in accordance with Condition 3.6.1 Table S4.7. The results can be seen in Appendix E.

3.5 Emissions to air

Emissions to air from the flare and engines are monitored on an annual incidence and were carried out on the 22nd February 2012. The results are available in Appendix F.

The monitoring data obtained shows that engine 1 exceeded the standard for carbon monoxide (CO) but remained within the limit of uncertainty. Engine 1 and 2 were both fully compliant for nitrogen oxides (NOx) and total volatile organic compounds (TVOC) against the emission standard. Non-methane volatile organic compounds (NMVOC) were not sampled this year following the re-issue of EA Guidance LFTGN08, which states that NMVOC sampling is no longer required.

The flare was operational for less than 10% of the time, so in this instance emission monitoring was not required.

4.0 Leachate Review

4.1 Leachate Quality

Leachate samples are required to be taken from 20 leachate wells on a six monthly basis in accordance with Condition 3.6.1a Table S4.8 of the variation permit. In total 16 leachate wells were sampled from Phase 1, 2 and 3 in April and October 2012. Cells 3D, 3K and LC5 have consistently not been able to provide sufficient liquid to sample whereas LC4 and cell 3F was unable to provide sufficient liquid in April and October respectively.

Leachate quality data is summarised in Appendix G.

In this section of the report the leachate analytical data for 2012 is compared to the input parameters derived from on site monitoring data used in the Hydrogeological Risk Assessment Review 2008, hereafter called the 2008 HRA. The 2008 HRA modelled for five List I substances; Cadmium, Chlorobenzene, Mecoprop, Naphthalene and Xylene; and two List II substances, Ammoniacal nitrogen and chloride. Chlorobenzene, Mecoprop, Naphthalene and Xylene were chosen due to their association with landfill leachate and chloride for its conservative nature. The leachate analytical data from 2012 has been compared against the minimum, mean and maximum input parameters detailed in the 2008 HRA, which is provided in Table 4.1 below for Phases 1 and 2.

Table 4.1 Leachate Quality Input Parameters Phase 1 and 2

	HRA modelled source term			**2012 data**		
	Minimum	Mean	Maximum	Minimum	Mean	Maximum
Ammoniacal Nitrogen (mg/l)	40	510	1390	50.4	290.4	681
Chloride (mg/l)	199	767	2470	81	688.1053	1430
Cadmium (mg/l)	0.0005	0.0011	0.0086	0.0001	0.000105	0.0002
Chlorobenzene (mg/)	0.0001	0.001	0.275	0.001	0.0021	0.008
Xylene (mg/l)	0.0001	0.001	0.0357	0.002	0.0028	0.009
Mecoprop (mg/l)	0.0001	0.01	0.102	0.00075	0.002963	0.00548
Naphthalene (mg/l)	0.0001	0.001	0.0357	0.00002	0.003257	0.00684

All points sampled on Phases 1 and 2 for Ammoniacal Nitrogen showed concentrations of less than the maximum input values, the maximum concentration was detected in well GL3.4 at 681mg/l. The mean concentration for Ammoniacal nitrogen is 290.4mg/l, below the mean value modelled in the HRA.

The maximum value for chloride was 1430mg/l, well below the 2008 HRA maximum input. The minimum figure is below the input parameters stipulated in the 2008 HRA at 81mg/l. The mean value is 688.1mg/l which is below the input parameter of 767mg/l modelled in the HRA.

The maximum concentration of Mecoprop for 2012 was 0.00548mg/l at well LE4 in October which is below the input parameter of 0.102mg/l. The mean concentration was 0.003mg/l, well below the modelled mean parameter of the HRA.

All results were below the maximum input parameter for Xylene. The maximum during 2012 was detected in leachate well GL1.3 at 0.009mg/l, below the maximum of 0.0357mg/l modelled in the HRA.

Cadmium concentration in all samples from Phases 1 and 2 was less than input parameters in the HRA. The maximum concentration was 0.0002mg/l and the mean was 0.000105mg/l, below the mean input parameter of 0.0011mg/l modelled.

Chlorobenzene had a maximum concentration of 0.008mg/l during 2012, detected in leachate well LE4 in October. All concentrations for Chlorobenzene were below the maximum modelled parameters but the minimum and mean were above the modelled parameters.

Naphthalene had a maximum concentration of 0.00684mg/l, below the modelled parameter of 0.0357mg/l. The mean concentration was 0.003mg/l, above the modelled parameter of 0.001mg/l.

Set out below in Table 4.2 is the leachate quality input parameters modelled in the 2008 HRA for Phase 3.

Table 4.2 Leachate Quality Input Parameters Phase 3

	HRA modelled source term			**2012 data**		
	Minimum	Mean	Maximum	Minimum	Mean	Maximum
Ammoniacal Nitrogen	40	510	1390	5.5	1036.346	1910
Chloride	199	767	2470	49	1110.846	2110
Chlorobenzene	0.0001	0.01	0.275	0.001	0.001	0.001
Xylene	0.0001	0.001	0.0244	0.002	0.018667	0.054
Mecoprop	0.0001	0.001	0.102	0.0004	0.0004	0.0004
Naphthalene	0.0001	0.01	0.044	0.00002	0.001733	0.005

In Phase 3 the maximum concentration for Ammoniacal Nitrogen detected was 1910mg/l which is above the maximum 2008 HRA input parameter at 1390mg/l, this was detected in cell 3G in October.

The maximum chloride concentration was 2110mg/l in cell 3G, below the maximum input parameter. However, the data shows that the mean chloride concentration of 1110.8mg/l is above the modelled parameter of 767mg/l.

Xylene concentration was at its maximum at leachate well Sump 3e, recorded at 0.054mg/l and thus above the maximum 0.0244mg/l modelled in the HRA. The mean concentration was 0.019mg/l, again above the modelled parameter in the HRA.

Mecoprop had a maximum concentration of 0.0004mg/l, significantly the modelled parameter of 0.102mg/l. The mean concentration was 0.0004mg/l, significantly below the modelled parameter.

Naphthalene had a maximum concentration detected at 0.005mg/l which is below the modelled parameter. The mean concentration was 0.002mg/l which is also below the modelled parameter as highlighted by the HRA.

Chlorobenzene mean and maximum concentrations were detected at 0.001mg/l in Phase 3 during 2012, below the maximum and mean parameters modelled by the HRA.

4.2 Leachate Levels

Leachate levels are monitored on a monthly incidence. Leachate levels are assessed against the assumptions made within the HRA and the trigger levels set out in Table S4.1 of the variation permit.

The results can be found in Appendix H.

In Phase 1 and 2 the average leachate level generally increased during 2012, see Figure 4.1. The levels ranged between a maximum of 70.526mAOD in leachate well LC9 on the 17th October and a minimum of 60.971mAOD also in well GL4.1 on 11th July. The average leachate level in Phase 1 and 2 was 66.44mAOD, 2.78m above the consent level.

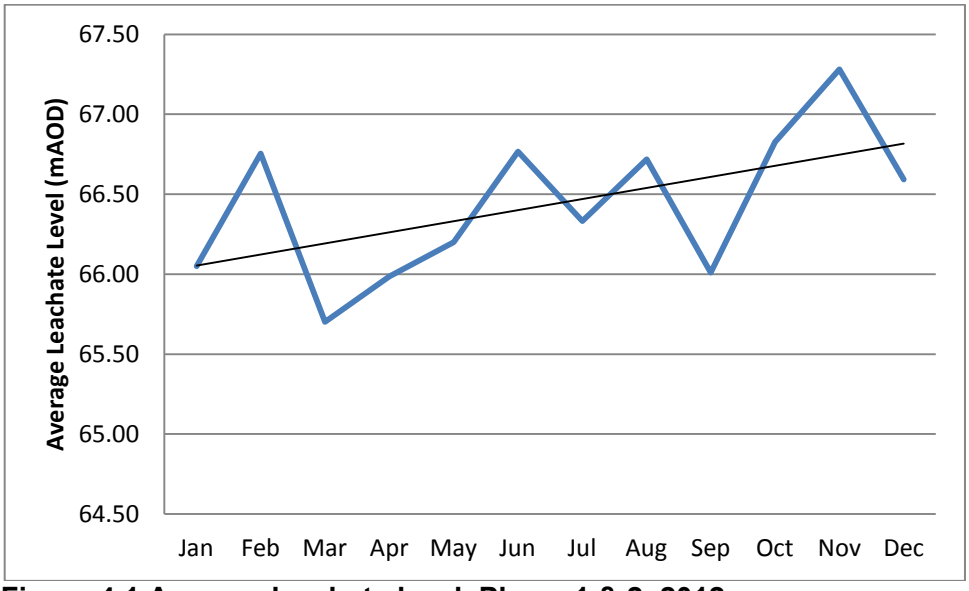

Figure 4.1 Average leachate level, Phase 1 & 2, 2012

Leachate levels across Phase 3 were generally increasing slightly during 2012. The year started off with an decrease and flat lined at the start of the year before then gradually increasing from August through to end of the year, see Figure 4.2. The levels ranged between a maximum of 68.015mAOD in leachate LC20 in October, and a minimum of 53.581mAOD in Sump 3K in May. The average leachate level in phase 3 was 61.96mAOD, which is below the trigger level of 64mAOD.

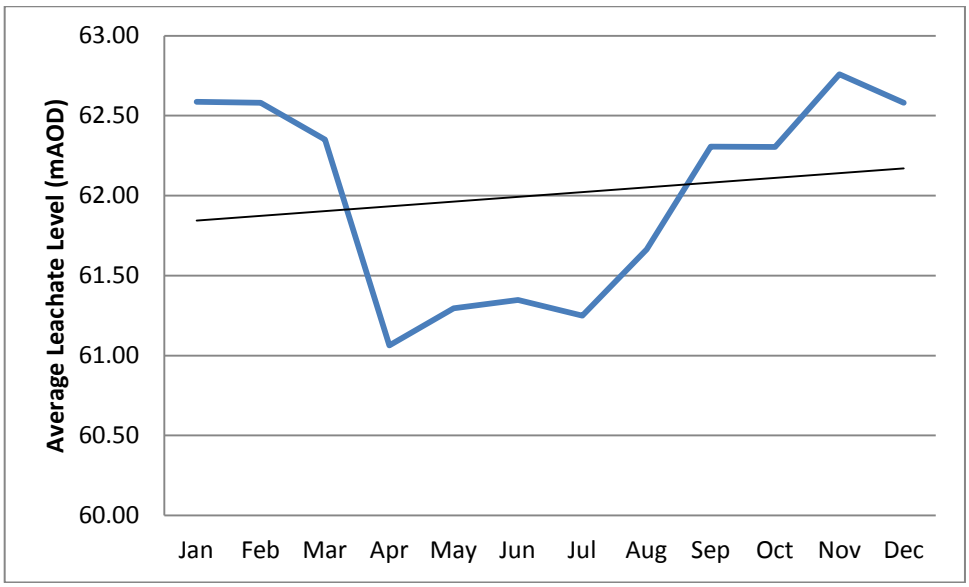

Figure 4.2 Average leachate level, Phase 3, 2012

The 2008 HRA modelled for a maximum of 1.75m leachate head above groundwater for Phases 1 and 2. In order to assess this, peripheral leachate wells were selected and compared to nearby groundwater levels and illustrated in Figures 4.3 - 4.6.

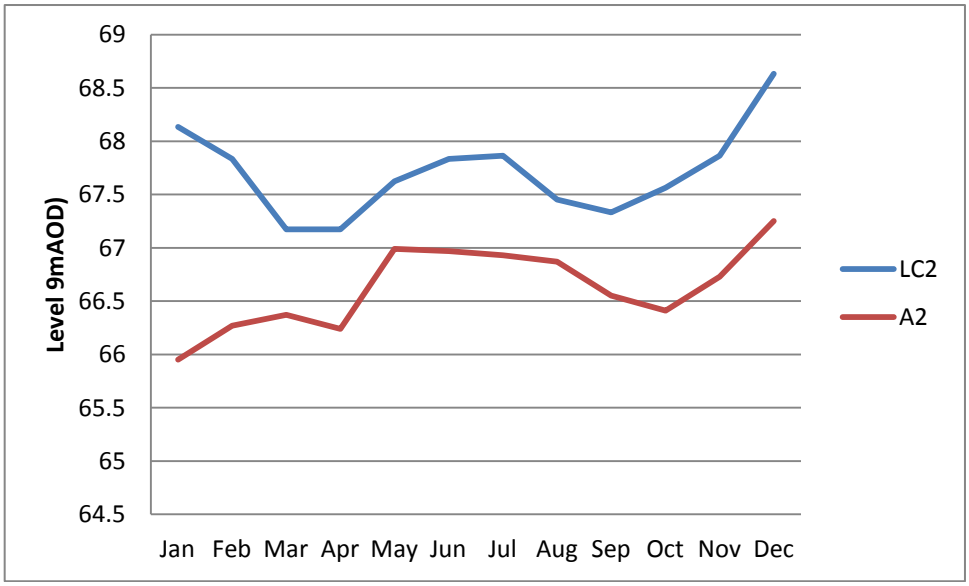

Figure 4.3 Comparison of Leachate Level in LC2 with Groundwater Level in A2

Figure 4.3 shows the leachate level in well LC2 and groundwater level in borehole A2 during 2012. Leachate level is continually less than 1.75m above the groundwater level apart from in Jan 2012.

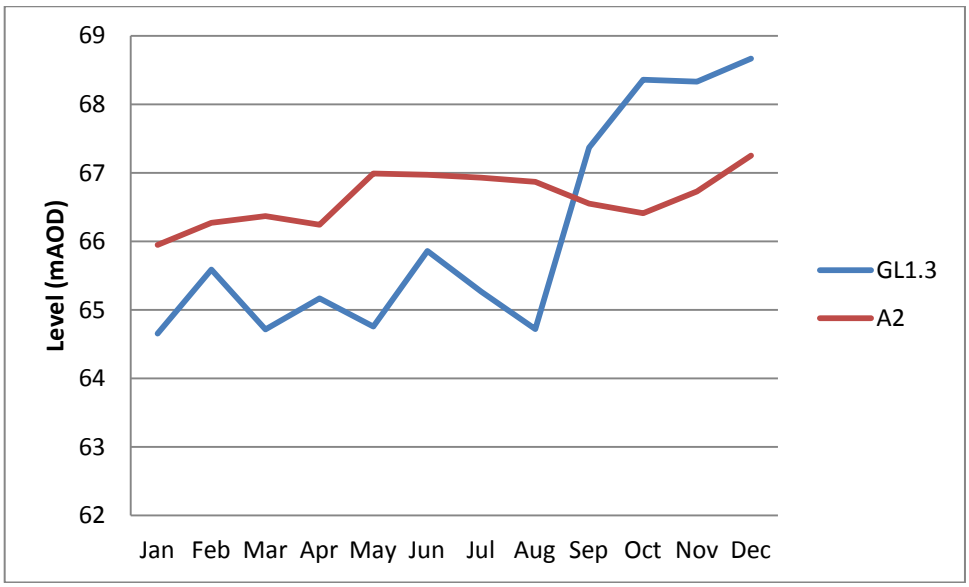

Figure 4.4 Comparison of Leachate Level in GL1.3 with Groundwater Level in A2

Figure 4.4 shows the leachate level in well GL1.3 and groundwater level in borehole A2 during 2012. Leachate level is below the groundwater level, below the 1.75m allowable head during 2012 apart from in May 2012.

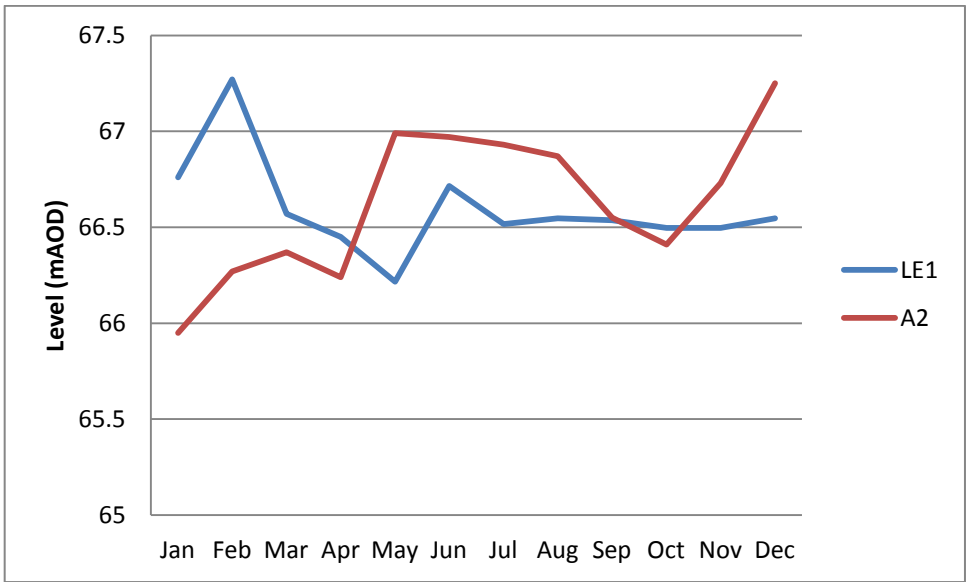

Figure 4.5 Comparison of Leachate Level in LE1 with Groundwater Level in A2

Figure 4.5 shows the leachate level in well LE1 and groundwater level in borehole A2 during 2012. The leachate level is continuously less than 1.75m above the groundwater level throughout 2012.

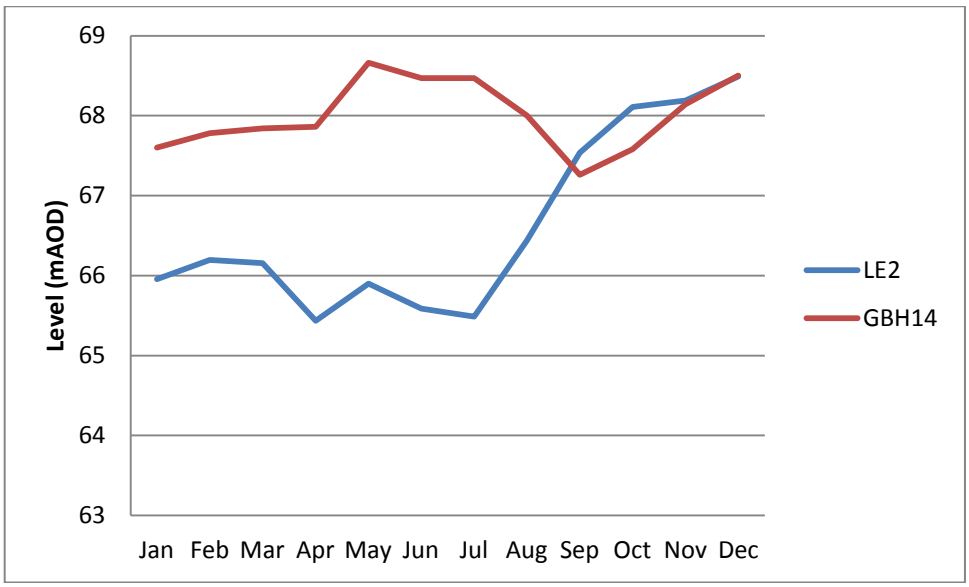

Figure 4.6 Comparison of Leachate Level in LE2 with Groundwater Level in GBH14

Figure 4.6 shows the leachate level in well LE2 and groundwater level in boreholes GBH14 during 2012. Leachate level was below 1.75m above the groundwater level for the whole of 2012.

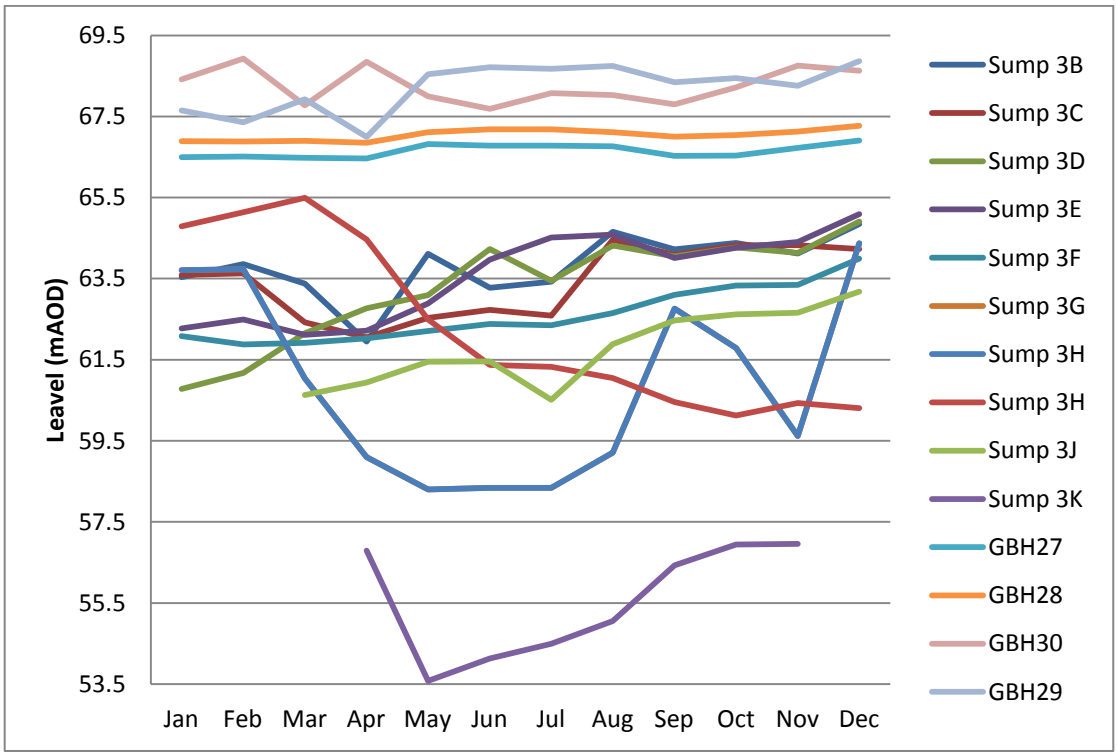

Figure 4.7 Comparison of Groundwater Levels (Blue) with Leachate Levels (Red) in Phase 3, 2012

Figure 4.7 illustrates groundwater levels and leachate levels around Phase 3 during 2012. It clearly demonstrates that leachate levels remain below groundwater levels, and therefore in hydraulic containment. GBH 27 remained considerably lower than other groundwater levels across the site, tracing a similar trend as leachate levels through the last quarter of the year.

5.0 Groundwater Review

5.1 Groundwater Quality

Groundwater sampling was scheduled to be undertaken quarterly and every 6 months from 25 boreholes. Due to elevated concentrations in some boreholes additional sampling was undertaken in some additional months throughout 2012.

Naphthalene

Naphthalene was compliant in all the groundwater boreholes across the site in 2012. The minimum concentration detected was less than 0.02ug/l in most of the groundwater boreholes during 2012. The maximum concentration detected was 0.85ug/l in groundwater GBH29 in July and the overall mean concentration was 0.08ug/l in 2012.

Chlorobenzene

Chlorobenzene concentrations were compliant in all groundwater boreholes during 2012. The concentration of Chlorobenzene detected was <1ug/l in all groundwater boreholes during 2012.

Xylene

Xylene concentrations were compliant in all groundwater boreholes during 2012. The concentration of Xylene detected was <2ug/l in all groundwater boreholes during 2012.

Ammoniacal Nitrogen

Ammoniacal Nitrogen concentration was detected above trigger levels groundwater boreholes in during 2012. An elevated concentration of Ammoniacal nitrogen was detected in groundwater borehole GBH20 at 4.4mg/l respectively in April and at 4.7mg/l in October.

Ammoniacal nitrogen concentrations in groundwater borehole GBH20 during 2012 is shown on the graph provided below in Figure 3.2.

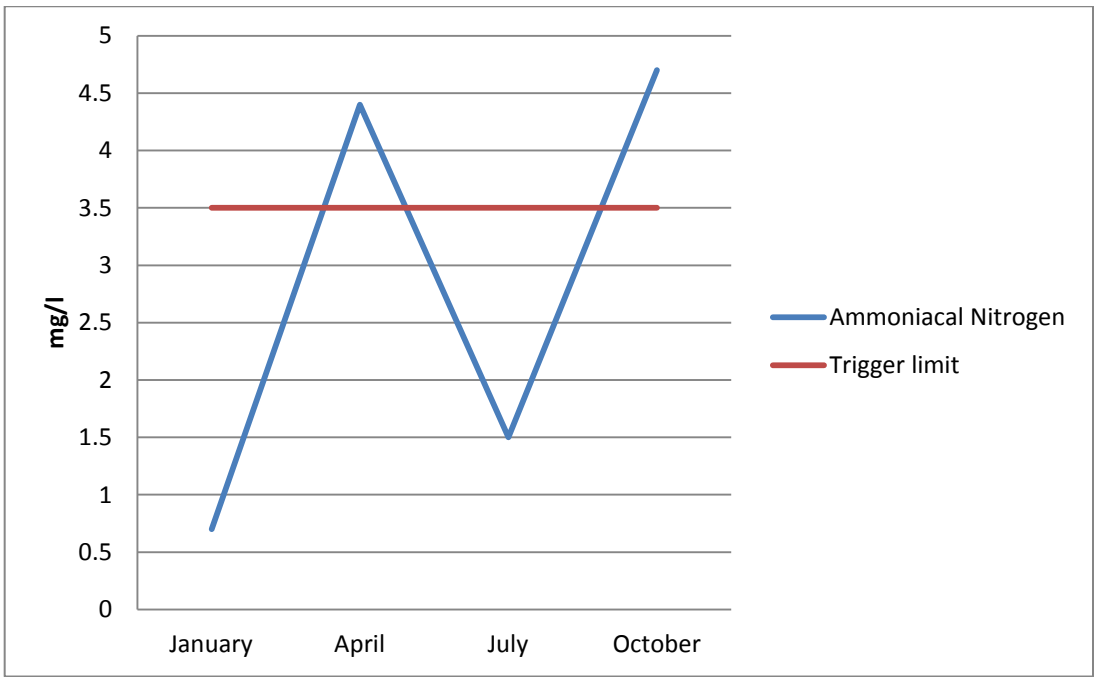

Figure 5.1 Ammoniacal nitrogen concentrations in groundwater borehole GBH20 during 2012

Mecoprop

Mecoprop concentrations in general were below trigger levels in all groundwater boreholes during 2012 the only exception was groundwater borehole GBH20. It was tested in April and had an elevated concentrations of 0.11ug/l. A further test in October showed Groundwater in GBH20 at 0.02ug/l which is lower than the trigger level.

Chloride

Chloride concentration was generally below trigger level in all groundwater boreholes during 2012 exception of GBH20 which breached in all for quarters. This has been confirmed by an Environment Agency (EA) report to be from an offsite source with new trigger due to be submitted to the EA in 2013.

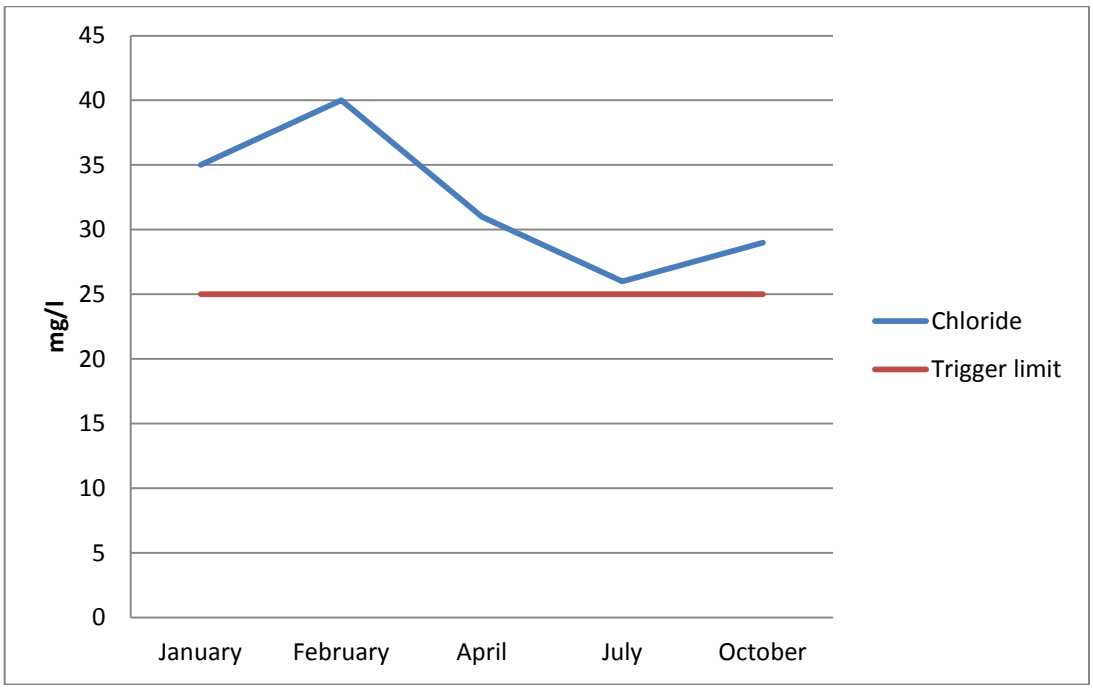

Figure 5.2 Chloride concentrations in groundwater borehole GBH20 during 2012

The groundwater quality data is tabulated in Appendix I.

5.2 Groundwater levels

Groundwater level data was recorded on a monthly basis from 25 boreholes located around the permitted area. Groundwater quality monitoring was undertaken on a quarterly and six monthly basis from these 25 boreholes.

Groundwater levels ranged from 65.6 mAOD (borehole GBH42, January 2012) to 68.92 mAOD (borehole GBH30, February 2012).

Seasonal variation was exhibited in most of the boreholes throughout the year, with levels gradually increased from January through to May then groundwater levels started to decreases through to September and then started increasing again towards the end of the year. (See Figure 3.1).

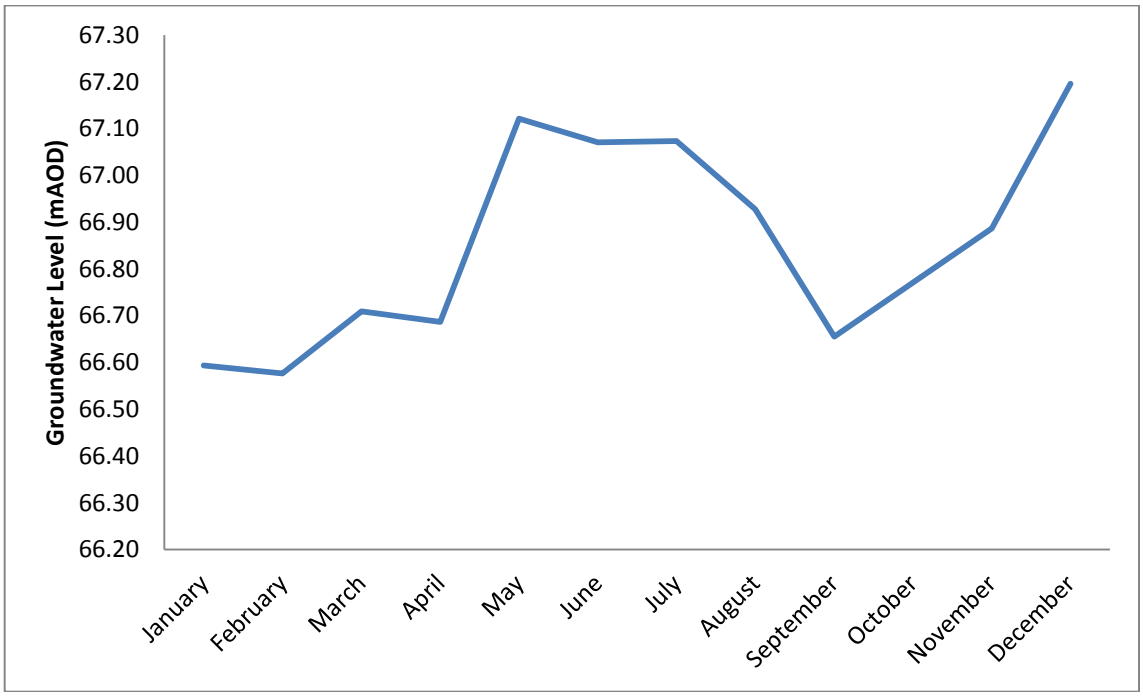

Figure 5.2 Average groundwater levels across Dix Pit

Appendix J includes all groundwater level data for 2012.

6.0 Surface Water Review

6.1 Surface Water Quality

Surface water quality is monitored on a monthly incidence from SW6 Discharge, into Dix Pit Lake. Due to the dry weather at the start of 2012 the only sample was obtained during September the discharge was not running at the time of monitoring during the remaining months of the year. The results are available in Appendix K.

Ammoniacal nitrogen, chloride and Suspended solids concentrations all remained well below their respective triggers of 5mg/l, 200mg/l and 35mg/l. The Ammoniacal Nitrogen concentration detected was 0.03mg/l. The chloride concentration detected was 39mg/l. The suspended solids concentration detected was 8mg/l

7.0 Conclusions

There was an overall improvement in gas compliance compared to 2011. Methane in borehole G18 was detected above trigger between May and November only and remained compliant for the rest of 2012.

The surface emissions that were detected through the FID survey showed that the site was within the Agency standard.

Leachate quality data was compared against the parameters as set out in the 2008 HRA. The quality of the leachate in Phases 1, 2 and 3 was within the input parameters modelled for all samples apart from In Phase 3 the maximum concentration for Ammoniacal Nitrogen detected was 1910mg/l which is above the maximum 2008 HRA input parameter at 1390mg/l, this was detected in cell 3G in October.

The maximum chloride concentration was 2110mg/l in cell 3G, below the maximum input parameter. However, the data shows that the mean chloride concentration of 1110.8mg/l is above the modelled parameter of 767mg/l.

Leachate levels remain within the levels assumed in the 2008 HRA.

Groundwater quality was generally good with a number of boreholes breaching however after resample were found to be compliant, borehole GBH20 was the only sample point to have exceeded it trigger for consecutive months however a report undertaken by the EA suggests that other sources may be affecting this, the EA findings were confirmed with further investigation that were undertaken during 2012. FCC Environment intends to submit a permit variation in 2013.

The surface water quality, from the discharge point into Dix Pit Lake was compliant throughout the year.

Overall it would seem that the landfill is working within the set parameters and is having minimum impact upon the surrounding environment. The leachate levels across site have risen, however actions are in place to make improvements in 2013.

Reference 5

FCC Environment, Dix Pit Landfill Annual Environmental Summary Report, 2014;

Dix Pit Landfill Site

ANNUAL ENVIRONMENTAL SUMMARY REPORT 2014

Permit Number
BV7214IR

Permit Variation
XP3032UG

March 2015

FCC Environment
Appleford Sidings
Sutton Courtenay
Abingdon
OX14 4PW

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APPENDIX A Dix Pit Site Plan

1.0 Introduction

This annual environmental monitoring report for Dix Pit has been produced in accordance with condition 4.2.1a of the Environmental Permit (BV7214IR, Variation XP303UG) and considers the results of environmental monitoring at Dix Pit landfill site undertaken between 1 January 2014 and 31 December 2014.

The environmental report includes:

- A background summary of the site and its environmental setting.
- A summary of the environmental monitoring data obtained.

This annual report looks at monitoring data in comparison to trigger levels specified in the permit and its impact on the surrounding environment.

2.0 Background

Dix Pit landfill site is located south of Stanton Harcourt village, Oxfordshire (SP 414 048), 10 miles from the centre of Oxford City. It has been an operational landfill site since 1985, formerly a gravel pit operated by Hanson. Oxfordshire County Council granted a waste disposal licence in 1985. Planning permission W2/84 was granted on 27 June 1985 for the disposal of commercial, industrial and domestic wastes to restore the quarry void. The landfill is engineered as a containment system with associated leachate and landfill gas management. An environmental monitoring plan of Dix Pit is provided in Appendix A.

3.0 Landfill Gas

3.1 Perimeter Boreholes

Landfill gas monitoring was undertaken on a monthly basis throughout 2013 at 31 boreholes. The gas data reviewed in this report is data collected during scheduled monthly monitoring; any additional monitoring carried out is not included. At each borehole the following parameters were measured; methane (%v/v), carbon dioxide (%v/v) and oxygen (%v/v) along with on site weather conditions.

3.1.1 Methane Concentrations

Table 3.1 shows monthly methane compliance for the perimeter boreholes. Average methane compliance in the perimeter boreholes for 2014 was 100%.

Table 3.1 Monthly methane compliance for perimeter boreholes

Month	Methane (% compliance)
January	100
February	100
March	100
April	100
May	100
June	100
July	100
August	100
September	100
October	100
November	100
December	100
January – December 2014 (average)	**100**

3.1.2 Carbon Dioxide concentrations

Table 3.2 shows monthly carbon dioxide compliance for the perimeter boreholes. Average carbon dioxide compliance in the perimeter boreholes for 2014 was 100%.

Table 3.2 Monthly carbon dioxide compliance for perimeter boreholes

Month	Carbon Dioxide (% compliance)
January	100
February	100
March	100
April	100
May	100
June	100
July	100
August	100
September	100
October	100
November	100
December	100
January – December 2014 (average)	**100**

3.2 Surface emissions

An FID survey of all capped areas and Flux box has been submitted to the Environment Agency in September 2014. These surveys showed that all points were within the EA standards.

3.3 Gas extraction wells

Landfill gas is controlled by an active gas extraction system, which creates an inward pressure gradient across the landfill to minimise potential off site migration. There is a power generation system located on site, which consists of two Jenbacher 320 engines, each with a capacity of 1.065 MW. As a back up there is a Hasse high temperature flare. Gas wells are monitored monthly as a minimum. Data is presented in Appendix D.

3.4 Gas extraction system

Trace gas analysis for Dix Pit gas extraction system was carried out in February 2014 in accordance with Condition 3.6.1 Table S4.7.

3.5 Emissions to air

Emissions to air from the flare and engines are monitored on an annual incidence and were carried out in February 2014.

4.0 Leachate Review

4.1 Leachate Quality

Leachate samples are required to be taken from 20 leachate wells on a six monthly basis in accordance with Condition 3.6.1a Table S4.8 of the variation permit. In total 16 leachate wells were sampled from Phase 1, 2 and 3 in April and October 2014.

In July 2014 a new Monitoring Schedule based on Environment Agency issuing a regulatory position statement on landfill monitoring and report standards in September 2013.

On the new schedule the leachate will be monitored quarterly for points: T1, Sump 3j, Sump 3k, and annually for all the points.

In this section of the report the leachate analytical data for 2014 is compared to the input parameters derived from on site monitoring data used in the Hydrogeological Risk Assessment Review 2008, hereafter called the 2008 HRA. The 2008 HRA modelled for five List I substances; Cadmium, Chlorobenzene, Mecoprop, Naphthalene and Xylene; and two List II substances, Ammoniacal nitrogen and chloride. Chlorobenzene, Mecoprop, Naphthalene and Xylene were chosen due to their association with landfill leachate and chloride for its conservative nature. The leachate analytical data from 2013 has been compared against the minimum, mean and maximum input parameters detailed in the 2008 HRA, which is provided in Table 4.1 below for Phases 1 and 2.

Table 4.1 Leachate Quality Input Parameters Phase 1 and 2

	HRA modelled source term			2013 data			2014 data		
	Minimum	Mean	Maximum	Minimum	Mean	Maximum	Minimum	Mean	Maximum
Ammoniacal Nitrogen (mg/l)	40	510	1390	9	270.99	386	42.6	309.9	615
Chloride (mg/l)	199	767	2470	193	510.44	888	70	650.7	1050
Cadmium (mg/l)	0.0005	0.0011	0.0086	0.0001	0.00015	0.001	0.0001	0.0001	0.0001
Chlorobenzene (mg/)	0.0001	0.001	0.275	0.001	0.009	0.039	0.001	0.0054	0.008
Xylene (mg/l)	0.0001	0.001	0.0357	0.002	0.003	0.007	0.002	0.01	0.014
Mecoprop (mg/l)	0.0001	0.01	0.102	0.00039	0.05275	0.109	0.00432	0.02675	0.003
Naphthalene (mg/l)	0.0001	0.001	0.0357	0.005	0.005	0.005	0.00016	0.003	0.00802

The maximum concentration was detected in well GL3.4 at 615 mg/l. The mean concentration for Ammoniacal nitrogen is 309.9mg/l, below the mean value modelled in the HRA.

The maximum value for chloride was 1050mg/l, below the 2008 HRA maximum input. The minimum figure is below the input parameters stipulated in the 2008 HRA at 199mg/l. The mean value is 650.7mg/l which is below the input parameter of 767mg/l modelled in the HRA.

The maximum concentration of Mecoprop for 2014 was 0.003mg/l at well LE3 in below the input parameter of 0.102mg/l. The mean concentration was 0.026mg/l, below the modelled mean parameter of the HRA.

All results were below the maximum input parameter for Xylene. The maximum during 2014 was detected in leachate well GL3.4 at 0.014mg/l, below the maximum of 0.0357mg/l modelled in the HRA.

Cadmium concentration in all samples from Phases 1 and 2 was less than input parameters in the HRA. The maximum concentration was 0.001mg/l and the mean was 0.0001mg/l, below the mean input parameter of 0.001mg/l modelled.

Chlorobenzene had a maximum concentration of 0.008mg/l during 2014, detected in leachate well LE1. All concentrations for Chlorobenzene were below the maximum modelled parameters but the minimum and mean were above the modelled parameters.

Naphthalene had a maximum concentration of 0.008mg/l, below the modelled parameter of 0.0357mg/l. The mean concentration was 0.003mg/l, above the modelled parameter of 0.001mg/l.

Set out below in Table 4.2 is the leachate quality input parameters modelled in the 2008 HRA for Phase 3.

Table 4.2 Leachate Quality Input Parameters Phase 3

	HRA modelled source term			2013 data			2014 data		
	Minimum	Mean	Maximum	Minimum	Mean	Maximum	Minimum	Mean	Maximum
Ammoniacal Nitrogen	40	510	1390	8.4	929	1930	196.00	923.00	2090.00
Chloride	199	767	2470	1.3	1110	2170	261.00	1250.00	2730.00
Chlorobenzene	0.0001	0.01	0.275	0.001	0.002	0.005	0.001	0.012	0.066
Xylene	0.0001	0.001	0.0244	0.002	0.024	0.071	0.002	0.018	0.032
Mecoprop	0.0001	0.001	0.102	0.0001	0.0003	0.0007	0.012	0.039	0.234
Naphthalene	0.0001	0.01	0.044	0.005	0.0056	0.008	0.000	0.005	0.023

In Phase 3 the maximum concentration for Ammoniacal Nitrogen detected was 2090mg/l which is above the maximum 2008 HRA input parameter at 1390mg/l, this was detected in cell 3G.

The maximum chloride concentration was 2730mg/l in cell 3F, above the maximum input parameter.

Xylene concentration was at its maximum in Cell 3G, recorded at 0.032mg/l and thus above the maximum 0.0244mg/l modelled in the HRA.

Mecoprop had a maximum concentration of 0.234mg/l, above the modelled parameter of 0.102mg/l.

Naphthalene had a maximum concentration detected at 0.023mg/l which is below the modelled parameter.

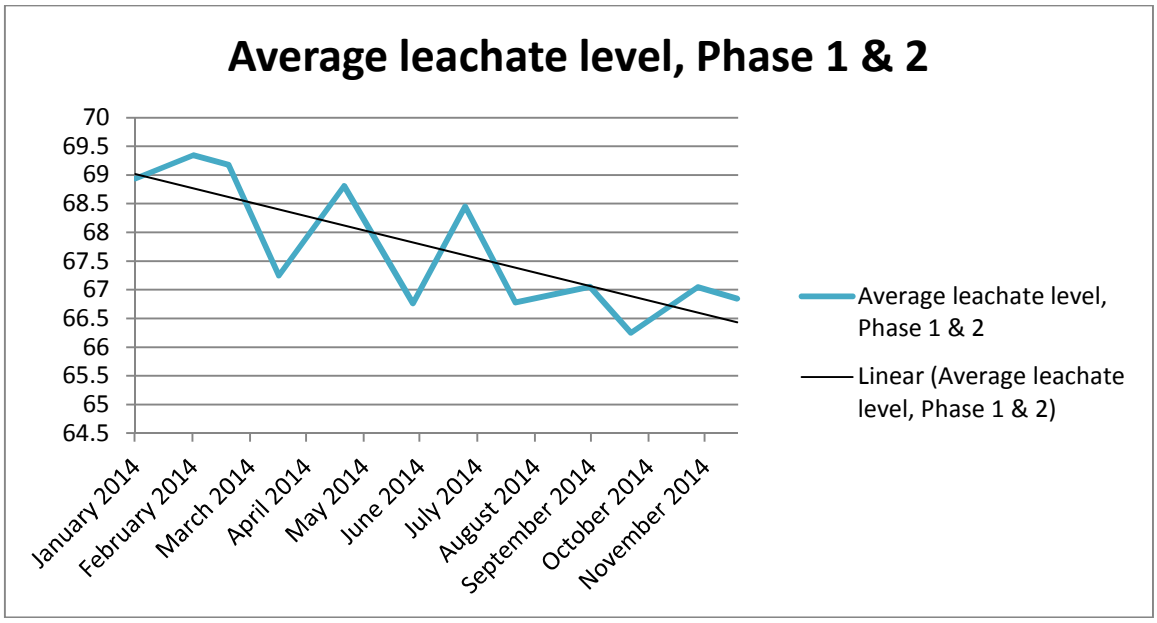
Chlorobenzene mean and maximum concentrations were detected at 0.066mg/l, below the maximum and mean parameters modelled by the HRA.

4.2 Leachate Levels

Leachate levels are monitored on a monthly incidence. Leachate levels are assessed against the assumptions made within the HRA and the trigger levels set out in Table S4.1 of the variation permit.

In Phase 1 and 2 the average leachate level generally decreased during 2014, see Figure 4.1.The average leachate level in Phase 1 and 2 was 67.72mAOD.

Figure 4.1 Average leachate level, Phase 1 & 2, 2014



Leachate levels across Phase 3 were generally decreased during 2014.

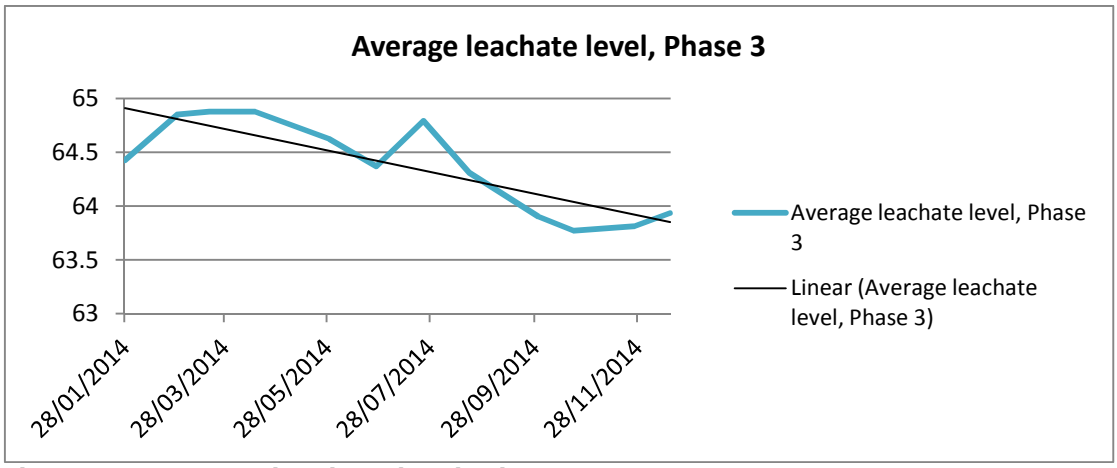


Figure 4.2 Average leachate level, Phase 3, 2014

5.0 Groundwater Review

5.1 Groundwater Quality

Groundwater sampling was scheduled to be undertaken quarterly and every 6 months from 25 boreholes. Due to elevated concentrations in some boreholes additional sampling was undertaken in some additional months throughout 2014.

In July 2014 a new Monitoring Schedule based on Environment Agency issuing a regulatory position statement on landfill monitoring and report standards in September 2013.

On the new schedule the ground water boreholes will be monitored quarterly and annually.

Naphthalene

Naphthalene was compliant in all the groundwater boreholes across the site in 2014

Chlorobenzene

Chlorobenzene concentrations were compliant in all groundwater boreholes during 2014.

Xylene

Xylene concentrations were compliant in all groundwater boreholes during 2014.

Ammoniacal Nitrogen

Wells GGH4o and GBH41 breached for ammonia but re-sampled and results were complaint. Both wells have been compliant since 2012 so we consider the first result an abnormality

.

Mecoprop

Mecoprop was compliant in all the groundwater boreholes across the site in 2014

Chloride

Chloride concentration was generally below trigger level in all groundwater boreholes during 2014 exception of GBH35 which breached in October and December.

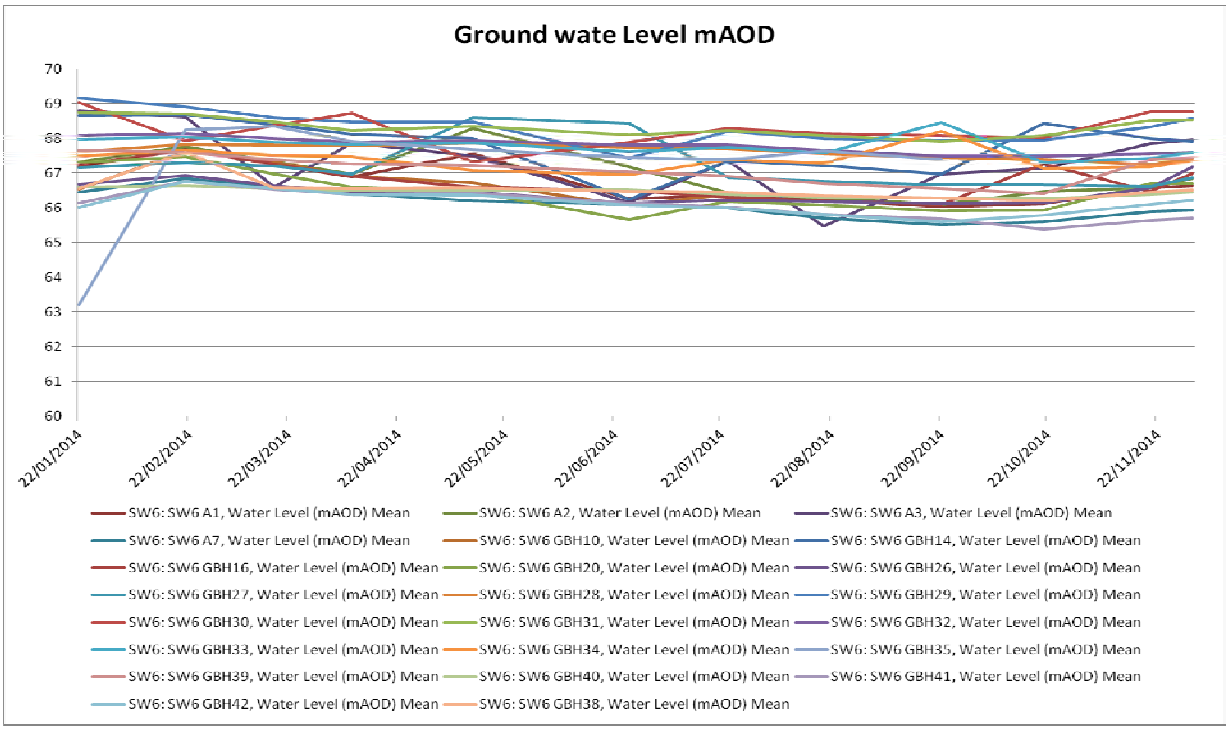
The HRA has been re-reviewed by the Environment Agency with the extra information FCC have provided. GBH35 can be used as an up-gradient borehole of the unfilled area of the site and as such the trigger levels will be removed with a Permit variation application.

5.2 Groundwater levels

Groundwater level data was recorded on a monthly basis from 25 boreholes located around the permitted area. Groundwater quality monitoring was undertaken on a quarterly and six monthly basis from these 25 boreholes.

Groundwater levels ranged from 61.85 mAOD (borehole A3, November 2013) to 69.22 mAOD (borehole GBH29, February 2013).

Seasonal variation was exhibited in most of the boreholes throughout the year, with levels gradually increased from January through to March then groundwater levels started to decreases through to October and then started increasing again towards the end of the year. (See Figure 5.1).



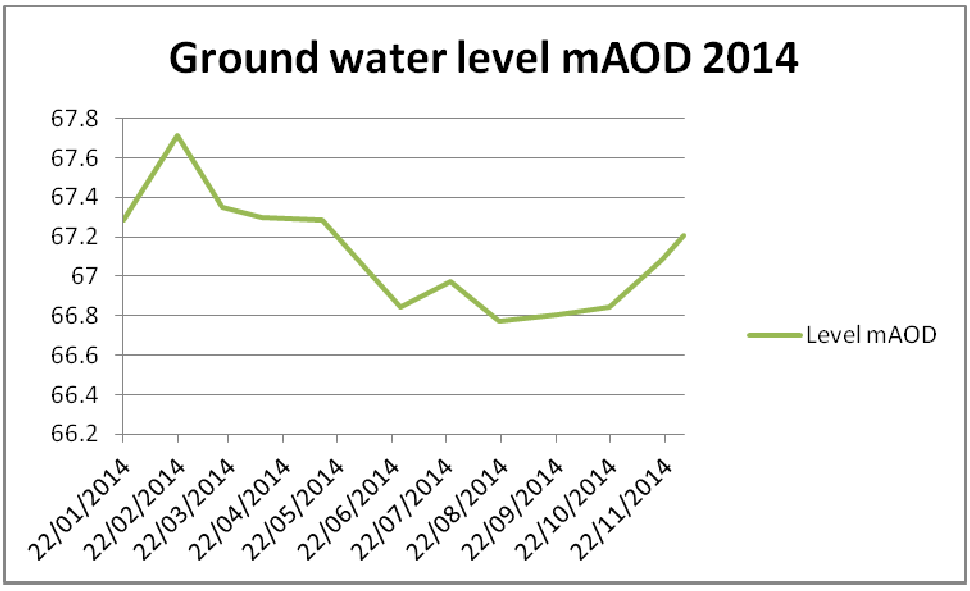


Figure 5.1 Average groundwater levels across Dix Pit

6.0 Surface Water Review

6.1 Surface Water Quality

Surface water quality is monitored on a monthly incidence from SW6 Discharge, into Dix Pit Lake. Samples were not taken in a couple of the months due to system not pumping and health and safety.

Ammoniacal nitrogen and chloride concentrations all remained well below their respective triggers of 5mg/l and 200mg/. There were no breaches in 2014.

7.0 Conclusions

There was an overall improvement in gas compliance compared to previous years, with no Methane or CO2 detected above trigger throughout the year.

Leachate levels reduced across the site throughout the year.

Groundwater quality was generally good with a number of boreholes breaching however after resample were found to be compliant.

The surface water quality was compliant throughout the year.

Overall it would seem that the landfill is working within the set parameters and is having minimum impact upon the surrounding environment. The leachate levels across site have made great progress and hopefully will be fully compliant within 2015

Reference 6

FCC Environment, Dix Pit Landfill Annual Environmental Summary Report, 2016;

Dix Pit Landfill Site

ANNUAL ENVIRONMENTAL SUMMARY REPORT 2016

Permit Number
BV7214IR

Permit Variation
V11

February 2017

FCC Environment
Appleford Sidings
Sutton Courtenay
Abingdon
OX14 4PW

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APPENDIX A Dix Pit Site Plan

1 Introduction

This annual environmental monitoring report for Dix Pit has been produced in accordance with condition 4.2.2a of the Environmental Permit (BV7214IRV11) and considers the results of environmental monitoring at Dix Pit landfill site undertaken between 1 January and 31 December 2016.

The environmental report includes:

- A background summary of the site and its environmental setting.
- A summary of the environmental monitoring data obtained.

This annual report looks at monitoring data in comparison to trigger levels specified in the permit and its impact on the surrounding environment.

2 Background

Dix Pit landfill site is located south of Stanton Harcourt village, Oxfordshire (SP 414 048), 10 miles from the centre of Oxford City. It was an operational landfill site since 1985 until 2015, formerly a gravel pit operated by Hanson. Oxfordshire County Council granted a waste disposal licence in 1985. Planning permission W2/84 was granted on 27 June 1985 for the disposal of commercial, industrial and domestic wastes to restore the quarry void. The landfill is engineered as a containment system with associated leachate and landfill gas management. An environmental monitoring plan of Dix Pit is provided in Appendix A.

3 Landfill Gas

3.1 Perimeter Boreholes

Landfill gas monitoring was undertaken on a monthly basis throughout 2016 at 31 boreholes. The gas data reviewed in this report is data collected during scheduled monthly monitoring; any additional monitoring carried out is not included. At each borehole the following parameters were measured; methane (%v/v), carbon dioxide (%v/v) and oxygen (%v/v) along with on site weather conditions.

3.1.1 Methane Concentrations

Table 1 shows monthly methane compliance for the perimeter boreholes. Average methane compliance in the perimeter boreholes for 2016 was 100%.

Table 1 monthly methane compliance for perimeter boreholes

Month	Methane (% compliance)
January	100
February	100
March	100
April	100
May	100
June	100
July	100
August	100
September	100
October	100
November	100
December	100
January – December 2016 (average)	**100**

3.1.2 Carbon dioxide concentration

Table 2 shows monthly carbon dioxide compliance for the perimeter boreholes. Average carbon dioxide compliance in the perimeter boreholes for 2016 was 98.65%.

Table 2 Monthly carbon dioxide compliance for perimeter boreholes

Month	Carbon Dioxide (% compliance)
January	100
February	100
March	100
April	100
May	96.8
June	93.8
July	90.3
August	96.8
September	100
October	93.8
November	100
December	100
January – December 2016 (average)	**97.6**

FCC submitted a permit variation during 2016 to change the CO2 levels for CO2 assessment levels in accordance to the perimeter gas IcOP release in

2012, discussions are still ongoing and the permit variation hasn't been issued yet.

3.2 Surface emissions

A FID survey of all capped areas was carried on and submitted to the Environment Agency in December 2016. This survey showed that all points were within the EA standards, with the exception of several wells within the operational area which will be rectified once the capping is finalised. FCC is currently capping cells J and K. An annual FID and flux box will be carried out during 2017 once the capping has been finished, it is currently forecast to be finished in March 2017.

3.3 Gas extraction wells

Landfill gas is controlled by an active gas extraction system, which creates an inward pressure gradient across the landfill to minimise potential off site migration. There is a power generation system located on site, which consists of one Jenbacher 320 engine, with a capacity of 1.065 MW. As a back up there is a Hasse high temperature flare. Gas wells are monitored monthly as a minimum.

3.4 Gas extraction system

Trace gas analysis for Dix Pit gas extraction system was carried out in February 2016 in accordance with Condition 3.5.1 Table S3.2.

3.5 Emissions to air

Emissions to air from the flare and engines are monitored on an annual incidence and were carried out in February 2016.

4 Leachate Review

4.1 Leachate Quality

Leachate samples are required to be taken from 20 leachate wells on an annual basis in accordance with Condition 3.5.1a Table S3.9 of the variation permit. In total 16 leachate wells were sampled from Phase 1, 2 and 3 in April and October 2016.

In July 2014 a new Monitoring Schedule based on Environment Agency issuing a regulatory position statement on landfill monitoring and report standards in September 2013.

On the new schedule the leachate will be monitored quarterly for points: T1, Sump 3j, Sump 3k and annually for all the points.

In this section of the report the leachate analytical data for 2016 is compared to the input parameters derived from on site monitoring data used in the Hydrogeological Risk Assessment Review 2013, hereafter called the 2013 HRA. The 2013 HRA modelled for five hazardous substances (previously known as List I substances); Cadmium, Chlorobenzene, Mecoprop, Naphthalene and Xylene; and two non hazardous substances (previously known as List II substances), Ammoniacal nitrogen and chloride. Chlorobenzene, Mecoprop, Naphthalene and Xylene were chosen due to their association with landfill leachate and chloride for its conservative nature. The leachate analytical data from 2016 has been compared against the minimum, mean and maximum input parameters detailed in the 2013 HRA, which is provided in Table 3 below for Phases 1 and 2.

Table 3 Leachate Quality Input Parameters Phase 1 and 2

Determinand	HRA modelled source term			2016 Data		
	Minimum	Mean	Maximum	Minimum	Mean	Maximum
Ammoniacal Nitrogen (mg/l)	0.3	242.8	701	139	238.9	452
Chloride (mg/l)	10	765	2170	232	667.3	1160
Cadmium (ug/l)	<0.0001	<0.0003	0.0012	N/A	<0.0001	N/A
Chlorobenzene (ug/l)	<0.0001	<0.0001	<0.001	<1	6	16
Mecoprop (ug/l)	0.002	0.024	0.53	12	50	134
Naphthalene (ug/l)	0.002	0.003	0.007	0.35	2.2	3.87
Xylene (ug/l)	<0.0002	0.0046	0.011	<1	4.72	16

Table 3 compares hazardous substances and non hazardous substances found in 2016 leachate quality for phase 1&2 with the parameters modelled in 2013 HRA review.

Ammoniacal nitrogen mean concentration is lower than the modelled in 2013 HRA review, the highest concentration is found in well GL3.4.
Chloride concentration mean found in 2016 is lower than the concentration modelled in 2013 HRA review; the highest concentration is found in well LE2.
The concentration of cadmium found in 2016 was lower than the concentration modelled in 2013 HRA review. Chlorobenzene mean

concentration found in phase 1&2 was higher than the one modelled in the HRA review. Mecoprop concentrations found in 2016 phase 1&2 quality data were higher than the concentrations modelled in 2013 HRA. Napthalene and Xylene concentrations found in 2016 phase 1&2 quality data were above the concentrations modelled in 2013 HRA review.

Set out below in Table 4 is the leachate quality input parameters modelled in the 2016 HRA for Phase 3.

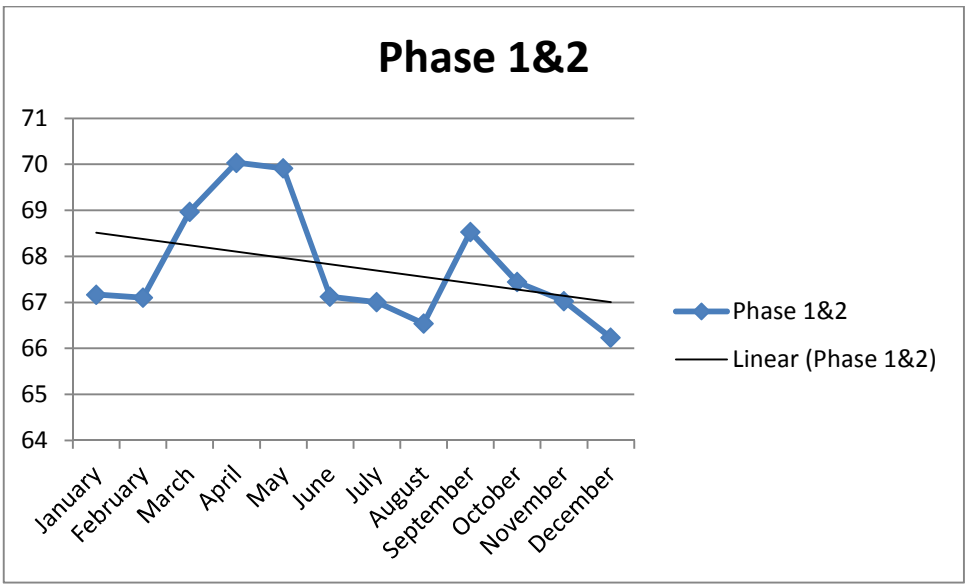
Table 4 Leachate Quality Input Parameters Phase 3

Determinad (mg/l)	HRA modelled source term			2016 data		
	Minimum	Mean	Maximum	Minimum	Mean	Maximum
Ammoniacal Nitrogen	0.02	505.87	1910	42.7	1334.6	2380
Chloride	4	888.1	2550	325	1687	2670
Chlorobenzene	0.0005	0.0011	0.065	<1	3	15
Xylene	0.003	0.009	0.03	<1	19.41	57
Mecoprop	0.0025	0.03	0.07	5.76	77.05	271
Naphthalene	0.001	0.002	0.0102	<0.02	1.52	6
Cadmium (mg/l)	1E-9	8.4E-9	5.5E-7	<0.0001	0.0018	0.0029

Table 4 compares hazardous substances and non hazardous substances found in 2016 leachate quality for phase 3 with the parameters modelled in 2013 HRA review.
Ammoniacal nitrogen mean concentration is higher than the modelled in 2013 HRA review, the highest concentration is found in well Sump 3J.
Chloride concentration mean found in 2016 is higher than the concentration modelled in 2013 HRA review; the highest concentration is found in Sump 3F.
The concentration of cadmium found in 2016 was higher than the concentration modelled in 2013 HRA review. Chlorobenzene mean concentration found in phase 3 was higher than the one modelled in the HRA review, the highest concentration was found in Sump 3C. Mecoprop concentrations found in 2016 phase 3 quality data was higher than the concentrations modelled in 2013 HRA. Napthalene concentrations found in 2016 quality samples were higher than the ones modelled in 2013 review, so were Xylene concentrations.

4.2 Leachate Levels

Leachate levels are monitored on a monthly incidence. Leachate levels are assessed against the assumptions made within the HRA and the trigger levels set out in Table S3.1 of the variation permit.

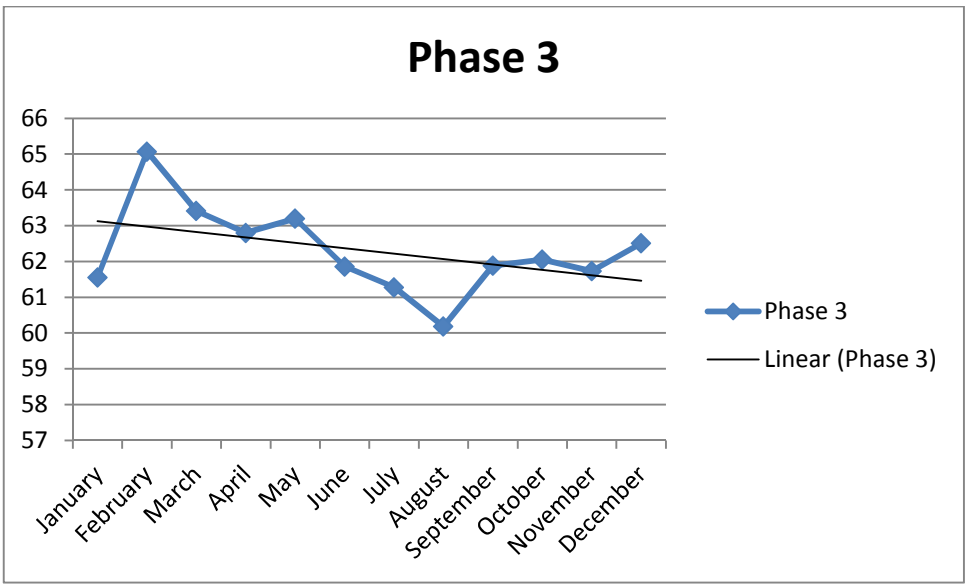


Graph 1 Average leachate level, Phase 1 & 2, 2016

In Phase 1 and 2 the average leachate level generally decreased during 2016, see graph 1.The average leachate level in Phase 1 and 2 was 67.75mAOD, Leachate levels seem to follow a seasonal variation. It is believed the leachate levels on these areas mirror the groundwater levels within the aquifer. FCC is intending to run a hydrological risk assessment (HRA) taking into account this to see if the current exceedance levels can be reviewed. FCC will submit this report to the Environment Agency and if appropriate vary the permit to include these new exceedance levels.

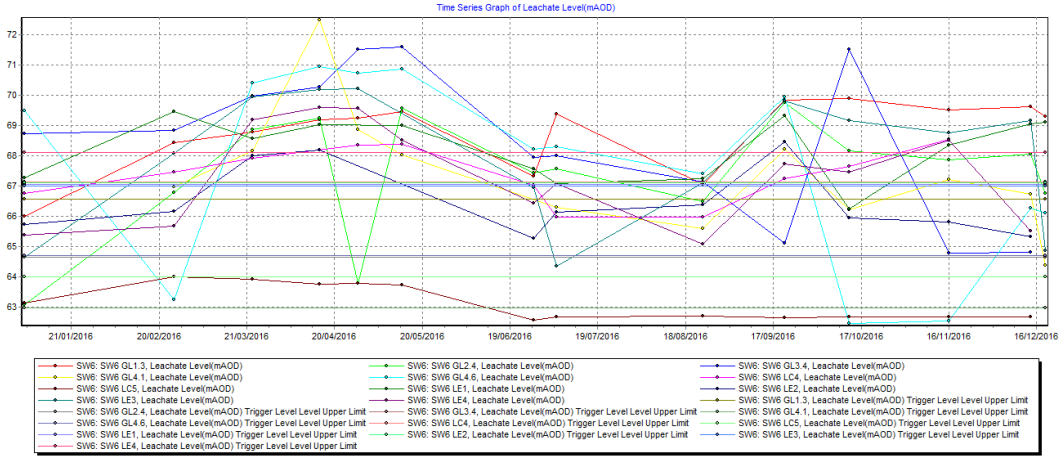
FCC believes that the wells used for compliance purposes in phase 1&2 at Dix Pit are not fit for purpose as they are of an unknown construction and of unknown depths. FCC proposed to substitute the entire infrastructure by 4 purposely built piezometric wells which will monitor the column of leachate action on the base of the phase. 4 leachate wells were suggested due to the size of the area and using the Environment Agency guidance for cells without basal engineering.

FCC will vary the permit to remove the unsuitable wells and include these purposely built leachate piezometric wells once the CQA report has been approved.



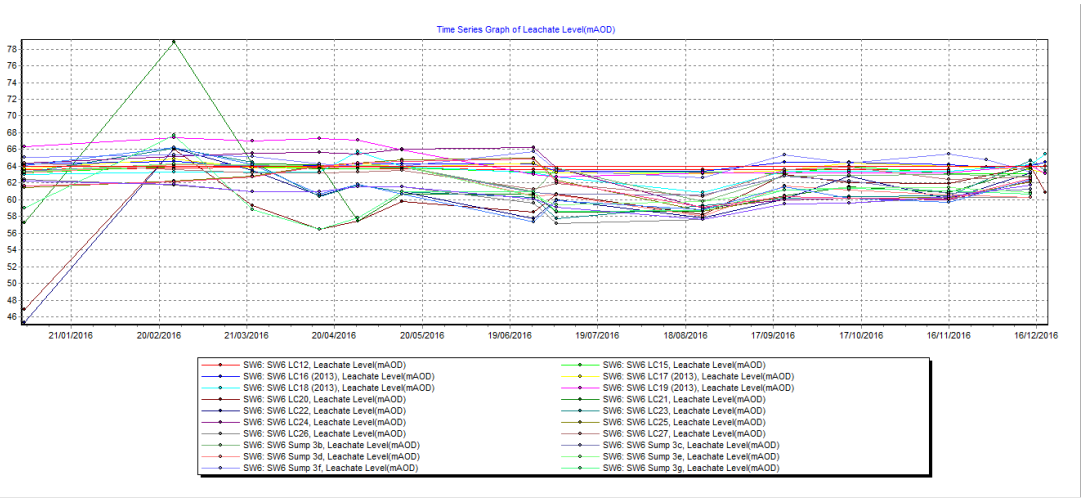
Graph 2 Average leachate level, Phase 3, 2016

Leachate levels across Phase 3 as shown in graph 2 have generally decreased during 2016. Dix Pit achieved full compliance during July and August; nonetheless some of the leachate wells exceeded the trigger limit in the following months. It is believed that some of these exceeding wells are be sheared or not deep enough. These therefore are not fit for purpose to measure the leachate levels acting on the base of the landfill and FCC is intending to redrill them during 2017.



Graph 3 Leachate levels in phase 1&2

Graph 3 shows the leachate levels recorded in phase 1&2 at Dix Pit landfill. Leachate levels appear to have a seasonal variation and the levels are higher during the wetter months and lower during summer. FCC is intending to re run the HRA to reassess whether the current assessment levels can be reviewed. This will be submitted to the Environment Agency for approval.



Graph 4 Leachate levels in phase 3

Graph 4 shows the leachate levels during 2016 in phase 3, it is possible to see a bit of seasonal fluctuation. FCC is re intending to re run the HRA to ensure the current exceedance levels are relevant. This will be sent to the Environmental Agency for approval.

As seen in the above figures Leachate levels have been decreasing across the 3 phases 1&2 and 3. FCC drilled 4 leachate wells in phase 1&2, these wells will substitute the current infrastructure believed to be not fit for purpose. FCC is intending to vary the permit to remove these unsuitable wells by the purposely built piezometric leachate wells once the CQA report has been approved. Leachate levels in phase 3 were compliant during the summer months and the majority of the wells were complaint thereafter. There were few exceptions, however, FCC believes that these wells are not fit for purpose and require to be redrilled. FCC will submit a CQA plan with the proposed wells to the Environment Agency for approval.

5 Groundwater Review

5.1 Groundwater Quality

Groundwater sampling was scheduled to be undertaken quarterly and every quarter months from 25 boreholes.
In July 2014 a new Monitoring Schedule based on Environment Agency issuing a regulatory position statement on landfill monitoring and report standards in September 2013.

On the new schedule the groundwater boreholes will be monitored quarterly and annually.

The HRA has been re-reviewed and approved by the Environment Agency and it was agreed that the upgradient of the exceedance levels will be removed with a Permit Variation.

Naphthalene

Naphthalene was compliant in all the groundwater boreholes across the site in 2016

Chlorobenzene

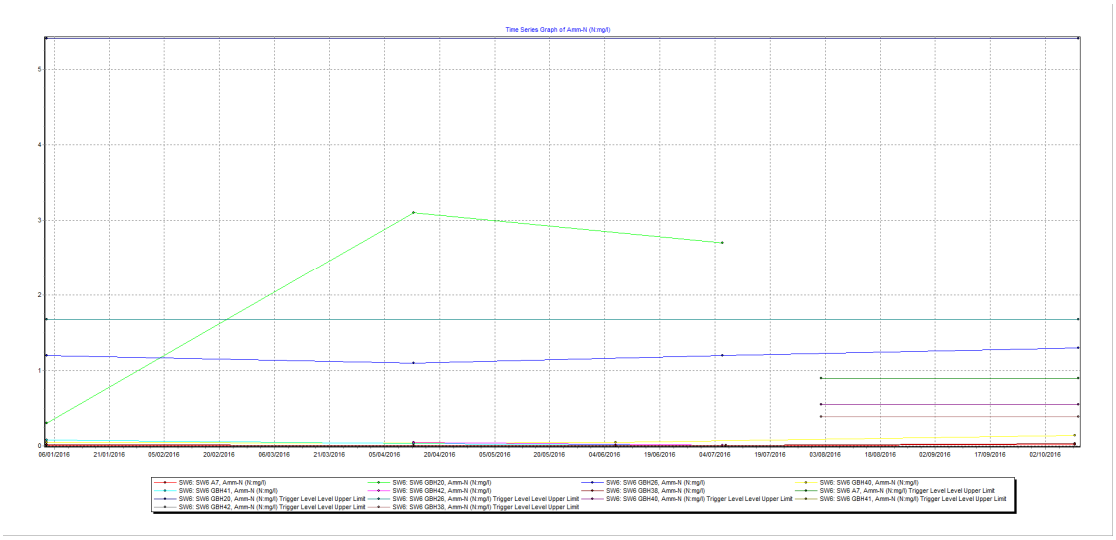
Chlorobenzene concentrations were compliant in all groundwater boreholes during 2016.

Xylene

Xylene concentrations were compliant in all groundwater boreholes during 2016.

Ammoniacal Nitrogen

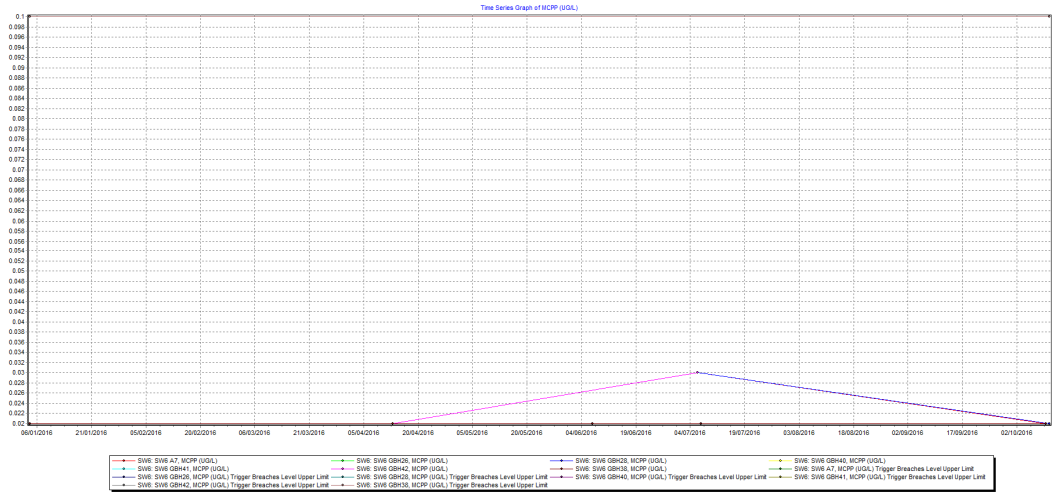
No breaches were encountered in the groundwater boreholes during 2016,; figure 5 shows the ammonical nitrogen concentration in all the down gradient boreholes for 2016



Graph 5 Ammoniacal Nitrogen concentration in Groundwater wells

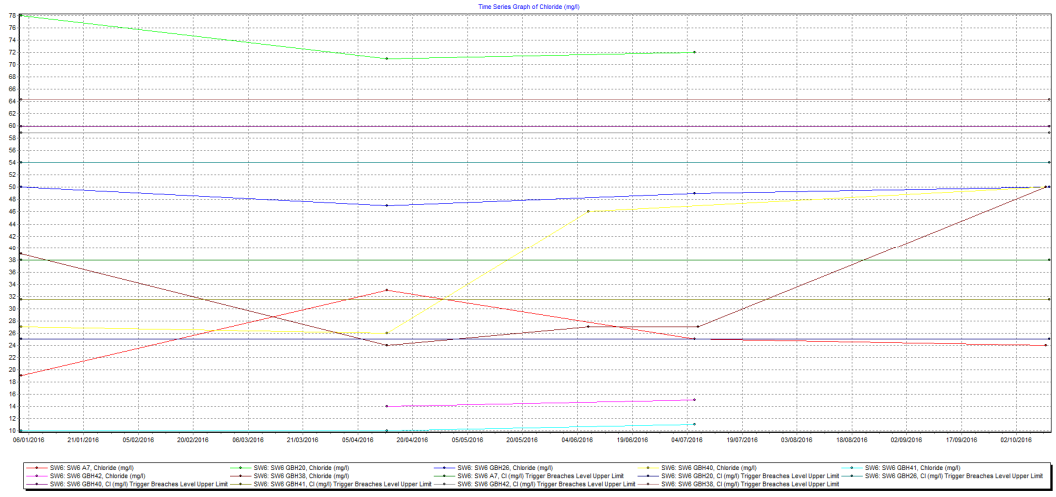
Mecoprop

Mecoprop was compliant in all the groundwater boreholes across the site in 2016. Graph 6 shows the concentrations found in the groundwater boreholes in 2016



Graph 6 Mecoprop concentrations in Groundwater wells on site

Chloride



Graph 7 Chloride concentrations in Groundwater wells

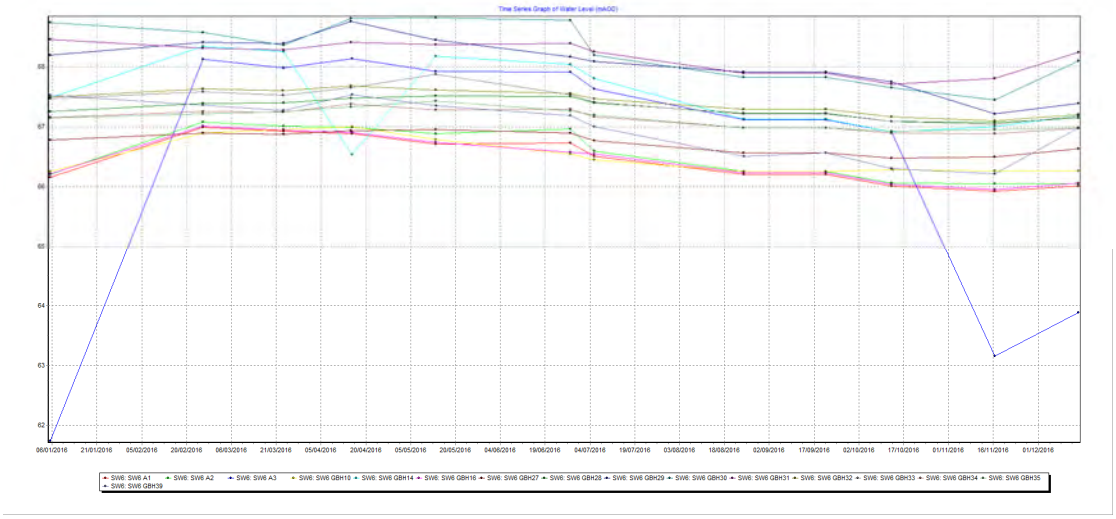
Chloride concentration was generally below trigger level in all groundwater boreholes during 2016 with the exception of GBH20. This borehole was couldn't be monitored during the summer months and therefore a trend could not be established. FCC doesn't believe that this borehole exceeding the level is related to the landfill activities and will propose to re-drill this borehole in a more suitable location. FCC will submit a CQA plan to re-drill this borehole to the Environment Agency shortly.

5.2 Groundwater levels

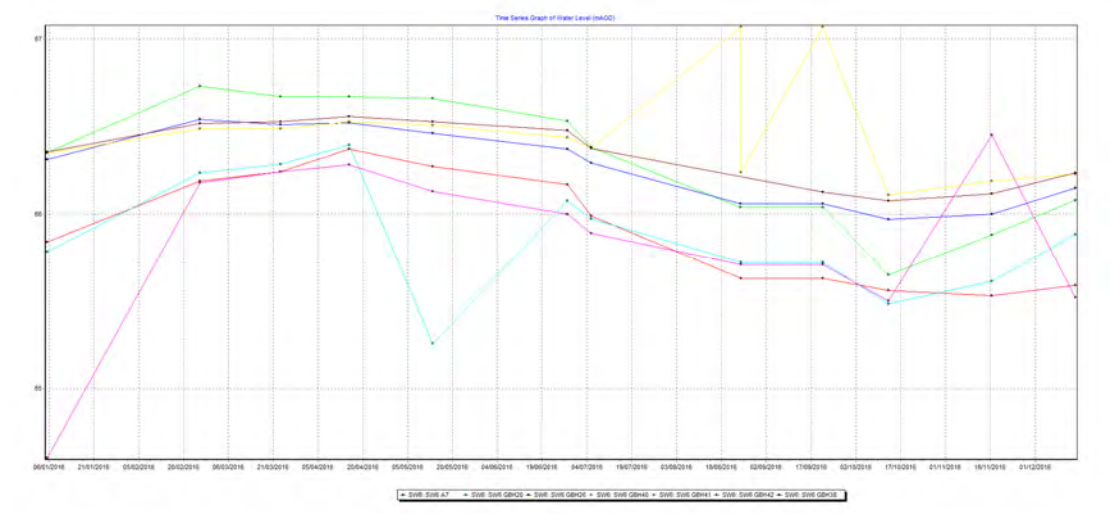
Groundwater level data was recorded on a monthly basis from 25 boreholes located around the permitted area. Groundwater quality monitoring was undertaken on quarterly and six monthly from these 25 boreholes.

Groundwater levels ranged from 61.74 mAOD (borehole A3, January 2016) to 68.82 mAOD (borehole GBH30, May 2016).

Seasonal variation was exhibited in most of the boreholes throughout the year, with levels gradually increased from January through to May then groundwater levels started to decreases through to November and then started increasing again towards the end of the year. (See graph 8 and 9).



Graph 8 groundwater levels in up gradient boreholes across Dix Pit



Graph 9 groundwater levels in down gradient boreholes across Dix Pit

6 Surface Water Review

6.1 Surface Water Quality

Surface water quality is monitored on a monthly incidence from SW6 Discharge, into Dix Pit Lake. A sample was taken in January only; no further samples were obtained afterwards as there was no water being discharged.

Suspended solids were exceeded in January but it is believed that was due to the positioning for the inlet of the pump that was too close to the base of the lagoon. Ammoniacal nitrogen and chloride concentrations all remained well below their respective triggers of 5mg/l and 200mg/l.

7 Conclusions

After reviewing the monitoring data collected throughout 2016 it is possible to conclude that the Dix Pit landfill has had negligible impact on the nearby environment. The local geology, sands and gravels but predominantly Oxford Clay, has a very low permeability and provides very good containment.

The possible hazard to the environment comes from fugitive surface emissions the uncapped areas on-site, this is scheduled to be completed by the March 2017 and an annual FID and flux box will be carried out. Gas collection infrastructure is continually installed and upgraded throughout the year.

Leachate levels have been decreasing through the year and phase 3 is borderline compliant. In addition, further infrastructure has been installed in phase 1&2 to ascertain the true level of leachate and to be substituted what was believed to be unsuitable infrastructure for monitoring. FCC is intending to vary the permit to include these new wells and remove the unsuitable infrastructure. FCC will be potentially drilling some leachate wells in phase 3 upon reviewing the current infrastructure.

The site is generally operating within expected limits.

Reference 7

Department for Communities and Local Government, National Planning Policy Framework, 2012, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/6077/2116950.pdf ;

Communities and Local Government

National Planning Policy Framework

www.communities.gov.uk
community, opportunity, prosperity

National Planning Policy Framework

March 2012
Department for Communities and Local Government

This document/publication is also available on our website at www.communities.gov.uk

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Ministerial foreword

The purpose of planning is to help achieve sustainable development.

Sustainable means ensuring that better lives for ourselves don't mean worse lives for future generations.

Development means growth. We must accommodate the new ways by which we will earn our living in a competitive world. We must house a rising population, which is living longer and wants to make new choices. We must respond to the changes that new technologies offer us. Our lives, and the places in which we live them, can be better, but they will certainly be worse if things stagnate.

Sustainable development is about change for the better, and not only in our built environment.

Our natural environment is essential to our wellbeing, and it can be better looked after than it has been. Habitats that have been degraded can be restored. Species that have been isolated can be reconnected. Green Belt land that has been depleted of diversity can be refilled by nature – and opened to people to experience it, to the benefit of body and soul.

Our historic environment – buildings, landscapes, towns and villages – can better be cherished if their spirit of place thrives, rather than withers.

Our standards of design can be so much higher. We are a nation renowned worldwide for creative excellence, yet, at home, confidence in development itself has been eroded by the too frequent experience of mediocrity.

So sustainable development is about positive growth – making economic, environmental and social progress for this and future generations.

The planning system is about helping to make this happen.

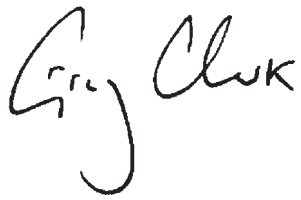
Development that is sustainable should go ahead, without delay – a presumption in favour of sustainable development that is the basis for every plan, and every decision. This framework sets out clearly what could make a proposed plan or development unsustainable.

In order to fulfil its purpose of helping achieve sustainable development, planning must not simply be about scrutiny. Planning must be a creative exercise in finding ways to enhance and improve the places in which we live our lives.

This should be a collective enterprise. Yet, in recent years, planning has tended to exclude, rather than to include, people and communities. In part, this has been a result of targets being imposed, and decisions taken, by bodies remote from them. Dismantling the unaccountable regional apparatus and introducing neighbourhood planning addresses this.

In part, people have been put off from getting involved because planning policy itself has become so elaborate and forbidding – the preserve of specialists, rather than people in communities.

This National Planning Policy Framework changes that. By replacing over a thousand pages of national policy with around fifty, written simply and clearly, we are allowing people and communities back into planning.



Rt Hon Greg Clark MP
Minister for Planning

Introduction

1. The National Planning Policy Framework sets out the Government's planning policies for England and how these are expected to be applied.[1] It sets out the Government's requirements for the planning system only to the extent that it is relevant, proportionate and necessary to do so. It provides a framework within which local people and their accountable councils can produce their own distinctive local and neighbourhood plans, which reflect the needs and priorities of their communities.

2. Planning law requires that applications for planning permission must be determined in accordance with the development plan,[2] unless material considerations indicate otherwise.[3] The National Planning Policy Framework must be taken into account in the preparation of local and neighbourhood plans, and is a material consideration in planning decisions.[4] Planning policies and decisions must reflect and where appropriate promote relevant EU obligations and statutory requirements.

3. This Framework does not contain specific policies for nationally significant infrastructure projects for which particular considerations apply. These are determined in accordance with the decision-making framework set out in the Planning Act 2008 and relevant national policy statements for major infrastructure, as well as any other matters that are considered both important and relevant (which may include the National Planning Policy Framework). National policy statements form part of the overall framework of national planning policy, and are a material consideration in decisions on planning applications.

4. This Framework should be read in conjunction with the Government's planning policy for traveller sites. Local planning authorities preparing plans for and taking decisions on travellers sites should also have regard to the policies in this Framework so far as relevant.

5. This Framework does not contain specific waste policies, since national waste planning policy will be published as part of the National Waste Management Plan for England.[5] However, local authorities preparing waste plans and taking decisions on waste applications should have regard to policies in this Framework so far as relevant.

1 A list of the documents revoked and replaced by this Framework is at Annex 3.
2 This includes the Local Plan and neighbourhood plans which have been made in relation to the area (see glossary for full definition).
3 Section 38(6) of the Planning and Compulsory Purchase Act 2004 and section 70(2) of the Town and Country Planning Act 1990.
4 Sections 19(2)(a) and 38(6) of the Planning and Compulsory Purchase Act 2004 and section 70(2) of the Town and Country Planning Act 1990. In relation to neighbourhood plans, under section 38B and C and paragraph 8(2) of new Schedule 4B to the 2004 Act (inserted by the Localism Act 2011 section 116 and Schedules 9 and 10) the independent examiner will consider whether having regard to national policy it is appropriate to make the plan.
5 The Waste Planning Policy Statement will remain in place until the National Waste Management Plan is published.

Achieving sustainable development

International and national bodies have set out broad principles of sustainable development. Resolution 42/187 of the United Nations General Assembly defined sustainable development as meeting the needs of the present without compromising the ability of future generations to meet their own needs. The UK Sustainable Development Strategy *Securing the Future* set out five 'guiding principles' of sustainable development: living within the planet's environmental limits; ensuring a strong, healthy and just society; achieving a sustainable economy; promoting good governance; and using sound science responsibly.

6. The purpose of the planning system is to contribute to the achievement of sustainable development. The policies in paragraphs 18 to 219, taken as a whole, constitute the Government's view of what sustainable development in England means in practice for the planning system.

7. There are three dimensions to sustainable development: economic, social and environmental. These dimensions give rise to the need for the planning system to perform a number of roles:

   - **an economic role** – contributing to building a strong, responsive and competitive economy, by ensuring that sufficient land of the right type is available in the right places and at the right time to support growth and innovation; and by identifying and coordinating development requirements, including the provision of infrastructure;
   - **a social role** – supporting strong, vibrant and healthy communities, by providing the supply of housing required to meet the needs of present and future generations; and by creating a high quality built environment, with accessible local services that reflect the community's needs and support its health, social and cultural well-being; and
   - **an environmental role** – contributing to protecting and enhancing our natural, built and historic environment; and, as part of this, helping to improve biodiversity, use natural resources prudently, minimise waste and pollution, and mitigate and adapt to climate change including moving to a low carbon economy.

8. These roles should not be undertaken in isolation, because they are mutually dependent. Economic growth can secure higher social and environmental standards, and well-designed buildings and places can improve the lives of people and communities. Therefore, to achieve sustainable development, economic, social and environmental gains should be sought jointly and simultaneously through the planning system. The planning system should play an active role in guiding development to sustainable solutions.

9. Pursuing sustainable development involves seeking positive improvements in the quality of the built, natural and historic environment, as well as in people's quality of life, including (but not limited to):

   - making it easier for jobs to be created in cities, towns and villages;
   - moving from a net loss of bio-diversity to achieving net gains for nature;[6]
   - replacing poor design with better design;
   - improving the conditions in which people live, work, travel and take leisure; and
   - widening the choice of high quality homes.

10. Plans and decisions need to take local circumstances into account, so that they respond to the different opportunites for achieving sustainable development in different areas.

The presumption in favour of sustainable development

11. Planning law requires that applications for planning permission must be determined in accordance with the development plan unless material considerations indicate otherwise.[7]

12. This National Planning Policy Framework does not change the statutory status of the development plan as the starting point for decision making. Proposed development that accords with an up-to-date Local Plan should be approved, and proposed development that conflicts should be refused unless other material considerations indicate otherwise. It is highly desirable that local planning authorities should have an up-to-date plan in place.

13. The National Planning Policy Framework constitutes guidance[8] for local planning authorities and decision-takers both in drawing up plans and as a material consideration in determining applications.

6 Natural Environment White Paper, *The Natural Choice: Securing the Value of Nature*, 2011.
7 Section 38(6) of the Planning and Compulsory Purchase Act 2004 and section 70(2) of the Town and Country Planning Act 1990.
8 A list of the documents revoked and replaced by this Framework is at Annex 3. Section 19(2)(a) of the Planning and Compulsory Purchase Act 2004 states, in relation to plan-making, that the local planning authority must have regard to national policies and advice contained in guidance issued by the Secretary of State.

14. At the heart of the National Planning Policy Framework is a **presumption in favour of sustainable development**, which should be seen as a golden thread running through both plan-making and decision-taking.

    For **plan-making** this means that:

    - local planning authorities should positively seek opportunities to meet the development needs of their area;
    - Local Plans should meet objectively assessed needs, with sufficient flexibility to adapt to rapid change, unless:
        - any adverse impacts of doing so would significantly and demonstrably outweigh the benefits, when assessed against the policies in this Framework taken as a whole; or
        - specific policies in this Framework indicate development should be restricted.[9]

    For **decision-taking** this means:[10]

    - approving development proposals that accord with the development plan without delay; and
    - where the development plan is absent, silent or relevant policies are out-of-date, granting permission unless:
        - any adverse impacts of doing so would significantly and demonstrably outweigh the benefits, when assessed against the policies in this Framework taken as a whole; or
        - specific policies in this Framework indicate development should be restricted.[9]

15. Policies in Local Plans should follow the approach of the presumption in favour of sustainable development so that it is clear that development which is sustainable can be approved without delay. All plans should be based upon and reflect the presumption in favour of sustainable development, with clear policies that will guide how the presumption should be applied locally.

16. The application of the presumption will have implications for how communities engage in neighbourhood planning. Critically, it will mean that neighbourhoods should:

    - develop plans that support the strategic development needs set out in Local Plans, including policies for housing and economic development;

9 For example, those policies relating to sites protected under the Birds and Habitats Directives (see paragraph 119) and/or designated as Sites of Special Scientific Interest; land designated as Green Belt, Local Green Space, an Area of Outstanding Natural Beauty, Heritage Coast or within a National Park (or the Broads Authority); designated heritage assets; and locations at risk of flooding or coastal erosion.

10 Unless material considerations indicate otherwise.

- plan positively to support local development, shaping and directing development in their area that is outside the strategic elements of the Local Plan; and
- identify opportunities to use Neighbourhood Development Orders to enable developments that are consistent with their neighbourhood plan to proceed.

Core planning principles

17. Within the overarching roles that the planning system ought to play, a set of core land-use planning principles should underpin both plan-making and decision-taking. These 12 principles are that planning should:

- be genuinely plan-led, empowering local people to shape their surroundings, with succinct local and neighbourhood plans setting out a positive vision for the future of the area. Plans should be kept up-to-date, and be based on joint working and co-operation to address larger than local issues. They should provide a practical framework within which decisions on planning applications can be made with a high degree of predictability and efficiency;
- not simply be about scrutiny, but instead be a creative exercise in finding ways to enhance and improve the places in which people live their lives;
- proactively drive and support sustainable economic development to deliver the homes, business and industrial units, infrastructure and thriving local places that the country needs. Every effort should be made objectively to identify and then meet the housing, business and other development needs of an area, and respond positively to wider opportunities for growth. Plans should take account of market signals, such as land prices and housing affordability, and set out a clear strategy for allocating sufficient land which is suitable for development in their area, taking account of the needs of the residential and business communities;
- always seek to secure high quality design and a good standard of amenity for all existing and future occupants of land and buildings;
- take account of the different roles and character of different areas, promoting the vitality of our main urban areas, protecting the Green Belts around them, recognising the intrinsic character and beauty of the countryside and supporting thriving rural communities within it;
- support the transition to a low carbon future in a changing climate, taking full account of flood risk and coastal change, and encourage the reuse of existing resources, including conversion of existing buildings, and encourage the use of renewable resources (for example, by the development of renewable energy);

- contribute to conserving and enhancing the natural environment and reducing pollution. Allocations of land for development should prefer land of lesser environmental value, where consistent with other policies in this Framework;
- encourage the effective use of land by reusing land that has been previously developed (brownfield land), provided that it is not of high environmental value;
- promote mixed use developments, and encourage multiple benefits from the use of land in urban and rural areas, recognising that some open land can perform many functions (such as for wildlife, recreation, flood risk mitigation, carbon storage, or food production);
- conserve heritage assets in a manner appropriate to their significance, so that they can be enjoyed for their contribution to the quality of life of this and future generations;
- actively manage patterns of growth to make the fullest possible use of public transport, walking and cycling, and focus significant development in locations which are or can be made sustainable; and
- take account of and support local strategies to improve health, social and cultural wellbeing for all, and deliver sufficient community and cultural facilities and services to meet local needs.

Delivering sustainable development

1. Building a strong, competitive economy

18. The Government is committed to securing economic growth in order to create jobs and prosperity, building on the country's inherent strengths, and to meeting the twin challenges of global competition and of a low carbon future.

19. The Government is committed to ensuring that the planning system does everything it can to support sustainable economic growth. Planning should operate to encourage and not act as an impediment to sustainable growth. Therefore significant weight should be placed on the need to support economic growth through the planning system.

20. To help achieve economic growth, local planning authorities should plan proactively to meet the development needs of business and support an economy fit for the 21st century.

21. Investment in business should not be over-burdened by the combined requirements of planning policy expectations. Planning policies should recognise and seek to address potential barriers to investment, including a poor environment or any lack of infrastructure, services or housing. In drawing up Local Plans, local planning authorities should:

- set out a clear economic vision and strategy for their area which positively and proactively encourages sustainable economic growth;

- set criteria, or identify strategic sites, for local and inward investment to match the strategy and to meet anticipated needs over the plan period;
- support existing business sectors, taking account of whether they are expanding or contracting and, where possible, identify and plan for new or emerging sectors likely to locate in their area. Policies should be flexible enough to accommodate needs not anticipated in the plan and to allow a rapid response to changes in economic circumstances;
- plan positively for the location, promotion and expansion of clusters or networks of knowledge driven, creative or high technology industries;
- identify priority areas for economic regeneration, infrastructure provision and environmental enhancement; and
- facilitate flexible working practices such as the integration of residential and commercial uses within the same unit.

22. Planning policies should avoid the long term protection of sites allocated for employment use where there is no reasonable prospect of a site being used for that purpose. Land allocations should be regularly reviewed. Where there is no reasonable prospect of a site being used for the allocated employment use, applications for alternative uses of land or buildings should be treated on their merits having regard to market signals and the relative need for different land uses to support sustainable local communities.

2. Ensuring the vitality of town centres

23. Planning policies should be positive, promote competitive town centre environments and set out policies for the management and growth of centres over the plan period. In drawing up Local Plans, local planning authorities should:

- recognise town centres as the heart of their communities and pursue policies to support their viability and vitality;
- define a network and hierarchy of centres that is resilient to anticipated future economic changes;
- define the extent of town centres and primary shopping areas, based on a clear definition of primary and secondary frontages in designated centres, and set policies that make clear which uses will be permitted in such locations;
- promote competitive town centres that provide customer choice and a diverse retail offer and which reflect the individuality of town centres;
- retain and enhance existing markets and, where appropriate, re-introduce or create new ones, ensuring that markets remain attractive and competitive;
- allocate a range of suitable sites to meet the scale and type of retail, leisure, commercial, office, tourism, cultural, community and residential development needed in town centres. It is important that needs for retail, leisure, office and other main town centre uses are met in full and are not compromised by limited site availability. Local planning authorities should

therefore undertake an assessment of the need to expand town centres to ensure a sufficient supply of suitable sites;

- allocate appropriate edge of centre sites for main town centre uses that are well connected to the town centre where suitable and viable town centre sites are not available. If sufficient edge of centre sites cannot be identified, set policies for meeting the identified needs in other accessible locations that are well connected to the town centre;
- set policies for the consideration of proposals for main town centre uses which cannot be accommodated in or adjacent to town centres;
- recognise that residential development can play an important role in ensuring the vitality of centres and set out policies to encourage residential development on appropriate sites; and
- where town centres are in decline, local planning authorities should plan positively for their future to encourage economic activity.

24. Local planning authorities should apply a sequential test to planning applications for main town centre uses that are not in an existing centre and are not in accordance with an up-to-date Local Plan. They should require applications for main town centre uses to be located in town centres, then in edge of centre locations and only if suitable sites are not available should out of centre sites be considered. When considering edge of centre and out of centre proposals, preference should be given to accessible sites that are well connected to the town centre. Applicants and local planning authorities should demonstrate flexibility on issues such as format and scale.

25. This sequential approach should not be applied to applications for small scale rural offices or other small scale rural development.

26. When assessing applications for retail, leisure and office development outside of town centres, which are not in accordance with an up-to-date Local Plan, local planning authorities should require an impact assessment if the development is over a proportionate, locally set floorspace threshold (if there is no locally set threshold, the default threshold is 2,500 sq m).This should include assessment of:

    - the impact of the proposal on existing, committed and planned public and private investment in a centre or centres in the catchment area of the proposal; and
    - the impact of the proposal on town centre vitality and viability, including local consumer choice and trade in the town centre and wider area, up to five years from the time the application is made. For major schemes where the full impact will not be realised in five years, the impact should also be assessed up to ten years from the time the application is made.

27. Where an application fails to satisfy the sequential test or is likely to have significant adverse impact on one or more of the above factors, it should be refused.

3. Supporting a prosperous rural economy

28. Planning policies should support economic growth in rural areas in order to create jobs and prosperity by taking a positive approach to sustainable new development. To promote a strong rural economy, local and neighbourhood plans should:

- support the sustainable growth and expansion of all types of business and enterprise in rural areas, both through conversion of existing buildings and well designed new buildings;
- promote the development and diversification of agricultural and other land-based rural businesses;
- support sustainable rural tourism and leisure developments that benefit businesses in rural areas, communities and visitors, and which respect the character of the countryside. This should include supporting the provision and expansion of tourist and visitor facilities in appropriate locations where identified needs are not met by existing facilities in rural service centres; and
- promote the retention and development of local services and community facilities in villages, such as local shops, meeting places, sports venues, cultural buildings, public houses and places of worship.

4. Promoting sustainable transport

29. Transport policies have an important role to play in facilitating sustainable development but also in contributing to wider sustainability and health objectives. Smarter use of technologies can reduce the need to travel. The transport system needs to be balanced in favour of sustainable transport modes, giving people a real choice about how they travel. However, the Government recognises that different policies and measures will be required in different communities and opportunities to maximise sustainable transport solutions will vary from urban to rural areas.

30. Encouragement should be given to solutions which support reductions in greenhouse gas emissions and reduce congestion. In preparing Local Plans, local planning authorities should therefore support a pattern of development which, where reasonable to do so, facilitates the use of sustainable modes of transport.

31. Local authorities should work with neighbouring authorities and transport providers to develop strategies for the provision of viable infrastructure necessary to support sustainable development, including large scale facilities such as rail freight interchanges, roadside facilities for motorists or transport investment necessary to support strategies for the growth of ports, airports or other major generators of travel demand in their areas. The primary function of roadside facilities for motorists should be to support the safety and welfare of the road user.

32. All developments that generate significant amounts of movement should be supported by a Transport Statement or Transport Assessment. Plans and decisions should take account of whether:

- the opportunities for sustainable transport modes have been taken up depending on the nature and location of the site, to reduce the need for major transport infrastructure;
- safe and suitable access to the site can be achieved for all people; and
- improvements can be undertaken within the transport network that cost effectively limit the significant impacts of the development. Development should only be prevented or refused on transport grounds where the residual cumulative impacts of development are severe.

33. When planning for ports, airports and airfields that are not subject to a separate national policy statement, plans should take account of their growth and role in serving business, leisure, training and emergency service needs. Plans should take account of this Framework as well as the principles set out in the relevant national policy statements and the Government Framework for UK Aviation.

34. Plans and decisions should ensure developments that generate significant movement are located where the need to travel will be minimised and the use of sustainable transport modes can be maximised. However this needs to take account of policies set out elsewhere in this Framework, particularly in rural areas.

35. Plans should protect and exploit opportunities for the use of sustainable transport modes for the movement of goods or people. Therefore, developments should be located and designed where practical to

- accommodate the efficient delivery of goods and supplies;
- give priority to pedestrian and cycle movements, and have access to high quality public transport facilities;
- create safe and secure layouts which minimise conflicts between traffic and cyclists or pedestrians, avoiding street clutter and where appropriate establishing home zones;
- incorporate facilities for charging plug-in and other ultra-low emission vehicles; and
- consider the needs of people with disabilities by all modes of transport.

36. A key tool to facilitate this will be a Travel Plan. All developments which generate significant amounts of movement should be required to provide a Travel Plan.

37. Planning policies should aim for a balance of land uses within their area so that people can be encouraged to minimise journey lengths for employment, shopping, leisure, education and other activities.

38. For larger scale residential developments in particular, planning policies should promote a mix of uses in order to provide opportunities to undertake day-to-day activities including work on site. Where practical, particularly within large-scale developments, key facilities such as primary schools and local shops should be located within walking distance of most properties.

39. If setting local parking standards for residential and non-residential development, local planning authorities should take into account:

    - the accessibility of the development;
    - the type, mix and use of development;
    - the availability of and opportunities for public transport;
    - local car ownership levels; and
    - an overall need to reduce the use of high-emission vehicles.

40. Local authorities should seek to improve the quality of parking in town centres so that it is convenient, safe and secure, including appropriate provision for motorcycles. They should set appropriate parking charges that do not undermine the vitality of town centres. Parking enforcement should be proportionate.

41. Local planning authorities should identify and protect, where there is robust evidence, sites and routes which could be critical in developing infrastructure to widen transport choice.

5. Supporting high quality communications infrastructure

42. Advanced, high quality communications infrastructure is essential for sustainable economic growth. The development of high speed broadband technology and other communications networks also plays a vital role in enhancing the provision of local community facilities and services.

43. In preparing Local Plans, local planning authorities should support the expansion of electronic communications networks, including telecommunications and high speed broadband. They should aim to keep the numbers of radio and telecommunications masts and the sites for such installations to a minimum consistent with the efficient operation of the network. Existing masts, buildings and other structures should be used, unless the need for a new site has been justified. Where new sites are required, equipment should be sympathetically designed and camouflaged where appropriate.

44. Local planning authorities should not impose a ban on new telecommunications development in certain areas, impose blanket Article 4 directions over a wide area or a wide range of telecommunications development or insist on minimum distances between new telecommunications development and existing development. They should ensure that:

    - they have evidence to demonstrate that telecommunications infrastructure will not cause significant and irremediable interference with other electrical equipment, air traffic services or instrumentation operated in the national interest; and
    - they have considered the possibility of the construction of new buildings or other structures interfering with broadcast and telecommunications services.

45. Applications for telecommunications development (including for prior approval under Part 24 of the General Permitted Development Order) should be supported by the necessary evidence to justify the proposed development. This should include:

    - the outcome of consultations with organisations with an interest in the proposed development, in particular with the relevant body where a mast is to be installed near a school or college or within a statutory safeguarding zone surrounding an aerodrome or technical site; and
    - for an addition to an existing mast or base station, a statement that self-certifies that the cumulative exposure, when operational, will not exceed International Commission on non-ionising radiation protection guidelines; or
    - for a new mast or base station, evidence that the applicant has explored the possibility of erecting antennas on an existing building, mast or other structure and a statement that self-certifies that, when operational, International Commission guidelines will be met.

46. Local planning authorities must determine applications on planning grounds. They should not seek to prevent competition between different operators, question the need for the telecommunications system, or determine health safeguards if the proposal meets International Commission guidelines for public exposure.

6. Delivering a wide choice of high quality homes

47. To boost significantly the supply of housing, local planning authorities should:

    - use their evidence base to ensure that their Local Plan meets the full, objectively assessed needs for market and affordable housing in the housing market area, as far as is consistent with the policies set out in this Framework, including identifying key sites which are critical to the delivery of the housing strategy over the plan period;
    - identify and update annually a supply of specific deliverable[11] sites sufficient to provide five years worth of housing against their housing requirements with an additional buffer of 5% (moved forward from later in the plan period) to ensure choice and competition in the market for land. Where there has been a record of persistent under delivery of housing, local planning authorities should increase the buffer to 20% (moved forward from later in the plan period) to provide a realistic prospect of achieving the planned supply and to ensure choice and competition in the market for land;
    - identify a supply of specific, developable[12] sites or broad locations for growth, for years 6-10 and, where possible, for years 11-15;

11 To be considered deliverable, sites should be available now, offer a suitable location for development now, and be achievable with a realistic prospect that housing will be delivered on the site within five years and in particular that development of the site is viable. Sites with planning permission should be considered deliverable until permission expires, unless there is clear evidence that schemes will not be implemented within five years, for example they will not be viable, there is no longer a demand for the type of units or sites have long term phasing plans.

12 To be considered developable, sites should be in a suitable location for housing development and there should be a reasonable prospect that the site is available and could be viably developed at the point envisaged.

- for market and affordable housing, illustrate the expected rate of housing delivery through a housing trajectory for the plan period and set out a housing implementation strategy for the full range of housing describing how they will maintain delivery of a five-year supply of housing land to meet their housing target; and
- set out their own approach to housing density to reflect local circumstances.

48. Local planning authorities may make an allowance for windfall sites in the five-year supply if they have compelling evidence that such sites have consistently become available in the local area and will continue to provide a reliable source of supply. Any allowance should be realistic having regard to the Strategic Housing Land Availability Assessment, historic windfall delivery rates and expected future trends, and should not include residential gardens.

49. Housing applications should be considered in the context of the presumption in favour of sustainable development. Relevant policies for the supply of housing should not be considered up-to-date if the local planning authority cannot demonstrate a five-year supply of deliverable housing sites.

50. To deliver a wide choice of high quality homes, widen opportunities for home ownership and create sustainable, inclusive and mixed communities, local planning authorities should:

- plan for a mix of housing based on current and future demographic trends, market trends and the needs of different groups in the community (such as, but not limited to, families with children, older people, people with disabilities, service families and people wishing to build their own homes);
- identify the size, type, tenure and range of housing that is required in particular locations, reflecting local demand; and
- where they have identified that affordable housing is needed, set policies for meeting this need on site, unless off-site provision or a financial contribution of broadly equivalent value can be robustly justified (for example to improve or make more effective use of the existing housing stock) and the agreed approach contributes to the objective of creating mixed and balanced communities. Such policies should be sufficiently flexible to take account of changing market conditions over time.

51. Local planning authorities should identify and bring back into residential use empty housing and buildings in line with local housing and empty homes strategies and, where appropriate, acquire properties under compulsory purchase powers. They should normally approve planning applications for change to residential use and any associated development from commercial buildings (currently in the B use classes) where there is an identified need for additional housing in that area, provided that there are not strong economic reasons why such development would be inappropriate.

52. The supply of new homes can sometimes be best achieved through planning for larger scale development, such as new settlements or extensions to existing villages and towns that follow the principles of Garden Cities.

Working with the support of their communities, local planning authorities should consider whether such opportunities provide the best way of achieving sustainable development. In doing so, they should consider whether it is appropriate to establish Green Belt around or adjoining any such new development.

53. Local planning authorities should consider the case for setting out policies to resist inappropriate development of residential gardens, for example where development would cause harm to the local area.

54. In rural areas, exercising the duty to cooperate with neighbouring authorities, local planning authorities should be responsive to local circumstances and plan housing development to reflect local needs, particularly for affordable housing, including through rural exception sites where appropriate. Local planning authorities should in particular consider whether allowing some market housing would facilitate the provision of significant additional affordable housing to meet local needs.

55. To promote sustainable development in rural areas, housing should be located where it will enhance or maintain the vitality of rural communities. For example, where there are groups of smaller settlements, development in one village may support services in a village nearby. Local planning authorities should avoid new isolated homes in the countryside unless there are special circumstances such as:

- the essential need for a rural worker to live permanently at or near their place of work in the countryside; or
- where such development would represent the optimal viable use of a heritage asset or would be appropriate enabling development to secure the future of heritage assets; or
- where the development would re-use redundant or disused buildings and lead to an enhancement to the immediate setting; or
- the exceptional quality or innovative nature of the design of the dwelling. Such a design should:
  - be truly outstanding or innovative, helping to raise standards of design more generally in rural areas;
  - reflect the highest standards in architecture;
  - significantly enhance its immediate setting; and
  - be sensitive to the defining characteristics of the local area.

7. Requiring good design

56. The Government attaches great importance to the design of the built environment. Good design is a key aspect of sustainable development, is indivisible from good planning, and should contribute positively to making places better for people.

57. It is important to plan positively for the achievement of high quality and inclusive design for all development, including individual buildings, public and private spaces and wider area development schemes.

58. Local and neighbourhood plans should develop robust and comprehensive policies that set out the quality of development that will be expected for the area. Such policies should be based on stated objectives for the future of the area and an understanding and evaluation of its defining characteristics. Planning policies and decisions should aim to ensure that developments:

    - will function well and add to the overall quality of the area, not just for the short term but over the lifetime of the development;
    - establish a strong sense of place, using streetscapes and buildings to create attractive and comfortable places to live, work and visit;
    - optimise the potential of the site to accommodate development, create and sustain an appropriate mix of uses (including incorporation of green and other public space as part of developments) and support local facilities and transport networks;
    - respond to local character and history, and reflect the identity of local surroundings and materials, while not preventing or discouraging appropriate innovation;
    - create safe and accessible environments where crime and disorder, and the fear of crime, do not undermine quality of life or community cohesion; and
    - are visually attractive as a result of good architecture and appropriate landscaping.

59. Local planning authorities should consider using design codes where they could help deliver high quality outcomes. However, design policies should avoid unnecessary prescription or detail and should concentrate on guiding the overall scale, density, massing, height, landscape, layout, materials and access of new development in relation to neighbouring buildings and the local area more generally.

60. Planning policies and decisions should not attempt to impose architectural styles or particular tastes and they should not stifle innovation, originality or initiative through unsubstantiated requirements to conform to certain development forms or styles. It is, however, proper to seek to promote or reinforce local distinctiveness.

61. Although visual appearance and the architecture of individual buildings are very important factors, securing high quality and inclusive design goes beyond aesthetic considerations. Therefore, planning policies and decisions should address the connections between people and places and the integration of new development into the natural, built and historic environment.

62. Local planning authorities should have local design review arrangements in place to provide assessment and support to ensure high standards of design.

They should also when appropriate refer major projects for a national design review.[13] In general, early engagement on design produces the greatest benefits. In assessing applications, local planning authorities should have regard to the recommendations from the design review panel.

63. In determining applications, great weight should be given to outstanding or innovative designs which help raise the standard of design more generally in the area.

64. Permission should be refused for development of poor design that fails to take the opportunities available for improving the character and quality of an area and the way it functions.

65. Local planning authorities should not refuse planning permission for buildings or infrastructure which promote high levels of sustainability because of concerns about incompatibility with an existing townscape, if those concerns have been mitigated by good design (unless the concern relates to a designated heritage asset and the impact would cause material harm to the asset or its setting which is not outweighed by the proposal's economic, social and environmental benefits).

66. Applicants will be expected to work closely with those directly affected by their proposals to evolve designs that take account of the views of the community. Proposals that can demonstrate this in developing the design of the new development should be looked on more favourably.

67. Poorly placed advertisements can have a negative impact on the appearance of the built and natural environment. Control over outdoor advertisements should be efficient, effective and simple in concept and operation. Only those advertisements which will clearly have an appreciable impact on a building or on their surroundings should be subject to the local planning authority's detailed assessment. Advertisements should be subject to control only in the interests of amenity and public safety, taking account of cumulative impacts.

68. Where an area justifies a degree of special protection on the grounds of amenity, an Area of Special Control Order[14] may be approved. Before formally proposing an Area of Special Control, the local planning authority is expected to consult local trade and amenity organisations about the proposal. Before a direction to remove deemed planning consent is made for specific advertisements,[15] local planning authorities will be expected to demonstrate that the direction would improve visual amenity and there is no other way of effectively controlling the display of that particular class of advertisement. The comments of organisations, and individuals, whose interests would be affected by the direction should be sought as part of the process.

13 Currently provided by Design Council Cabe.
14 Regulation 20, The Town and Country Planning (Control of Advertisements) (England) Regulations 2007.
15 Regulation 7, The Town and Country Planning (Control of Advertisements) (England) Regulations 2007.

8. Promoting healthy communities

69. The planning system can play an important role in facilitating social interaction and creating healthy, inclusive communities. Local planning authorities should create a shared vision with communities of the residential environment and facilities they wish to see. To support this, local planning authorities should aim to involve all sections of the community in the development of Local Plans and in planning decisions, and should facilitate neighbourhood planning. Planning policies and decisions, in turn, should aim to achieve places which promote:

- opportunities for meetings between members of the community who might not otherwise come into contact with each other, including through mixed-use developments, strong neighbourhood centres and active street frontages which bring together those who work, live and play in the vicinity;
- safe and accessible environments where crime and disorder, and the fear of crime, do not undermine quality of life or community cohesion; and
- safe and accessible developments, containing clear and legible pedestrian routes, and high quality public space, which encourage the active and continual use of public areas.

70. To deliver the social, recreational and cultural facilities and services the community needs, planning policies and decisions should:

- plan positively for the provision and use of shared space, community facilities (such as local shops, meeting places, sports venues, cultural buildings, public houses and places of worship) and other local services to enhance the sustainability of communities and residential environments;
- guard against the unnecessary loss of valued facilities and services, particularly where this would reduce the community's ability to meet its day-to-day needs;
- ensure that established shops, facilities and services are able to develop and modernise in a way that is sustainable, and retained for the benefit of the community; and
- ensure an integrated approach to considering the location of housing, economic uses and community facilities and services.

71. Local planning authorities should take a positive and collaborative approach to enable development to be brought forward under a Community Right to Build Order, including working with communities to identify and resolve key issues before applications are submitted.

72. The Government attaches great importance to ensuring that a sufficient choice of school places is available to meet the needs of existing and new communities. Local planning authorities should take a proactive, positive and collaborative approach to meeting this requirement, and to development that will widen choice in education. They should:

- give great weight to the need to create, expand or alter schools; and

- work with schools promoters to identify and resolve key planning issues before applications are submitted.

73. Access to high quality open spaces and opportunities for sport and recreation can make an important contribution to the health and well-being of communities. Planning policies should be based on robust and up-to-date assessments of the needs for open space, sports and recreation facilities and opportunities for new provision. The assessments should identify specific needs and quantitative or qualitative deficits or surpluses of open space, sports and recreational facilities in the local area. Information gained from the assessments should be used to determine what open space, sports and recreational provision is required.

74. Existing open space, sports and recreational buildings and land, including playing fields, should not be built on unless:

- an assessment has been undertaken which has clearly shown the open space, buildings or land to be surplus to requirements; or
- the loss resulting from the proposed development would be replaced by equivalent or better provision in terms of quantity and quality in a suitable location; or
- the development is for alternative sports and recreational provision, the needs for which clearly outweigh the loss.

75. Planning policies should protect and enhance public rights of way and access. Local authorities should seek opportunities to provide better facilities for users, for example by adding links to existing rights of way networks including National Trails.

76. Local communities through local and neighbourhood plans should be able to identify for special protection green areas of particular importance to them. By designating land as Local Green Space local communities will be able to rule out new development other than in very special circumstances. Identifying land as Local Green Space should therefore be consistent with the local planning of sustainable development and complement investment in sufficient homes, jobs and other essential services. Local Green Spaces should only be designated when a plan is prepared or reviewed, and be capable of enduring beyond the end of the plan period.

77. The Local Green Space designation will not be appropriate for most green areas or open space. The designation should only be used:

- where the green space is in reasonably close proximity to the community it serves;
- where the green area is demonstrably special to a local community and holds a particular local significance, for example because of its beauty, historic significance, recreational value (including as a playing field), tranquillity or richness of its wildlife; and
- where the green area concerned is local in character and is not an extensive tract of land.

78. Local policy for managing development within a Local Green Space should be consistent with policy for Green Belts.

9. Protecting Green Belt land

79. The Government attaches great importance to Green Belts. The fundamental aim of Green Belt policy is to prevent urban sprawl by keeping land permanently open; the essential characteristics of Green Belts are their openness and their permanence.

80. Green Belt serves five purposes:

- to check the unrestricted sprawl of large built-up areas;
- to prevent neighbouring towns merging into one another;
- to assist in safeguarding the countryside from encroachment;
- to preserve the setting and special character of historic towns; and
- to assist in urban regeneration, by encouraging the recycling of derelict and other urban land.

81. Once Green Belts have been defined, local planning authorities should plan positively to enhance the beneficial use of the Green Belt, such as looking for opportunities to provide access; to provide opportunities for outdoor sport and recreation; to retain and enhance landscapes, visual amenity and biodiversity; or to improve damaged and derelict land.

82. The general extent of Green Belts across the country is already established. New Green Belts should only be established in exceptional circumstances, for example when planning for larger scale development such as new settlements or major urban extensions. If proposing a new Green Belt, local planning authorities should:

- demonstrate why normal planning and development management policies would not be adequate;
- set out whether any major changes in circumstances have made the adoption of this exceptional measure necessary;
- show what the consequences of the proposal would be for sustainable development;
- demonstrate the necessity for the Green Belt and its consistency with Local Plans for adjoining areas; and
- show how the Green Belt would meet the other objectives of the Framework.

83. Local planning authorities with Green Belts in their area should establish Green Belt boundaries in their Local Plans which set the framework for Green Belt and settlement policy. Once established, Green Belt boundaries should only be altered in exceptional circumstances, through the preparation or review of the Local Plan. At that time, authorities should consider the Green

Belt boundaries having regard to their intended permanence in the long term, so that they should be capable of enduring beyond the plan period.

84. When drawing up or reviewing Green Belt boundaries local planning authorities should take account of the need to promote sustainable patterns of development. They should consider the consequences for sustainable development of channelling development towards urban areas inside the Green Belt boundary, towards towns and villages inset within the Green Belt or towards locations beyond the outer Green Belt boundary.

85. When defining boundaries, local planning authorities should:

- ensure consistency with the Local Plan strategy for meeting identified requirements for sustainable development;
- not include land which it is unnecessary to keep permanently open;
- where necessary, identify in their plans areas of 'safeguarded land' between the urban area and the Green Belt, in order to meet longer-term development needs stretching well beyond the plan period;
- make clear that the safeguarded land is not allocated for development at the present time. Planning permission for the permanent development of safeguarded land should only be granted following a Local Plan review which proposes the development;
- satisfy themselves that Green Belt boundaries will not need to be altered at the end of the development plan period; and
- define boundaries clearly, using physical features that are readily recognisable and likely to be permanent.

86. If it is necessary to prevent development in a village primarily because of the important contribution which the open character of the village makes to the openness of the Green Belt, the village should be included in the Green Belt. If, however, the character of the village needs to be protected for other reasons, other means should be used, such as conservation area or normal development management policies, and the village should be excluded from the Green Belt.

87. As with previous Green Belt policy, inappropriate development is, by definition, harmful to the Green Belt and should not be approved except in very special circumstances.

88. When considering any planning application, local planning authorities should ensure that substantial weight is given to any harm to the Green Belt. 'Very special circumstances' will not exist unless the potential harm to the Green Belt by reason of inappropriateness, and any other harm, is clearly outweighed by other considerations.

89. A local planning authority should regard the construction of new buildings as inappropriate in Green Belt. Exceptions to this are:

- buildings for agriculture and forestry;

- provision of appropriate facilities for outdoor sport, outdoor recreation and for cemeteries, as long as it preserves the openness of the Green Belt and does not conflict with the purposes of including land within it;
- the extension or alteration of a building provided that it does not result in disproportionate additions over and above the size of the original building;
- the replacement of a building, provided the new building is in the same use and not materially larger than the one it replaces;
- limited infilling in villages, and limited affordable housing for local community needs under policies set out in the Local Plan; or
- limited infilling or the partial or complete redevelopment of previously developed sites (brownfield land), whether redundant or in continuing use (excluding temporary buildings), which would not have a greater impact on the openness of the Green Belt and the purpose of including land within it than the existing development.

90. Certain other forms of development are also not inappropriate in Green Belt provided they preserve the openness of the Green Belt and do not conflict with the purposes of including land in Green Belt. These are:

- mineral extraction;
- engineering operations;
- local transport infrastructure which can demonstrate a requirement for a Green Belt location;
- the re-use of buildings provided that the buildings are of permanent and substantial construction; and
- development brought forward under a Community Right to Build Order.

91. When located in the Green Belt, elements of many renewable energy projects will comprise inappropriate development. In such cases developers will need to demonstrate very special circumstances if projects are to proceed. Such very special circumstances may include the wider environmental benefits associated with increased production of energy from renewable sources.

92. Community Forests offer valuable opportunities for improving the environment around towns, by upgrading the landscape and providing for recreation and wildlife. An approved Community Forest plan may be a material consideration in preparing development plans and in deciding planning applications. Any development proposals within Community Forests in the Green Belt should be subject to the normal policies controlling development in Green Belts.

10. Meeting the challenge of climate change, flooding and coastal change

93. Planning plays a key role in helping shape places to secure radical reductions in greenhouse gas emissions, minimising vulnerability and providing resilience to the impacts of climate change, and supporting the delivery of renewable

and low carbon energy and associated infrastructure. This is central to the economic, social and environmental dimensions of sustainable development.

94. Local planning authorities should adopt proactive strategies to mitigate and adapt to climate change,[16] taking full account of flood risk, coastal change and water supply and demand considerations.

95. To support the move to a low carbon future, local planning authorities should:

- plan for new development in locations and ways which reduce greenhouse gas emissions;
- actively support energy efficiency improvements to existing buildings; and
- when setting any local requirement for a building's sustainability, do so in a way consistent with the Government's zero carbon buildings policy and adopt nationally described standards.

96. In determining planning applications, local planning authorities should expect new development to:

- comply with adopted Local Plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable; and
- take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.

97. To help increase the use and supply of renewable and low carbon energy, local planning authorities should recognise the responsibility on all communities to contribute to energy generation from renewable or low carbon sources. They should:

- have a positive strategy to promote energy from renewable and low carbon sources;
- design their policies to maximise renewable and low carbon energy development while ensuring that adverse impacts are addressed satisfactorily, including cumulative landscape and visual impacts;
- consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure the development of such sources;[17]
- support community-led initiatives for renewable and low carbon energy, including developments outside such areas being taken forward through neighbourhood planning; and

16 In line with the objectives and provisions of the Climate Change Act 2008.

17 In assessing the likely impacts of potential wind energy development when identifying suitable areas, and in determining planning applications for such development, planning authorities should follow the approach set out in the National Policy Statement for Renewable Energy Infrastructure (read with the relevant sections of the Overarching National Policy Statement for Energy Infrastructure, including that on aviation impacts). Where plans identify areas as suitable for renewable and low-carbon energy development, they should make clear what criteria have determined their selection, including for what size of development the areas are considered suitable.

- identify opportunities where development can draw its energy supply from decentralised, renewable or low carbon energy supply systems and for co-locating potential heat customers and suppliers.

98. When determining planning applications, local planning authorities should:

    - not require applicants for energy development to demonstrate the overall need for renewable or low carbon energy and also recognise that even small-scale projects provide a valuable contribution to cutting greenhouse gas emissions; and
    - approve the application[18] if its impacts are (or can be made) acceptable. Once suitable areas for renewable and low carbon energy have been identified in plans, local planning authorities should also expect subsequent applications for commercial scale projects outside these areas to demonstrate that the proposed location meets the criteria used in identifying suitable areas.

99. Local Plans should take account of climate change over the longer term, including factors such as flood risk, coastal change, water supply and changes to biodiversity and landscape. New development should be planned to avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure.

100. Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk, but where development is necessary, making it safe without increasing flood risk elsewhere.[19] Local Plans should be supported by Strategic Flood Risk Assessment and develop policies to manage flood risk from all sources, taking account of advice from the Environment Agency and other relevant flood risk management bodies, such as lead local flood authorities and internal drainage boards. Local Plans should apply a sequential, risk-based approach to the location of development to avoid where possible flood risk to people and property and manage any residual risk, taking account of the impacts of climate change, by:

    - applying the Sequential Test;
    - if necessary, applying the Exception Test;
    - safeguarding land from development that is required for current and future flood management;
    - using opportunities offered by new development to reduce the causes and impacts of flooding; and
    - where climate change is expected to increase flood risk so that some existing development may not be sustainable in the long-term, seeking

18 Unless material considerations indicate otherwise.
19 Technical guidance on flood risk published alongside this Framework sets out how this policy should be implemented.

opportunities to facilitate the relocation of development, including housing, to more sustainable locations.

101. The aim of the Sequential Test is to steer new development to areas with the lowest probability of flooding. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower probability of flooding. The Strategic Flood Risk Assessment will provide the basis for applying this test. A sequential approach should be used in areas known to be at risk from any form of flooding.

102. If, following application of the Sequential Test, it is not possible, consistent with wider sustainability objectives, for the development to be located in zones with a lower probability of flooding, the Exception Test can be applied if appropriate. For the Exception Test to be passed:

- it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a Strategic Flood Risk Assessment where one has been prepared; and
- a site-specific flood risk assessment must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

Both elements of the test will have to be passed for development to be allocated or permitted.

103. When determining planning applications, local planning authorities should ensure flood risk is not increased elsewhere and only consider development appropriate in areas at risk of flooding where, informed by a site-specific flood risk assessment[20] following the Sequential Test, and if required the Exception Test, it can be demonstrated that:

- within the site, the most vulnerable development is located in areas of lowest flood risk unless there are overriding reasons to prefer a different location; and
- development is appropriately flood resilient and resistant, including safe access and escape routes where required, and that any residual risk can be safely managed, including by emergency planning; and it gives priority to the use of sustainable drainage systems.[21]

104. For individual developments on sites allocated in development plans through the Sequential Test, applicants need not apply the Sequential Test. Applications for minor development and changes of use should not be

20 A site-specific flood risk assessment is required for proposals of 1 hectare or greater in Flood Zone 1; all proposals for new development (including minor development and change of use) in Flood Zones 2 and 3, or in an area within Flood Zone 1 which has critical drainage problems (as notified to the local planning authority by the Environment Agency); and where proposed development or a change of use to a more vulnerable class may be subject to other sources of flooding.

21 The Floods and Water Management Act 2010 establishes a Sustainable Drainage Systems Approving Body in unitary or county councils. This body must approve drainage systems in new developments and re-developments before construction begins.

subject to the Sequential or Exception Tests[22] but should still meet the requirements for site-specific flood risk assessments.

105. In coastal areas, local planning authorities should take account of the UK Marine Policy Statement and marine plans and apply Integrated Coastal Zone Management across local authority and land/sea boundaries, ensuring integration of the terrestrial and marine planning regimes.

106. Local planning authorities should reduce risk from coastal change by avoiding inappropriate development in vulnerable areas or adding to the impacts of physical changes to the coast. They should identify as a Coastal Change Management Area any area likely to be affected by physical changes to the coast, and:

- be clear as to what development will be appropriate in such areas and in what circumstances; and
- make provision for development and infrastructure that needs to be relocated away from Coastal Change Management Areas.

107. When assessing applications, authorities should consider development in a Coastal Change Management Area appropriate where it is demonstrated that:

- it will be safe over its planned lifetime and will not have an unacceptable impact on coastal change;
- the character of the coast including designations is not compromised;
- the development provides wider sustainability benefits; and
- the development does not hinder the creation and maintenance of a continuous signed and managed route around the coast.[23]

108. Local planning authorities should also ensure appropriate development in a Coastal Change Management Area is not impacted by coastal change by limiting the planned life-time of the proposed development through temporary permission and restoration conditions where necessary to reduce the risk to people and the development.

11. Conserving and enhancing the natural environment

109. The planning system should contribute to and enhance the natural and local environment by:

- protecting and enhancing valued landscapes, geological conservation interests and soils;
- recognising the wider benefits of ecosystem services;
- minimising impacts on biodiversity and providing net gains in biodiversity where possible, contributing to the Government's commitment to halt the

22 Except for any proposal involving a change of use to a caravan, camping or chalet site, or to a mobile home or park home site, where the Sequential and Exception Tests should be applied as appropriate.

23 As required by the Marine and Coastal Access Act 2009.

overall decline in biodiversity, including by establishing coherent ecological networks that are more resilient to current and future pressures;

- preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability; and

- remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate.

110. In preparing plans to meet development needs, the aim should be to minimise pollution and other adverse effects on the local and natural environment. Plans should allocate land with the least environmental or amenity value, where consistent with other policies in this Framework.

111. Planning policies and decisions should encourage the effective use of land by re-using land that has been previously developed (brownfield land), provided that it is not of high environmental value. Local planning authorities may continue to consider the case for setting a locally appropriate target for the use of brownfield land.

112. Local planning authorities should take into account the economic and other benefits of the best and most versatile agricultural land. Where significant development of agricultural land is demonstrated to be necessary, local planning authorities should seek to use areas of poorer quality land in preference to that of a higher quality.

113. Local planning authorities should set criteria based policies against which proposals for any development on or affecting protected wildlife or geodiversity sites or landscape areas will be judged. Distinctions should be made between the hierarchy of international, national and locally designated sites,[24] so that protection is commensurate with their status and gives appropriate weight to their importance and the contribution that they make to wider ecological networks.

114. Local planning authorities should:

- set out a strategic approach in their Local Plans, planning positively for the creation, protection, enhancement and management of networks of biodiversity and green infrastructure; and

- maintain the character of the undeveloped coast, protecting and enhancing its distinctive landscapes, particularly in areas defined as Heritage Coast, and improve public access to and enjoyment of the coast.

115. Great weight should be given to conserving landscape and scenic beauty in National Parks, the Broads and Areas of Outstanding Natural Beauty, which have the highest status of protection in relation to landscape and scenic beauty. The conservation of wildlife and cultural heritage are important

24 Circular 06/2005 provides further guidance in respect of statutory obligations for biodiversity and geological conservation and their impact within the planning system.

considerations in all these areas, and should be given great weight in National Parks and the Broads.[25]

116. Planning permission should be refused for major developments in these designated areas except in exceptional circumstances and where it can be demonstrated they are in the public interest. Consideration of such applications should include an assessment of:

- the need for the development, including in terms of any national considerations, and the impact of permitting it, or refusing it, upon the local economy;
- the cost of, and scope for, developing elsewhere outside the designated area, or meeting the need for it in some other way; and
- any detrimental effect on the environment, the landscape and recreational opportunities, and the extent to which that could be moderated.

117. To minimise impacts on biodiversity and geodiversity, planning policies should:

- plan for biodiversity at a landscape-scale across local authority boundaries;
- identify and map components of the local ecological networks, including the hierarchy of international, national and locally designated sites of importance for biodiversity, wildlife corridors and stepping stones that connect them and areas identified by local partnerships for habitat restoration or creation;
- promote the preservation, restoration and re-creation of priority habitats, ecological networks and the protection and recovery of priority species populations, linked to national and local targets, and identify suitable indicators for monitoring biodiversity in the plan;
- aim to prevent harm to geological conservation interests; and
- where Nature Improvement Areas are identified in Local Plans, consider specifying the types of development that may be appropriate in these Areas.

118. When determining planning applications, local planning authorities should aim to conserve and enhance biodiversity by applying the following principles:

- if significant harm resulting from a development cannot be avoided (through locating on an alternative site with less harmful impacts), adequately mitigated, or, as a last resort, compensated for, then planning permission should be refused;
- proposed development on land within or outside a Site of Special Scientific Interest likely to have an adverse effect on a Site of Special Scientific Interest (either individually or in combination with other developments) should not normally be permitted. Where an adverse effect on the site's notified special interest features is likely, an exception should only be made

25 *English National Parks and the Broads: UK Government Vision and Circular 2010* provides further guidance and information about their statutory purposes, management and other matters.

where the benefits of the development, at this site, clearly outweigh both the impacts that it is likely to have on the features of the site that make it of special scientific interest and any broader impacts on the national network of Sites of Special Scientific Interest;

- development proposals where the primary objective is to conserve or enhance biodiversity should be permitted;
- opportunities to incorporate biodiversity in and around developments should be encouraged;
- planning permission should be refused for development resulting in the loss or deterioration of irreplaceable habitats, including ancient woodland and the loss of aged or veteran trees found outside ancient woodland, unless the need for, and benefits of, the development in that location clearly outweigh the loss; and
- the following wildlife sites should be given the same protection as European sites:
  - potential Special Protection Areas and possible Special Areas of Conservation;
  - listed or proposed Ramsar sites;[26] and
  - sites identified, or required, as compensatory measures for adverse effects on European sites, potential Special Protection Areas, possible Special Areas of Conservation, and listed or proposed Ramsar sites.

119. The presumption in favour of sustainable development (paragraph 14) does not apply where development requiring appropriate assessment under the Birds or Habitats Directives is being considered, planned or determined.

120. To prevent unacceptable risks from pollution and land instability, planning policies and decisions should ensure that new development is appropriate for its location. The effects (including cumulative effects) of pollution on health, the natural environment or general amenity, and the potential sensitivity of the area or proposed development to adverse effects from pollution, should be taken into account. Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner.

121. Planning policies and decisions should also ensure that:

- the site is suitable for its new use taking account of ground conditions and land instability, including from natural hazards or former activities such as mining, pollution arising from previous uses and any proposals for mitigation including land remediation or impacts on the natural environment arising from that remediation;
- after remediation, as a minimum, land should not be capable of being determined as contaminated land under Part IIA of the Environmental Protection Act 1990; and

26 Potential Special Protection Areas, possible Special Areas of Conservation and proposed Ramsar sites are sites on which Government has initiated public consultation on the scientific case for designation as a Special Protection Area, candidate Special Area of Conservation or Ramsar site.

- adequate site investigation information, prepared by a competent person, is presented.

122. In doing so, local planning authorities should focus on whether the development itself is an acceptable use of the land, and the impact of the use, rather than the control of processes or emissions themselves where these are subject to approval under pollution control regimes. Local planning authorities should assume that these regimes will operate effectively. Equally, where a planning decision has been made on a particular development, the planning issues should not be revisited through the permitting regimes operated by pollution control authorities.

123. Planning policies and decisions should aim to:

- avoid noise from giving rise to significant adverse impacts[27] on health and quality of life as a result of new development;
- mitigate and reduce to a minimum other adverse impacts[27] on health and quality of life arising from noise from new development, including through the use of conditions;
- recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established;[28] and
- identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

124. Planning policies should sustain compliance with and contribute towards EU limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and the cumulative impacts on air quality from individual sites in local areas. Planning decisions should ensure that any new development in Air Quality Management Areas is consistent with the local air quality action plan.

125. By encouraging good design, planning policies and decisions should limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation.

27 See Explanatory Note to the Noise Policy Statement for England (Department for the Environment, Food and Rural Affairs).

28 Subject to the provisions of the Environmental Protection Act 1990 and other relevant law.

12. Conserving and enhancing the historic environment

126. Local planning authorities should set out in their Local Plan a positive strategy for the conservation and enjoyment of the historic environment,[29] including heritage assets most at risk through neglect, decay or other threats. In doing so, they should recognise that heritage assets are an irreplaceable resource and conserve them in a manner appropriate to their significance. In developing this strategy, local planning authorities should take into account:

- the desirability of sustaining and enhancing the significance of heritage assets and putting them to viable uses consistent with their conservation;
- the wider social, cultural, economic and environmental benefits that conservation of the historic environment can bring;
- the desirability of new development making a positive contribution to local character and distinctiveness; and
- opportunities to draw on the contribution made by the historic environment to the character of a place.

127. When considering the designation of conservation areas, local planning authorities should ensure that an area justifies such status because of its special architectural or historic interest, and that the concept of conservation is not devalued through the designation of areas that lack special interest.

128. In determining applications, local planning authorities should require an applicant to describe the significance of any heritage assets affected, including any contribution made by their setting. The level of detail should be proportionate to the assets' importance and no more than is sufficient to understand the potential impact of the proposal on their significance. As a minimum the relevant historic environment record should have been consulted and the heritage assets assessed using appropriate expertise where necessary. Where a site on which development is proposed includes or has the potential to include heritage assets with archaeological interest, local planning authorities should require developers to submit an appropriate desk-based assessment and, where necessary, a field evaluation.

129. Local planning authorities should identify and assess the particular significance of any heritage asset that may be affected by a proposal (including by development affecting the setting of a heritage asset) taking account of the available evidence and any necessary expertise. They should take this assessment into account when considering the impact of a proposal on a heritage asset, to avoid or minimise conflict between the heritage asset's conservation and any aspect of the proposal.

130. Where there is evidence of deliberate neglect of or damage to a heritage asset the deteriorated state of the heritage asset should not be taken into account in any decision.

29 The principles and policies set out in this section apply to the heritage-related consent regimes for which local planning authorities are responsible under the Planning (Listed Buildings and Conservation Areas) Act 1990, as well as to plan-making and decision-taking.

131. In determining planning applications, local planning authorities should take account of:

- the desirability of sustaining and enhancing the significance of heritage assets and putting them to viable uses consistent with their conservation;
- the positive contribution that conservation of heritage assets can make to sustainable communities including their economic vitality; and
- the desirability of new development making a positive contribution to local character and distinctiveness.

132. When considering the impact of a proposed development on the significance of a designated heritage asset, great weight should be given to the asset's conservation. The more important the asset, the greater the weight should be. Significance can be harmed or lost through alteration or destruction of the heritage asset or development within its setting. As heritage assets are irreplaceable, any harm or loss should require clear and convincing justification. Substantial harm to or loss of a grade II listed building, park or garden should be exceptional. Substantial harm to or loss of designated heritage assets of the highest significance, notably scheduled monuments, protected wreck sites, battlefields, grade I and II* listed buildings, grade I and II* registered parks and gardens, and World Heritage Sites, should be wholly exceptional.

133. Where a proposed development will lead to substantial harm to or total loss of significance of a designated heritage asset, local planning authorities should refuse consent, unless it can be demonstrated that the substantial harm or loss is necessary to achieve substantial public benefits that outweigh that harm or loss, or all of the following apply:

- the nature of the heritage asset prevents all reasonable uses of the site; and
- no viable use of the heritage asset itself can be found in the medium term through appropriate marketing that will enable its conservation; and
- conservation by grant-funding or some form of charitable or public ownership is demonstrably not possible; and
- the harm or loss is outweighed by the benefit of bringing the site back into use.

134. Where a development proposal will lead to less than substantial harm to the significance of a designated heritage asset, this harm should be weighed against the public benefits of the proposal, including securing its optimum viable use.

135. The effect of an application on the significance of a non-designated heritage asset should be taken into account in determining the application. In weighing applications that affect directly or indirectly non designated heritage assets, a balanced judgement will be required having regard to the scale of any harm or loss and the significance of the heritage asset.

136. Local planning authorities should not permit loss of the whole or part of a heritage asset without taking all reasonable steps to ensure the new development will proceed after the loss has occurred.

137. Local planning authorities should look for opportunities for new development within Conservation Areas and World Heritage Sites and within the setting of heritage assets to enhance or better reveal their significance. Proposals that preserve those elements of the setting that make a positive contribution to or better reveal the significance of the asset should be treated favourably.

138. Not all elements of a World Heritage Site or Conservation Area will necessarily contribute to its significance. Loss of a building (or other element) which makes a positive contribution to the significance of the Conservation Area or World Heritage Site should be treated either as substantial harm under paragraph 133 or less than substantial harm under paragraph 134, as appropriate, taking into account the relative significance of the element affected and its contribution to the significance of the Conservation Area or World Heritage Site as a whole.

139. Non-designated heritage assets of archaeological interest that are demonstrably of equivalent significance to scheduled monuments, should be considered subject to the policies for designated heritage assets.

140. Local planning authorities should assess whether the benefits of a proposal for enabling development, which would otherwise conflict with planning policies but which would secure the future conservation of a heritage asset, outweigh the disbenefits of departing from those policies.

141. Local planning authorities should make information about the significance of the historic environment gathered as part of plan-making or development management publicly accessible. They should also require developers to record and advance understanding of the significance of any heritage assets to be lost (wholly or in part) in a manner proportionate to their importance and the impact, and to make this evidence (and any archive generated) publicly accessible.[30] However, the ability to record evidence of our past should not be a factor in deciding whether such loss should be permitted.

13. Facilitating the sustainable use of minerals

142. Minerals are essential to support sustainable economic growth and our quality of life. It is therefore important that there is a sufficient supply of material to provide the infrastructure, buildings, energy and goods that the country needs. However, since minerals are a finite natural resource, and can only be worked where they are found, it is important to make best use of them to secure their long-term conservation.

143. In preparing Local Plans, local planning authorities should:

30 Copies of evidence should be deposited with the relevant Historic Environment Record, and any archives with a local museum or other public depository.

- identify and include policies for extraction of mineral resource of local and national importance in their area, but should not identify new sites or extensions to existing sites for peat extraction;
- so far as practicable, take account of the contribution that substitute or secondary and recycled materials and minerals waste would make to the supply of materials, before considering extraction of primary materials, whilst aiming to source minerals supplies indigenously;
- define Minerals Safeguarding Areas and adopt appropriate policies in order that known locations of specific minerals resources of local and national importance are not needlessly sterilised by non-mineral development, whilst not creating a presumption that resources defined will be worked; and define Minerals Consultation Areas based on these Minerals Safeguarding Areas;
- safeguard:
  - existing, planned and potential rail heads, rail links to quarries, wharfage and associated storage, handling and processing facilities for the bulk transport by rail, sea or inland waterways of minerals, including recycled, secondary and marine-dredged materials; and
  - existing, planned and potential sites for concrete batching, the manufacture of coated materials, other concrete products and the handling, processing and distribution of substitute, recycled and secondary aggregate material.
- set out policies to encourage the prior extraction of minerals, where practicable and environmentally feasible, if it is necessary for non-mineral development to take place;
- set out environmental criteria, in line with the policies in this Framework, against which planning applications will be assessed so as to ensure that permitted operations do not have unacceptable adverse impacts on the natural and historic environment or human health, including from noise, dust, visual intrusion, traffic, tip- and quarry-slope stability, differential settlement of quarry backfill, mining subsidence, increased flood risk, impacts on the flow and quantity of surface and groundwater and migration of contamination from the site; and take into account the cumulative effects of multiple impacts from individual sites and/or a number of sites in a locality;
- when developing noise limits, recognise that some noisy short-term activities, which may otherwise be regarded as unacceptable, are unavoidable to facilitate minerals extraction; and
- put in place policies to ensure worked land is reclaimed at the earliest opportunity, taking account of aviation safety, and that high quality restoration and aftercare of mineral sites takes place, including for agriculture (safeguarding the long term potential of best and most versatile agricultural land and conserving soil resources), geodiversity, biodiversity, native woodland, the historic environment and recreation.

144. When determining planning applications, local planning authorities should:

- give great weight to the benefits of the mineral extraction, including to the economy;
- as far as is practical, provide for the maintenance of landbanks of non-energy minerals from outside National Parks, the Broads, Areas of Outstanding Natural Beauty and World Heritage sites, Scheduled Monuments and Conservation Areas;
- ensure, in granting planning permission for mineral development, that there are no unacceptable adverse impacts on the natural and historic environment, human health or aviation safety, and take into account the cumulative effect of multiple impacts from individual sites and/or from a number of sites in a locality;
- ensure that any unavoidable noise, dust and particle emissions and any blasting vibrations are controlled, mitigated or removed at source,[31] and establish appropriate noise limits for extraction in proximity to noise sensitive properties;
- not grant planning permission for peat extraction from new or extended sites;
- provide for restoration and aftercare at the earliest opportunity to be carried out to high environmental standards, through the application of appropriate conditions, where necessary. Bonds or other financial guarantees to underpin planning conditions should only be sought in exceptional circumstances;
- not normally permit other development proposals in mineral safeguarding areas where they might constrain potential future use for these purposes;
- consider how to meet any demand for small-scale extraction of building stone at, or close to, relic quarries needed for the repair of heritage assets, taking account of the need to protect designated sites; and
- recognise the small-scale nature and impact of building and roofing stone quarries, and the need for a flexible approach to the potentially long duration of planning permissions reflecting the intermittent or low rate of working at many sites.

145. Minerals planning authorities should plan for a steady and adequate supply of aggregates by:

- preparing an annual Local Aggregate Assessment, either individually or jointly by agreement with another or other mineral planning authorities, based on a rolling average of 10 years sales data and other relevant local information, and an assessment of all supply options (including marine dredged, secondary and recycled sources);
- participating in the operation of an Aggregate Working Party and taking the advice of that Party into account when preparing their Local Aggregate Assessment;

31 Technical guidance on minerals published alongside this Framework sets out how these policies should be implemented.

- making provision for the land-won and other elements of their Local Aggregate Assessment in their mineral plans taking account of the advice of the Aggregate Working Parties and the National Aggregate Co-ordinating Group as appropriate. Such provision should take the form of specific sites, preferred areas and/or areas of search and locational criteria as appropriate;
- taking account of published National and Sub National Guidelines on future provision which should be used as a guideline when planning for the future demand for and supply of aggregates;
- using landbanks of aggregate minerals reserves principally as an indicator of the security of aggregate minerals supply, and to indicate the additional provision that needs to be made for new aggregate extraction and alternative supplies in mineral plans;
- making provision for the maintenance of landbanks of at least 7 years for sand and gravel and at least 10 years for crushed rock, whilst ensuring that the capacity of operations to supply a wide range of materials is not compromised. Longer periods may be appropriate to take account of the need to supply a range of types of aggregates, locations of permitted reserves relative to markets, and productive capacity of permitted sites;
- ensuring that large landbanks bound up in very few sites do not stifle competition; and
- calculating and maintaining separate landbanks for any aggregate materials of a specific type or quality which have a distinct and separate market.

146. Minerals planning authorities should plan for a steady and adequate supply of industrial minerals by:

- co-operating with neighbouring and more distant authorities to co-ordinate the planning of industrial minerals to ensure adequate provision is made to support their likely use in industrial and manufacturing processes;
- encouraging safeguarding or stockpiling so that important minerals remain available for use;
- providing a stock of permitted reserves to support the level of actual and proposed investment required for new or existing plant and the maintenance and improvement of existing plant and equipment, as follows:
  - at least 10 years for individual silica sand sites;
  - at least 15 years for cement primary (chalk and limestone) and secondary (clay and shale) materials to maintain an existing plant, and for silica sand sites where significant new capital is required; and
  - at least 25 years for brick clay, and for cement primary and secondary materials to support a new kiln.
- taking account of the need for provision of brick clay from a number of different sources to enable appropriate blends to be made.

147. Minerals planning authorities should also:

- when planning for on-shore oil and gas development, including unconventional hydrocarbons, clearly distinguish between the three phases of development (exploration, appraisal and production) and address constraints on production and processing within areas that are licensed for oil and gas exploration or production;
- encourage underground gas and carbon storage and associated infrastructure if local geological circumstances indicate its feasibility;
- indicate any areas where coal extraction and the disposal of colliery spoil may be acceptable;
- encourage capture and use of methane from coal mines in active and abandoned coalfield areas; and
- provide for coal producers to extract separately, and if necessary stockpile, fireclay so that it remains available for use.

148. When determining planning applications, minerals planning authorities should ensure that the integrity and safety of underground storage facilities are appropriate, taking into account the maintenance of gas pressure, prevention of leakage of gas and the avoidance of pollution.

149. Permission should not be given for the extraction of coal unless the proposal is environmentally acceptable, or can be made so by planning conditions or obligations; or if not, it provides national, local or community benefits which clearly outweigh the likely impacts to justify the grant of planning permission.

Plan-making

Local Plans

150. Local Plans are the key to delivering sustainable development that reflects the vision and aspirations of local communities. Planning decisions must be taken in accordance with the development plan unless material considerations indicate otherwise.[32]

151. Local Plans must be prepared with the objective of contributing to the achievement of sustainable development.[33] To this end, they should be consistent with the principles and policies set out in this Framework, including the presumption in favour of sustainable development.

152. Local planning authorities should seek opportunities to achieve each of the economic, social and environmental dimensions of sustainable development, and net gains across all three. Significant adverse impacts on any of these dimensions should be avoided and, wherever possible, alternative options which reduce or eliminate such impacts should be pursued. Where adverse impacts are unavoidable, measures to mitigate the impact should be considered. Where adequate mitigation measures are not possible, compensatory measures may be appropriate.

153. Each local planning authority should produce a Local Plan for its area. This can be reviewed in whole or in part to respond flexibly to changing circumstances. Any additional development plan documents should only be used where clearly justified. Supplementary planning documents should be used where they can help applicants make successful applications or aid infrastructure delivery, and should not be used to add unnecessarily to the financial burdens on development.

154. Local Plans should be aspirational but realistic. They should address the spatial implications of economic, social and environmental change. Local Plans should set out the opportunities for development and clear policies on what will or will not be permitted and where. Only policies that provide a clear indication of how a decision maker should react to a development proposal should be included in the plan.

155. Early and meaningful engagement and collaboration with neighbourhoods, local organisations and businesses is essential. A wide section of the community should be proactively engaged, so that Local Plans, as far as possible, reflect a collective vision and a set of agreed priorities for the sustainable development of the area, including those contained in any neighbourhood plans that have been made.

156. Local planning authorities should set out the **strategic priorities** for the area in the Local Plan. This should include strategic policies to deliver:

    - the homes and jobs needed in the area;

32 Section 38(6) of the Planning and Compulsory Purchase Act 2004.

33 Under section 39(2) of the Planning and Compulsory Purchase Act 2004 a local authority exercising their plan making functions must do so with the objective of contributing to the achievement of sustainable development.

- the provision of retail, leisure and other commercial development;
- the provision of infrastructure for transport, telecommunications, waste management, water supply, wastewater, flood risk and coastal change management, and the provision of minerals and energy (including heat);
- the provision of health, security, community and cultural infrastructure and other local facilities; and
- climate change mitigation and adaptation, conservation and enhancement of the natural and historic environment, including landscape.

157. Crucially, Local Plans should:

- plan positively for the development and infrastructure required in the area to meet the objectives, principles and policies of this Framework;
- be drawn up over an appropriate time scale, preferably a 15-year time horizon, take account of longer term requirements, and be kept up to date;
- be based on co-operation with neighbouring authorities, public, voluntary and private sector organisations;
- indicate broad locations for strategic development on a key diagram and land-use designations on a proposals map;
- allocate sites to promote development and flexible use of land, bringing forward new land where necessary, and provide detail on form, scale, access and quantum of development where appropriate;
- identify areas where it may be necessary to limit freedom to change the uses of buildings, and support such restrictions with a clear explanation;
- identify land where development would be inappropriate, for instance because of its environmental or historic significance; and
- contain a clear strategy for enhancing the natural, built and historic environment, and supporting Nature Improvement Areas where they have been identified.

Using a proportionate evidence base

158. Each local planning authority should ensure that the Local Plan is based on adequate, up-to-date and relevant evidence about the economic, social and environmental characteristics and prospects of the area. Local planning authorities should ensure that their assessment of and strategies for housing, employment and other uses are integrated, and that they take full account of relevant market and economic signals.

Housing

159. Local planning authorities should have a clear understanding of housing needs in their area. They should:

- prepare a Strategic Housing Market Assessment to assess their full housing needs, working with neighbouring authorities where housing market areas cross administrative boundaries. The Strategic Housing Market Assessment

should identify the scale and mix of housing and the range of tenures that the local population is likely to need over the plan period which:

- meets household and population projections, taking account of migration and demographic change;
- addresses the need for all types of housing, including affordable housing and the needs of different groups in the community (such as, but not limited to, families with children, older people, people with disabilities, service families and people wishing to build their own homes);[34] and
- caters for housing demand and the scale of housing supply necessary to meet this demand;

- prepare a Strategic Housing Land Availability Assessment to establish realistic assumptions about the availability, suitability and the likely economic viability of land to meet the identified need for housing over the plan period.

Business

160. Local planning authorities should have a clear understanding of business needs within the economic markets operating in and across their area. To achieve this, they should:

- work together with county and neighbouring authorities and with Local Enterprise Partnerships to prepare and maintain a robust evidence base to understand both existing business needs and likely changes in the market; and
- work closely with the business community to understand their changing needs and identify and address barriers to investment, including a lack of housing, infrastructure or viability.

161. Local planning authorities should use this evidence base to assess:

- the needs for land or floorspace for economic development, including both the quantitative and qualitative needs for all foreseeable types of economic activity over the plan period, including for retail and leisure development;
- the existing and future supply of land available for economic development and its sufficiency and suitability to meet the identified needs. Reviews of land available for economic development should be undertaken at the same time as, or combined with, Strategic Housing Land Availability Assessments and should include a reappraisal of the suitability of previously allocated land;
- the role and function of town centres and the relationship between them, including any trends in the performance of centres;
- the capacity of existing centres to accommodate new town centre development;
- locations of deprivation which may benefit from planned remedial action; and

34 The planning policy for traveller sites sets out how travellers' accommodation needs should also be assessed.

- the needs of the food production industry and any barriers to investment that planning can resolve.

Infrastructure

162. Local planning authorities should work with other authorities and providers to:

- assess the quality and capacity of infrastructure for transport, water supply, wastewater and its treatment, energy (including heat), telecommunications, utilities, waste, health, social care, education, flood risk and coastal change management, and its ability to meet forecast demands; and
- take account of the need for strategic infrastructure including nationally significant infrastructure within their areas.

Minerals

163. Minerals planning authorities should work with other relevant organisations to use the best available information to:

- develop and maintain an understanding of the extent and location of mineral resource in their areas; and
- assess the projected demand for their use, taking full account of opportunities to use materials from secondary and other sources which could provide suitable alternatives to primary materials.

Defence, national security, counter-terrorism and resilience

164. Local planning authorities should:

- work with the Ministry of Defence's Strategic Planning Team to ensure that they have and take into account the most up-to-date information about defence and security needs in their area; and
- work with local advisors and others to ensure that they have and take into account the most up-to-date information about higher risk sites in their area for malicious threats and natural hazards, including steps that can be taken to reduce vulnerability and increase resilience.

Environment

165. Planning policies and decisions should be based on up-to-date information about the natural environment and other characteristics of the area including drawing, for example, from River Basin Management Plans. Working with Local Nature Partnerships where appropriate, this should include an assessment of existing and potential components of ecological networks. A sustainability appraisal which meets the requirements of the European Directive on strategic environmental assessment should be an integral part of the plan preparation process, and should consider all the likely significant effects on the environment, economic and social factors.

166. Local Plans may require a variety of other environmental assessments, including under the Habitats Regulations where there is a likely significant effect on a European wildlife site (which may not necessarily be within the same local authority area), Strategic Flood Risk Assessment and assessments of the physical constraints on land use.[35] Wherever possible, assessments should share the same evidence base and be

35 Such as land instability, contamination and subsidence.

conducted over similar timescales, but local authorities should take care to ensure that the purposes and statutory requirements of different assessment processes are respected.

167. Assessments should be proportionate, and should not repeat policy assessment that has already been undertaken. Wherever possible the local planning authority should consider how the preparation of any assessment will contribute to the plan's evidence base. The process should be started early in the plan-making process and key stakeholders should be consulted in identifying the issues that the assessment must cover.

168. Shoreline Management Plans should inform the evidence base for planning in coastal areas. The prediction of future impacts should include the longer term nature and inherent uncertainty of coastal processes (including coastal landslip), and take account of climate change.

Historic environment

169. Local planning authorities should have up-to-date evidence about the historic environment in their area and use it to assess the significance of heritage assets and the contribution they make to their environment. They should also use it to predict the likelihood that currently unidentified heritage assets, particularly sites of historic and archaeological interest, will be discovered in the future. Local planning authorities should either maintain or have access to a historic environment record.

170. Where appropriate, landscape character assessments should also be prepared, integrated with assessment of historic landscape character, and for areas where there are major expansion options assessments of landscape sensitivity.

Health and well-being

171. Local planning authorities should work with public health leads and health organisations to understand and take account of the health status and needs of the local population (such as for sports, recreation and places of worship), including expected future changes, and any information about relevant barriers to improving health and well-being.

Public safety from major accidents

172. Planning policies should be based on up-to-date information on the location of major hazards and on the mitigation of the consequences of major accidents.

Ensuring viability and deliverability

173. Pursuing sustainable development requires careful attention to viability and costs in plan-making and decision-taking. Plans should be deliverable. Therefore, the sites and the scale of development identified in the plan should not be subject to such a scale of obligations and policy burdens that their ability to be developed viably is threatened. To ensure viability, the costs of any requirements likely to be applied to development, such as requirements for affordable housing, standards, infrastructure contributions or other requirements should, when taking account of the normal cost of development and mitigation, provide competitive returns to a willing land owner and willing developer to enable the development to be deliverable.

174. Local planning authorities should set out their policy on local standards in the Local Plan, including requirements for affordable housing. They should assess the likely cumulative impacts on development in their area of all existing and proposed local standards, supplementary planning documents and policies that support the development plan, when added to nationally required standards. In order to be appropriate, the cumulative impact of these standards and policies should not put implementation of the plan at serious risk, and should facilitate development throughout the economic cycle. Evidence supporting the assessment should be proportionate, using only appropriate available evidence.

175. Where practical, Community Infrastructure Levy charges should be worked up and tested alongside the Local Plan. The Community Infrastructure Levy should support and incentivise new development, particularly by placing control over a meaningful proportion of the funds raised with the neighbourhoods where development takes place.

176. Where safeguards are necessary to make a particular development acceptable in planning terms (such as environmental mitigation or compensation), the development should not be approved if the measures required cannot be secured through appropriate conditions or agreements. The need for such safeguards should be clearly justified through discussions with the applicant, and the options for keeping such costs to a minimum fully explored, so that development is not inhibited unnecessarily.

177. It is equally important to ensure that there is a reasonable prospect that planned infrastructure is deliverable in a timely fashion. To facilitate this, it is important that local planning authorities understand district-wide development costs at the time Local Plans are drawn up. For this reason, infrastructure and development policies should be planned at the same time, in the Local Plan. Any affordable housing or local standards requirements that may be applied to development should be assessed at the plan-making stage, where possible, and kept under review.

Planning strategically across local boundaries

178. Public bodies have a duty to cooperate on planning issues that cross administrative boundaries, particularly those which relate to the **strategic priorities** set out in paragraph 156. The Government expects joint working on areas of common interest to be diligently undertaken for the mutual benefit of neighbouring authorities.

179. Local planning authorities should work collaboratively with other bodies to ensure that strategic priorities across local boundaries are properly co-ordinated and clearly reflected in individual Local Plans.[36] Joint working should enable local planning authorities to work together to meet development requirements which cannot wholly be met within their own areas – for instance, because of a lack of physical capacity or because to do so would cause significant harm to the principles and policies of this Framework. As part of this process, they should consider producing joint

36 In marine areas, local planning authorities should collaborate with the Marine Management Organisation to ensure that policies across the land/sea boundary are integrated.

planning policies on strategic matters and informal strategies such as joint infrastructure and investment plans.

180. Local planning authorities should take account of different geographic areas, including travel-to-work areas. In two tier areas, county and district authorities should cooperate with each other on relevant issues. Local planning authorities should work collaboratively on strategic planning priorities to enable delivery of sustainable development in consultation with Local Enterprise Partnerships and Local Nature Partnerships. Local planning authorities should also work collaboratively with private sector bodies, utility and infrastructure providers.

181. Local planning authorities will be expected to demonstrate evidence of having effectively cooperated to plan for issues with cross-boundary impacts when their Local Plans are submitted for examination. This could be by way of plans or policies prepared as part of a joint committee, a memorandum of understanding or a jointly prepared strategy which is presented as evidence of an agreed position. Cooperation should be a continuous process of engagement from initial thinking through to implementation, resulting in a final position where plans are in place to provide the land and infrastructure necessary to support current and projected future levels of development.

Examining Local Plans

182. The Local Plan will be examined by an independent inspector whose role is to assess whether the plan has been prepared in accordance with the Duty to Cooperate, legal and procedural requirements, and whether it is sound. A local planning authority should submit a plan for examination which it considers is "sound" – namely that it is:

- **Positively prepared** – the plan should be prepared based on a strategy which seeks to meet objectively assessed development and infrastructure requirements, including unmet requirements from neighbouring authorities where it is reasonable to do so and consistent with achieving sustainable development;
- **Justified** – the plan should be the most appropriate strategy, when considered against the reasonable alternatives, based on proportionate evidence;
- **Effective** – the plan should be deliverable over its period and based on effective joint working on cross-boundary strategic priorities; and
- **Consistent with national policy** – the plan should enable the delivery of sustainable development in accordance with the policies in the Framework.

Neighbourhood plans

183. Neighbourhood planning gives communities direct power to develop a shared vision for their neighbourhood and deliver the sustainable development they need. Parishes and neighbourhood forums can use neighbourhood planning to:

- set planning policies through neighbourhood plans to determine decisions on planning applications; and
- grant planning permission through Neighbourhood Development Orders and Community Right to Build Orders for specific development which complies with the order.

184. Neighbourhood planning provides a powerful set of tools for local people to ensure that they get the right types of development for their community. The ambition of the neighbourhood should be aligned with the strategic needs and priorities of the wider local area. Neighbourhood plans must be in general conformity with the strategic policies of the Local Plan. To facilitate this, local planning authorities should set out clearly their strategic policies for the area and ensure that an up-to-date Local Plan is in place as quickly as possible. Neighbourhood plans should reflect these policies and neighbourhoods should plan positively to support them. Neighbourhood plans and orders should not promote less development than set out in the Local Plan or undermine its strategic policies.

185. Outside these strategic elements, neighbourhood plans will be able to shape and direct sustainable development in their area. Once a neighbourhood plan has demonstrated its general conformity with the strategic policies of the Local Plan and is brought into force, the policies it contains take precedence over existing non-strategic policies in the Local Plan for that neighbourhood, where they are in conflict. Local planning authorities should avoid duplicating planning processes for non-strategic policies where a neighbourhood plan is in preparation.

Decision-taking

186. Local planning authorities should approach decision-taking in a positive way to foster the delivery of sustainable development. The relationship between decision-taking and plan-making should be seamless, translating plans into high quality development on the ground.

187. Local planning authorities should look for solutions rather than problems, and decision-takers at every level should seek to approve applications for sustainable development where possible. Local planning authorities should work proactively with applicants to secure developments that improve the economic, social and environmental conditions of the area.

Pre-application engagement and front loading

188. Early engagement has significant potential to improve the efficiency and effectiveness of the planning application system for all parties. Good quality pre-application discussion enables better coordination between public and private resources and improved outcomes for the community.

189. Local planning authorities have a key role to play in encouraging other parties to take maximum advantage of the pre-application stage. They cannot require that a developer engages with them before submitting a planning application, but they should encourage take-up of any pre-application services they do offer. They should also, where they think this would be beneficial, encourage any applicants who are not already required to do so by law to engage with the local community before submitting their applications.

190. The more issues that can be resolved at pre-application stage, the greater the benefits. For their role in the planning system to be effective and positive, statutory planning consultees will need to take the same early, pro-active approach, and provide advice in a timely manner throughout the development process. This assists local planning authorities in issuing timely decisions, helping to ensure that applicants do not experience unnecessary delays and costs.

191. The participation of other consenting bodies in pre-application discussions should enable early consideration of all the fundamental issues relating to whether a particular development will be acceptable in principle, even where other consents relating to how a development is built or operated are needed at a later stage. Wherever possible, parallel processing of other consents should be encouraged to help speed up the process and resolve any issues as early as possible.

192. The right information is crucial to good decision-taking, particularly where formal assessments are required (such as Environmental Impact Assessment, Habitats Regulations Assessment and Flood Risk Assessment). To avoid delay, applicants should discuss what information is needed with the local planning authority and expert bodies as early as possible.

193. Local planning authorities should publish a list of their information requirements for applications, which should be proportionate to the nature and scale of development proposals and reviewed on a frequent basis. Local planning authorities should only request supporting information that is relevant, necessary and material to the application in question.

194. Local planning authorities should consult the appropriate bodies when planning, or determining applications, for development around major hazards.

195. Applicants and local planning authorities should consider the potential of entering into planning performance agreements, where this might achieve a faster and more effective application process.

Determining applications

196. The planning system is plan-led. Planning law requires that applications for planning permission must be determined in accordance with the development plan,[37] unless material considerations indicate otherwise.[38] This Framework is a material consideration in planning decisions.

197. In assessing and determining development proposals, local planning authorities should apply the presumption in favour of sustainable development.

198. Where a Neighbourhood Development Order has been made, a planning application is not required for development that is within the terms of the order. Where a planning application conflicts with a neighbourhood plan that has been brought into force, planning permission should not normally be granted.

Tailoring planning controls to local circumstances

199. Local planning authorities should consider using Local Development Orders to relax planning controls for particular areas or categories of development, where the impacts would be acceptable, and in particular where this would promote economic, social or environmental gains for the area, such as boosting enterprise.

200. The use of Article 4 directions to remove national permitted development rights should be limited to situations where this is necessary to protect local amenity or the wellbeing of the area (this could include the use of Article 4 directions to require planning permission for the demolition of local facilities). Similarly, planning conditions should not be used to restrict national permitted development rights unless there is clear justification to do so.

201. Communities can use Neighbourhood Development Orders and Community Right to Build Orders to grant planning permission. Where such an order is in

37 Section 38(1) of the Planning and Compulsory Purchase Act 2004: this includes adopted or approved development plan documents i.e. the Local Plan and neighbourhood plans which have been made in relation to the area (and the London Plan).

38 Section 38(6) of the Planning and Compulsory Purchase Act 2004 and section 70(2) of the Town and Country Planning Act 1990.

place, no further planning permission is required for development which falls within its scope.

202. Neighbourhood Development Orders and Community Right to Build Orders require the support of the local community through a referendum. Therefore, local planning authorities should take a proactive and positive approach to proposals, working collaboratively with community organisations to resolve any issues before draft orders are submitted for examination. Policies in this Framework that relate to decision-taking should be read as applying to the consideration of proposed Neighbourhood Development Orders, wherever this is appropriate given the context and relevant legislation.

Planning conditions and obligations

203. Local planning authorities should consider whether otherwise unacceptable development could be made acceptable through the use of conditions or planning obligations. Planning obligations should only be used where it is not possible to address unacceptable impacts through a planning condition.

204. Planning obligations should only be sought where they meet all of the following tests:

- necessary to make the development acceptable in planning terms;
- directly related to the development; and
- fairly and reasonably related in scale and kind to the development.

205. Where obligations are being sought or revised, local planning authorities should take account of changes in market conditions over time and, wherever appropriate, be sufficiently flexible to prevent planned development being stalled.

206. Planning conditions should only be imposed where they are necessary, relevant to planning and to the development to be permitted, enforceable, precise and reasonable in all other respects.

Enforcement

207. Effective enforcement is important as a means of maintaining public confidence in the planning system. Enforcement action is discretionary, and local planning authorities should act proportionately in responding to suspected breaches of planning control. Local planning authorities should consider publishing a local enforcement plan to manage enforcement proactively, in a way that is appropriate to their area. This should set out how they will monitor the implementation of planning permissions, investigate alleged cases of unauthorised development and take action where it is appropriate to do so.

Annex 1: Implementation

208. The policies in this Framework apply from the day of publication.

209. The National Planning Policy Framework aims to strengthen local decision making and reinforce the importance of up-to-date plans.

210. Planning law requires that applications for planning permission must be determined in accordance with the development plan unless material considerations indicate otherwise.

211. For the purposes of decision-taking, the policies in the Local Plan (and the London Plan) should not be considered out-of-date simply because they were adopted prior to the publication of this Framework.

212. However, the policies contained in this Framework are material considerations which local planning authorities should take into account from the day of its publication. The Framework must also be taken into account in the preparation of plans.

213. Plans may, therefore, need to be revised to take into account the policies in this Framework. This should be progressed as quickly as possible, either through a partial review or by preparing a new plan.

214. For 12 months from the day of publication, decision-takers may continue to give full weight to relevant policies adopted since 2004[39] even if there is a limited degree of conflict with this Framework.

215. In other cases and following this 12-month period, due weight should be given to relevant policies in existing plans according to their degree of consistency with this framework (the closer the policies in the plan to the policies in the Framework, the greater the weight that may be given).

216. From the day of publication, decision-takers may also give weight[40] to relevant policies in emerging plans according to:

- the stage of preparation of the emerging plan (the more advanced the preparation, the greater the weight that may be given);
- the extent to which there are unresolved objections to relevant policies (the less significant the unresolved objections, the greater the weight that may be given); and
- the degree of consistency of the relevant policies in the emerging plan to the policies in this Framework (the closer the policies in the emerging plan to the policies in the Framework, the greater the weight that may be given).

217. Advice will be available immediately and free of charge from a support service provided by the Local Government Association, the Planning

39 In development plan documents adopted in accordance with the Planning and Compulsory Purchase Act 2004 or published in the London Plan.

40 Unless other material considerations indicate otherwise.

Inspectorate and the Department for Communities and Local Government. This will assist local planning authorities in considering the need to update their Local Plan and taking forward efficient and effective reviews.

218. Where it would be appropriate and assist the process of preparing or amending Local Plans, regional strategy[41] policies can be reflected in Local Plans by undertaking a partial review focusing on the specific issues involved. Local planning authorities may also continue to draw on evidence that informed the preparation of regional strategies to support Local Plan policies, supplemented as needed by up-to-date, robust local evidence.

219. This Framework has been drafted to reflect the law following the implementation of the Localism Act 2011, so, where appropriate, policies will apply only when the relevant legislation is in force.

41 Regional strategies remain part of the development plan until they are abolished by Order using powers taken in the Localism Act. It is the government's clear policy intention to revoke the regional strategies outside of London, subject to the outcome of the environmental assessments that are currently being undertaken.

Annex 2: Glossary

Affordable housing: Social rented, affordable rented and intermediate housing, provided to eligible households whose needs are not met by the market. Eligibility is determined with regard to local incomes and local house prices. Affordable housing should include provisions to remain at an affordable price for future eligible households or for the subsidy to be recycled for alternative affordable housing provision.

Social rented housing is owned by local authorities and private registered providers (as defined in section 80 of the Housing and Regeneration Act 2008), for which guideline target rents are determined through the national rent regime. It may also be owned by other persons and provided under equivalent rental arrangements to the above, as agreed with the local authority or with the Homes and Communities Agency.

Affordable rented housing is let by local authorities or private registered providers of social housing to households who are eligible for social rented housing. Affordable Rent is subject to rent controls that require a rent of no more than 80% of the local market rent (including service charges, where applicable).

Intermediate housing is homes for sale and rent provided at a cost above social rent, but below market levels subject to the criteria in the Affordable Housing definition above. These can include shared equity (shared ownership and equity loans), other low cost homes for sale and intermediate rent, but not affordable rented housing.

Homes that do not meet the above definition of affordable housing, such as "low cost market" housing, may not be considered as affordable housing for planning purposes.

Aged or veteran tree: A tree which, because of its great age, size or condition is of exceptional value for wildlife, in the landscape, or culturally.

Air Quality Management Areas: Areas designated by local authorities because they are not likely to achieve national air quality objectives by the relevant deadlines.

Ancient woodland: An area that has been wooded continuously since at least 1600 AD.

Archaeological interest: There will be archaeological interest in a heritage asset if it holds, or potentially may hold, evidence of past human activity worthy of expert investigation at some point. Heritage assets with archaeological interest are the primary source of evidence about the substance and evolution of places, and of the people and cultures that made them.

Article 4 direction: A direction which withdraws automatic planning permission granted by the General Permitted Development Order.

Best and most versatile agricultural land: Land in grades 1, 2 and 3a of the Agricultural Land Classification.

Birds and Habitats Directives: European Directives to conserve natural habitats and wild fauna and flora.

Climate change adaptation: Adjustments to natural or human systems in response to actual or expected climatic factors or their effects, including from changes in rainfall and rising temperatures, which moderate harm or exploit beneficial opportunitiClimate change mitigation: Action to reduce the impact of human activity on the climate system, primarily through reducing greenhouse gas emissions.

Coastal Change Management Area: An area identified in Local Plans as likely to be affected by coastal change (physical change to the shoreline through erosion, coastal landslip, permanent inundation or coastal accretion).

Conservation (for heritage policy): The process of maintaining and managing change to a heritage asset in a way that sustains and, where appropriate, enhances its significance.

Community Forest: An area identified through the England Community Forest Programme to revitalise countryside and green space in and around major conurbations.

Community Infrastructure Levy: A levy allowing local authorities to raise funds from owners or developers of land undertaking new building projects in their area.

Community Right to Build Order: An Order made by the local planning authority (under the Town and Country Planning Act 1990) that grants planning permission for a site-specific development proposal or classes of development.

Competent person (to prepare site investigation information): A person with a recognised relevant qualification, sufficient experience in dealing with the type(s) of pollution or land instability, and membership of a relevant professional organisation.

Decentralised energy: Local renewable energy and local low-carbon energy usually but not always on a relatively small scale encompassing a diverse range of technologies.

Designated heritage asset: A World Heritage Site, Scheduled Monument, Listed Building, Protected Wreck Site, Registered Park and Garden, Registered Battlefield or Conservation Area designated under the relevant legislation.

Development plan: This includes adopted Local Plans, neighbourhood plans and the London Plan, and is defined in section 38 of the Planning and Compulsory Purchase Act 2004. (Regional strategies remain part of the development plan until they are abolished by Order using powers taken in the Localism Act. It is the government's clear policy intention to revoke the regional strategies outside of London, subject to the outcome of the environmental assessments that are currently being undertaken.)

Economic development: Development, including those within the B Use Classes, public and community uses and main town centre uses (but excluding housing development).

Ecological networks: These link sites of biodiversity importance.

Ecosystem services: The benefits people obtain from ecosystems such as, food, water, flood and disease control and recreation.

Edge of centre: For retail purposes, a location that is well connected and up to 300 metres of the primary shopping area. For all other main town centre uses, a location within 300 metres of a town centre boundary. For office development, this includes locations outside the town centre but within 500 metres of a public transport interchange. In determining whether a site falls within the definition of edge of centre, account should be taken of local circumstances.

Environmental Impact Assessment: A procedure to be followed for certain types of project to ensure that decisions are made in full knowledge of any likely significant effects on the environment.

European site: This includes candidate Special Areas of Conservation, Sites of Community Importance, Special Areas of Conservation and Special Protection Areas, and is defined in regulation 8 of the Conservation of Habitats and Species Regulations 2010.

Geodiversity: The range of rocks, minerals, fossils, soils and landforms.

Green infrastructure: A network of multi-functional green space, urban and rural, which is capable of delivering a wide range of environmental and quality of life benefits for local communities.

Heritage asset: A building, monument, site, place, area or landscape identified as having a degree of significance meriting consideration in planning decisions, because of its heritage interest. Heritage asset includes designated heritage assets and assets identified by the local planning authority (including local listing).

Heritage Coast: Areas of undeveloped coastline which are managed to conserve their natural beauty and, where appropriate, to improve accessibility for visitors.

Historic environment: All aspects of the environment resulting from the interaction between people and places through time, including all surviving physical remains of past human activity, whether visible, buried or submerged, and landscaped and planted or managed flora.

Historic environment record: Information services that seek to provide access to comprehensive and dynamic resources relating to the historic environment of a defined geographic area for public benefit and use.

Inclusive design: Designing the built environment, including buildings and their surrounding spaces, to ensure that they can be accessed and used by everyone.

Instrumentation operated in the national interest: Includes meteorological and climate monitoring installations, satellite and radio communication, defence and national security sites and magnetic calibration facilities operated by or on behalf of the Government, delegated authorities or for defence purposes.

International, national and locally designated sites of importance for biodiversity: All international sites (Special Areas of Conservation, Special Protection Areas, and Ramsar sites), national sites (Sites of Special Scientific Interest) and locally designated sites including Local Wildlife Sites.

Local Development Order: An Order made by a local planning authority (under the Town and Country Planning Act 1990) that grants planning permission for a specific development proposal or classes of development.

Local Enterprise Partnership: A body, designated by the Secretary of State for Communities and Local Government, established for the purpose of creating or improving the conditions for economic growth in an area.

Local Nature Partnership: A body, designated by the Secretary of State for Environment, Food and Rural Affairs, established for the purpose of protecting and improving the natural environment in an area and the benefits derived from it.

Local planning authority: The public authority whose duty it is to carry out specific planning functions for a particular area. All references to local planning authority apply to the district council, London borough council, county council, Broads Authority, National Park Authority and the Greater London Authority, to the extent appropriate to their responsibilities.

Local Plan: The plan for the future development of the local area, drawn up by the local planning authority in consultation with the community. In law this is described as the development plan documents adopted under the Planning and Compulsory Purchase Act 2004. Current core strategies or other planning policies, which under the regulations would be considered to be development plan documents, form part of the Local Plan. The term includes old policies which have been saved under the 2004 Act.

Main town centre uses: Retail development (including warehouse clubs and factory outlet centres); leisure, entertainment facilities the more intensive sport and recreation uses (including cinemas, restaurants, drive-through restaurants, bars and pubs, night-clubs, casinos, health and fitness centres, indoor bowling centres, and bingo halls); offices; and arts, culture and tourism development (including theatres, museums, galleries and concert halls, hotels and conference facilities).

Major Hazards: Major hazard installations and pipelines, licensed explosive sites and nuclear installations, around which Health and Safety Executive (and Office for Nuclear Regulation) consultation distances to mitigate the consequences to public safety of major accidents may apply.

Minerals of local and national importance: Minerals which are necessary to meet society's needs, including aggregates, brickclay (especially Etruria Marl and fireclay), silica sand (including high grade silica sands), cement raw materials, gypsum, salt, fluorspar, shallow and deep-mined coal, oil and gas (including hydrocarbons), tungsten, kaolin, ball clay, potash and local minerals of importance to heritage assets and local distinctiveness.

Mineral Safeguarding Area: An area designated by Minerals Planning Authorities which covers known deposits of minerals which are desired to be kept safeguarded from unnecessary sterilisation by non-mineral development.

National Trails: Long distance routes for walking, cycling and horse riding.

Nature Improvement Areas: Inter-connected networks of wildlife habitats intended to re-establish thriving wildlife populations and help species respond to the challenges of climate change.

Neighbourhood Development Order: An Order made by a local planning authority (under the Town and Country Planning Act 1990) through which Parish Councils and neighbourhood forums can grant planning permission for a specific development proposal or classes of development.

Neighbourhood plans: A plan prepared by a Parish Council or Neighbourhood Forum for a particular neighbourhood area (made under the Planning and Compulsory Purchase Act 2004).

Older people: People over retirement age, including the active, newly-retired through to the very frail elderly, whose housing needs can encompass accessible, adaptable general needs housing for those looking to downsize from family housing and the full range of retirement and specialised housing for those with support or care needs.

Open space: All open space of public value, including not just land, but also areas of water (such as rivers, canals, lakes and reservoirs) which offer important opportunities for sport and recreation and can act as a visual amenity.

Original building: A building as it existed on 1 July 1948 or, if constructed after 1 July 1948, as it was built originally.

Out of centre: A location which is not in or on the edge of a centre but not necessarily outside the urban area.

Out of town: A location out of centre that is outside the existing urban area.

People with disabilities: People have a disability if they have a physical or mental impairment, and that impairment has a substantial and long-term adverse effect on their ability to carry out normal day-to-day activities. These persons include, but are not limited to, people with ambulatory difficulties, blindness, learning difficulties, autism and mental health needs.

Planning condition: A condition imposed on a grant of planning permission (in accordance with the Town and Country Planning Act 1990) or a condition included in a Local Development Order or Neighbourhood Development Order.

Planning obligation: A legally enforceable obligation entered into under section 106 of the Town and Country Planning Act 1990 to mitigate the impacts of a development proposal.

Playing field: The whole of a site which encompasses at least one playing pitch as defined in the Town and Country Planning (Development Management Procedure) (England) Order 2010.

Pollution: Anything that affects the quality of land, air, water or soils, which might lead to an adverse impact on human health, the natural environment or general amenity. Pollution can arise from a range of emissions, including smoke, fumes, gases, dust, steam, odour, noise and light.

Previously developed land: Land which is or was occupied by a permanent structure, including the curtilage of the developed land (although it should not be assumed that the whole of the curtilage should be developed) and any associated fixed surface infrastructure. This excludes: land that is or has been occupied by agricultural or forestry buildings; land that has been developed for minerals extraction or waste disposal by landfill purposes where provision for restoration has been made through development control procedures; land in built-up areas such as private residential gardens, parks, recreation grounds and allotments; and land that was previously-developed but where the remains of the permanent structure or fixed surface structure have blended into the landscape in the process of time.

Primary shopping area: Defined area where retail development is concentrated (generally comprising the primary and those secondary frontages which are adjoining and closely related to the primary shopping frontage).

Primary and secondary frontages: Primary frontages are likely to include a high proportion of retail uses which may include food, drinks, clothing and household goods. Secondary frontages provide greater opportunities for a diversity of uses such as restaurants, cinemas and businesses.

Priority habitats and species: Species and Habitats of Principle Importance included in the England Biodiversity List published by the Secretary of State under section 41 of the Natural Environment and Rural Communities Act 2006.

Ramsar sites: Wetlands of international importance, designated under the 1971 Ramsar Convention.

Renewable and low carbon energy: Includes energy for heating and cooling as well as generating electricity. Renewable energy covers those energy flows that occur naturally and repeatedly in the environment – from the wind, the fall of water, the movement of the oceans, from the sun and also from biomass and deep geothermal heat. Low carbon technologies are those that can help reduce emissions (compared to conventional use of fossil fuels).

Rural exception sites: Small sites used for affordable housing in perpetuity where sites would not normally be used for housing. Rural exception sites seek to address the needs of the local community by accommodating households who are either current residents or have an existing family or employment connection. Small numbers of market homes may be allowed at the local authority's discretion, for example where essential to enable the delivery of affordable units without grant funding.

Safeguarding zone: An area defined in Circular 01/03: Safeguarding aerodromes, technical sites and military explosives storage areas, to safeguard such sites.

Setting of a heritage asset: The surroundings in which a heritage asset is experienced. Its extent is not fixed and may change as the asset and its surroundings evolve. Elements of a setting may make a positive or negative contribution to the significance of an asset, may affect the ability to appreciate that significance or may be neutral.

Shoreline Management Plans: A plan providing a large-scale assessment of the risk to people and to the developed, historic and natural environment associated with coastal processes.

Significance (for heritage policy): The value of a heritage asset to this and future generations because of its heritage interest. That interest may be archaeological, architectural, artistic or historic. Significance derives not only from a heritage asset's physical presence, but also from its setting.

Special Areas of Conservation: Areas given special protection under the European Union's Habitats Directive, which is transposed into UK law by the Habitats and Conservation of Species Regulations 2010.

Special Protection Areas: Areas which have been identified as being of international importance for the breeding, feeding, wintering or the migration of rare and vulnerable species of birds found within European Union countries. They are European designated sites, classified under the Birds Directive.

Site investigation information: Includes a risk assessment of land potentially affected by contamination, or ground stability and slope stability reports, as appropriate. All investigations of land potentially affected by contamination should be carried out in accordance with established procedures (such as BS10175 (2001) Code of Practice for the Investigation of Potentially Contaminated Sites). The minimum information that should be provided by an applicant is the report of a desk study and site reconnaissance.

Site of Special Scientific Interest: Sites designated by Natural England under the Wildlife and Countryside Act 1981.

Stepping stones: Pockets of habitat that, while not necessarily connected, facilitate the movement of species across otherwise inhospitable landscapes.

Strategic Environmental Assessment: A procedure (set out in the Environmental Assessment of Plans and Programmes Regulations 2004) which requires the formal environmental assessment of certain plans and programmes which are likely to have significant effects on the environment.

Supplementary planning documents: Documents which add further detail to the policies in the Local Plan. They can be used to provide further guidance for development on specific sites, or on particular issues, such as design. Supplementary planning documents are capable of being a material consideration in planning decisions but are not part of the development plan.

Sustainable transport modes: Any efficient, safe and accessible means of transport with overall low impact on the environment, including walking and cycling, low and ultra low emission vehicles, car sharing and public transport.

Town centre: Area defined on the local authority's proposal map, including the primary shopping area and areas predominantly occupied by main town centre uses within or adjacent to the primary shopping area. References to town centres or centres apply to city centres, town centres, district centres and local centres but exclude small parades of shops of purely neighbourhood significance. Unless they are identified as centres in Local Plans, existing out-of-centre developments, comprising or including main town centre uses, do not constitute town centres.

Transport assessment: A comprehensive and systematic process that sets out transport issues relating to a proposed development. It identifies what measures will be required to improve accessibility and safety for all modes of travel, particularly for alternatives to the car such as walking, cycling and public transport and what measures will need to be taken to deal with the anticipated transport impacts of the development.

Transport statement: A simplified version of a transport assessment where it is agreed the transport issues arising out of development proposals are limited and a full transport assessment is not required.

Travel plan: A long-term management strategy for an organisation or site that seeks to deliver sustainable transport objectives through action and is articulated in a document that is regularly reviewed.

Wildlife corridor: Areas of habitat connecting wildlife populations.

Windfall sites: Sites which have not been specifically identified as available in the Local Plan process. They normally comprise previously-developed sites that have unexpectedly become available.

Annex 3: Documents replaced by this Framework

1. Planning Policy Statement: *Delivering Sustainable Development* (31 January 2005)
2. Planning Policy Statement: *Planning and Climate Change – Supplement to Planning Policy Statement 1* (17 December 2007)
3. Planning Policy Guidance 2: *Green Belts* (24 January 1995)
4. Planning Policy Statement 3: *Housing* (9 June 2011)
5. Planning Policy Statement 4: *Planning for Sustainable Economic Growth* (29 December 2009)
6. Planning Policy Statement 5: *Planning for the Historic Environment* (23 March 2010)
7. Planning Policy Statement 7: *Sustainable Development in Rural Areas* (3 August 2004)
8. Planning Policy Guidance 8: *Telecommunications* (23 August 2001)
9. Planning Policy Statement 9: *Biodiversity and Geological Conservation* (16 August 2005)
10. Planning Policy Statement 12: *Local Spatial Planning* (4 June 2008)
11. Planning Policy Guidance 13: *Transport* (3 January 2011)
12. Planning Policy Guidance 14: *Development on Unstable Land* (30 April 1990)
13. Planning Policy Guidance 17: *Planning for Open Space, Sport and Recreation* (24 July 2002)
14. Planning Policy Guidance 18: *Enforcing Planning Control* (20 December 1991)
15. Planning Policy Guidance 19: *Outdoor Advertisement Control* (23 March 1992)
16. Planning Policy Guidance 20: *Coastal Planning* (1 October 1992)
17. Planning Policy Statement 22: *Renewable Energy* (10 August 2004)
18. Planning Policy Statement 23: *Planning and Pollution Control* (3 November 2004)
19. Planning Policy Guidance 24: *Planning and Noise* (3 October 1994)
20. Planning Policy Statement 25: *Development and Flood Risk* (29 March 2010)
21. Planning Policy Statement 25 Supplement: *Development and Coastal Change* (9 March 2010)
22. Minerals Policy Statement 1: *Planning and Minerals* (13 November 2006)
23. Minerals Policy Statement 2: *Controlling and Mitigating the Environmental Effects of Minerals Extraction In England*. This includes its Annex 1: *Dust* and Annex 2: *Noise* (23 March 2005 - Annex 1: 23 March 2005 and Annex 2: 23 May 2005)
24. Minerals Planning Guidance 2: *Applications, permissions and conditions* (10 July 1998)
25. Minerals Planning Guidance 3: Coal *Mining and Colliery Spoil Disposal* (30 March 1999)
26. Minerals Planning Guidance 5: *Stability in surface mineral workings and tips* (28 January 2000)
27. Minerals Planning Guidance 7: *Reclamation of minerals workings* (29 November 1996)

28. Minerals Planning Guidance 10: *Provision of raw material for the cement industry* (20 November 1991)
29. Minerals Planning Guidance 13: *Guidance for peat provision in England* (13 July 1995)
30. Minerals Planning Guidance 15: *Provision of silica sand in England* (23 September 1996)
31. Circular 05/2005: *Planning Obligations* (18 July 2005)
32. Government Office London Circular 1/2008: *Strategic Planning in London* (4 April 2008)
33. Letter to Chief Planning Officers: *Town and Country Planning (Electronic Communications) (England) Order 2003* (2 April 2003)
34. Letter to Chief Planning Officers: *Planning Obligations and Planning Registers* (3 April 2002)
35. Letter to Chief Planning Officers: *Model Planning Conditions for development on land affected by contamination* (30 May 2008)
36. Letter to Chief Planning Officers: *Planning for Housing and Economic Recovery* (12 May 2009)
37. Letter to Chief Planning Officers: *Development and Flood Risk – Update to the Practice Guide to Planning Policy Statement 25* (14 December 2009)
38. Letter to Chief Planning Officers: *Implementation of Planning Policy Statement 25 (PPS25) – Development and Flood Risk* (7 May 2009)
39. Letter to Chief Planning Officers: *The Planning Bill – delivering well designed homes and high quality places* (23 February 2009)
40. Letter to Chief Planning Officers: *Planning and Climate Change – Update* (20 January 2009)
41. Letter to Chief Planning Officers: *New powers for local authorities to stop 'garden- grabbing'* (15 June 2010)
42. Letter to Chief Planning Officer: *Area Based Grant: Climate Change New Burdens* (14 January 2010)
43. Letter to Chief Planning Officers: *The Localism Bill* (15 December 2010)
44. Letter to Chief Planning Officers: *Planning policy on residential parking standards, parking charges, and electric vehicle charging infrastructure* (14 January 2011)

Reference 8

Department for Communities and Local Government, Planning Practice Guidance, 2016;

• What is the role of Local Plans in considering contamination?

Consideration of land contamination in Local Plans will vary between places and the type of issues that the plan needs to cover, but it can be helpful to:

- consider a strategic, phased approach to dealing with potential contamination if this is an issue over a wide area, and in doing so, recognise that dealing with land contamination can help contribute to achieving the objectives of EU directives such as the Water Framework Directive;
- use sustainability appraisal to shape an appropriate strategy, including through work on the 'baseline', appropriate objectives for the assessment of impact and proposed monitoring;
- allocate land which is known to be affected by contamination only for appropriate development – and be clear on the approach to remediation;
- have regard to the possible impact of land contamination on neighbouring areas (eg by polluting surface water or groundwater); and
- be clear on the role of developers and requirements for information and assessments.

Paragraph: 005 Reference ID: 33-005-20140306

Revision date: 06 03 2014

1 What should a Local Plan contain?

The Local Plan should make clear what is intended to happen in the area over the life of the plan, where and when this will occur and how it will be delivered. This can be done by setting out broad locations and specific allocations of land for different purposes; through designations showing areas where particular opportunities or considerations apply (such as protected habitats); and through criteria-based policies to be taken into account when considering development. A policies map must illustrate geographically the application of policies in a development plan. The policies map may be supported by such other information as the Local Planning Authority sees fit to best explain the spatial application of development plan policies.

Local Plans should be tailored to the needs of each area in terms of their strategy and the policies required. They should focus on the key issues that need to be addressed and be aspirational but realistic in what they propose. The Local Plan should aim to meet the objectively assessed development and infrastructure needs of the area, including unmet needs of neighbouring areas where this is consistent with policies in the National Planning Policy Framework as a whole. Local Plans should recognise the contribution that Neighbourhood Plans can make in planning to meet development and infrastructure needs.

Paragraph: 002 Reference ID: 12-002-20140306

Revision date: 06 03 2014

- **How does the planning system deal with hazardous substances?**

There are 3 elements to how the planning system deals with preventing and limiting the consequences of major accidents:

- **1. Hazardous substances consent**

This is required for the presence of certain quantities of hazardous substances. This is a key part of the controls for storage and use of hazardous substances which could, in quantities at or above specified limits, present a major off-site risk.

- The purpose of hazardous substances consent
- Deciding whether a hazardous substances consent is needed
- Applying for hazardous substances consent
- Deciding applications for hazardous substances consent
- After consent has been granted
- Breaches of hazardous substances control

- **2. Dealing with hazardous substances in plan-making**

When preparing Local Plans, local planning authorities are required to have regard to the prevention of major accidents and limiting their consequences. They must also consider the long-term need for appropriate distances between hazardous establishments and population or environmentally sensitive areas. They must also consider whether additional measures for existing establishments are required so that risks to people in the area are not increased. Detailed requirements are set out in the Town and Country Planning (Local Planning) (England) Regulations 2012.

Further guidance can be found under dealing with hazardous substances in plan-making.

- **3. Handling development proposals around hazardous installations**

When considering development proposals around hazardous installations the local planning authority is expected to seek technical advice on the risks presented by major accident hazards affecting people in the surrounding area and the environment. This advice is sought from the Control of Major Accident Hazards (COMAH) competent authority. This allows those making planning decisions to give due weight to those risks, when balanced against other relevant planning considerations. The competent authority also provides advice on developments around pipelines, licensed explosives sites, licensed ports, developments around nuclear installations and other relevant sites. There are also additional expectations on how local authorities notify people about applications in the vicinity of a hazardous establishment.

Further guidance on development can be found under handling development proposals around hazardous installations.

Paragraph: 002 Reference ID: 39-002-20161209

Revision date: 09 12 2016 See previous version

What are the links between health and planning?

The link between planning and health has been long established. The built and natural environments are major determinants of health and wellbeing. The importance of this role is highlighted in the promoting health communities section. This is further supported by the 3 dimensions to sustainable development (see National Planning Policy Framework paragraph 7.

Further links to planning and health are found throughout the whole of the National Planning Policy Framework. Key areas include the core planning principles (see National Planning Policy Framework paragraph 17) and the policies on transport (see National Planning Policy Framework chapter 4, high quality homes (see National Planning Policy Framework chapter 6), good design (see National Planning Policy Framework chapter 7), climate change (see National Planning Policy Framework chapter 10) and the natural environment (see National Planning Policy Framework chapter 11).

The National Planning Policy Framework encourages local planning authorities to engage with relevant organisations when carrying out their planning function. In the case of health and wellbeing, the key contacts are set out in this guidance. Engagement with these organisations will help ensure that local strategies to improve health and wellbeing) and the provision of the required health infrastructure (see National Planning Policy Framework paragraphs 7, 156 and 162) are supported and taken into account in local and neighbourhood plan making and when determining planning applications.

The range of issues that could be considered through the plan-making and decision-making processes, in respect of health and healthcare infrastructure, include how:

- development proposals can support strong, vibrant and healthy communities and help create healthy living environments which should, where possible, include making physical activity easy to do and create places and spaces to meet to support community engagement and social capital;
- the local plan promotes health, social and cultural wellbeing and supports the reduction of health inequalities;
- the local plan considers the local health and wellbeing strategy and other relevant health improvement strategies in the area;
- the healthcare infrastructure implications of any relevant proposed local development have been considered;
- opportunities for healthy lifestyles have been considered (eg planning for an environment that supports people of all ages in making healthy choices, helps to promote active travel and physical activity, and promotes access to healthier food, high quality open spaces, green infrastructure and opportunities for play, sport and recreation);
- potential pollution and other environmental hazards, which might lead to an adverse impact on human health, are accounted for in the consideration of new development proposals; and
- access to the whole community by all sections of the community, whether able-bodied or disabled, has been promoted.

Paragraph: 002 Reference ID: 53-002-20140306

Revision date: 06 03 2014

Reference 9

Vale of White Horse District Council, Planning Decision note, Refusal of Planning Permission at Christ Church Hobbyhorse Lane Sutton Courtenay ABINGDON

OX14 4BB, Ref P16/V2306/O , 2016;

PLANNING

ELECTRONIC VERSION

Planning Decision

P16/V2306/O

The Portsmouth Roman Catholic Diocesan Trust
c/o The AED Practice
Rockwell House
Wartling Hill
Wartling
BN271RY

REFUSAL OF PLANNING PERMISSION

Application No : **P16/V2306/O**

Application proposal, including any amendments :
Development of redundant site to provide 15no. 2 storey residential dwellings with new access off Hobbyhorse Lane

Site Location : **Christ Church Hobbyhorse Lane Sutton Courtenay ABINGDON OX14 4BB**

Vale of White Horse District Council hereby gives notice that **planning permission is REFUSED** for the carrying out of the development referred to above for the following reason(s) :

1. This is an unallocated site extending beyond the built limits of Sutton Courtenay into the open countryside in a manner which does not accord with the District's strategy for growth set out in the Development Plan. Having regard to its location, the proposal would be detrimental to the character of the settlement and the wider landscape. As such, the proposal is considered contrary to the provisions of the Vale of White Horse Development Plan, in particular Core Policies 1, 3, 4, 15, 37, 38 and 44 of the Local Plan 2031 Part One, Saved Policy NE9 of the Local Plan 2011 and advice within the council's adopted Design Guide and within the NPPF. The benefits of the proposal are not considered to outweigh this harm and no material considerations exist to warrant a departure from the Development Plan.

2. The proposal does not demonstrate sufficient retention and enhancement of existing green infrastructure to ensure there is no net loss of biodiversity from the implementation of this proposal. As such, the proposal does not comply

with Core Policies 38 and 45 of the Local Plan 2031 and advice within the NPPF.

3. The application fails to provide sufficient information to demonstrate that the proposals will not lead to an increase in surface water flooding. In particular, information relating to the impact on groundwater levels and the associated viability of the proposed SuDS drainage system and flood exceedance routing is all required to properly demonstrate the impacts of this proposal. Without this information, the proposal is considered to increase the risk of flooding, contrary to Core Policy 42 of the Vale of White Horse Local Plan 2031 Part One and advice within the NPPF. It is acknowledged that it may be possible to overcome this refusal reason through the submission of additional information and mitigation proposals.

4. The application fails to provide sufficient evidence to demonstrate that the occupiers of the proposed development would not be adversely affected by odours arising from the existing composting plant and landfill facility located to the east of the site. As such the proposal is contrary to Saved Policy DC10 of the Vale of White Horse Local Plan 2011. It is acknowledged that it may be possible to overcome this refusal reason through the submission of additional information and mitigation proposals.

5. The application does not include a suitable contaminated land assessment or an assessment of landfill gas to demonstrate that the site is suitable for a residential use and that that the occupiers of the proposed dwellings would not be harmed by the effects of contamination or landfill gas. As such the proposal is contrary to Core Policy 43 of the Local Plan 2031 Part One and Saved Policy DC10 of the Local Plan 2011. It is acknowledged that it may be possible to overcome this refusal reason through the submission of additional information and mitigation proposals.

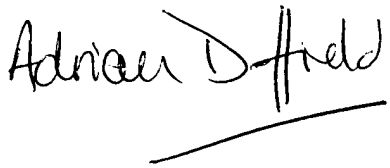
6. The application does not include sufficient survey evidence to demonstrate that the proposal will not have materially harm or preserve habitats suitable for water voles. Water voles are a protected species under both British and European legislation. As such, the proposal is contrary to Core Policy 46 of the Local Plan 2031 Part One and advice within the NPPF. It is acknowledged that it may be possible to overcome this refusal reason through the submission of additional information and mitigation proposals.

7. The detailed proposals for the access to the site, which include the reduction in the width of Hobbyhorse Lane, would conflict with the delivery of a safe access arrangement for the strategic allocation in the Vale of White Horse Local Plan 2031 to the north and east of this site on the opposite side of Hobbyhorse Lane. This would harm the delivery strategy of the Local Plan 2031 Part One and as such is contrary to Core Policies 3, 4 and 47 of that Plan. The proposals would also cause harm to highway safety on Hobbyhorse Lane for motorists, cyclists and pedestrians contrary to Saved Policy DC5 of the Vale of

White Horse Local Plan 2011. It is acknowledged that it may be possible to overcome this refusal reason through the submission of additional information and mitigation proposals.

8. In the absence of a Section 106 agreement relating to the provision of affordable housing and financial contributions towards community, leisure, recreation, open space and play area maintenance, public transport and waste collections, the proposal would place increased pressure on these facilities and fail to provide the social, recreational, and cultural facilities and services the community needs. This is considered contrary to Core Policies 7 and 24 of the Local Plan 2031 Part One and advice within the NPPF. It is acknowledged this reason for refusal can be overcome through the submission of an acceptable Section 106 agreement.

In accordance with paragraphs 186 and 187 of the National Planning Policy Framework the Council takes a positive and proactive approach to development proposals. The Planning Service works with applicants/agents in a positive and proactive manner by offering a pre-application advice service and by advising applicants/agents of issues that arise during the processing of their application and where possible suggesting solutions to problems. The applicant/agent was advised why the proposal does not accord with the development plan and that there are no other material considerations to outweigh those objections before the application was determined.



Head of Planning
23rd December 2016

STATUTORY INFORMATIVE

Appeals to the Secretary of State

If you are aggrieved by the decision of your local planning authority to refuse permission for the proposed development or to grant it subject to conditions, then you can appeal to the Secretary of State for the Environment under sections 78 and 79 of the Town and Country Planning Act 1990.

If you want to appeal, then you must do so within **six months** of the date of this notice, using a form which you can get from :

The Planning Inspectorate
Customer Support Unit
Temple Quay House
2 The Square
Temple Quay
Bristol
BS1 6PN
Telephone : 0303 444 5000
www.planningportal.gov.uk
email: enquiries@pins.gsi.gov.uk.

The Secretary of State can allow a longer period for giving notice of an appeal, but he will not normally be prepared to use this power unless there are special circumstances which excuse the delay in giving notice of appeal.

The Secretary of State need not consider an appeal if it seems to him that the local planning authority could not have granted planning permission for the proposed development or could not have granted it without the conditions it imposed, having regard to the statutory requirements, to the provisions of the development order and to any directions given under the order.

In practice, the Secretary of State does not refuse to consider appeals solely because the local planning authority based its decision on a direction given by him.

Purchase Notice

If either the local planning authority or the Secretary of State for the Environment refuses permission to develop land or grants its subject to conditions, the owner may claim that he can neither put the land to a reasonably beneficial use in its existing state nor can he render the land capable of a reasonably beneficial use by the carrying out of any development which has been or would be permitted.

In these circumstances, the owner may serve a purchase notice on the Council

(District Council, London Borough Council or Common Council of the City of London) in whose area the land is situated. This notice will require the Council to purchase his interest in the land in accordance with the provisions of Part VI, Chapter 1 of the Town and Country Planning Act 1990.

Compensation

In certain circumstances compensation may be claimed from the local planning authority if permission is refused or granted subject to conditions by the Secretary of State on appeal or on reference of the application to him.

These circumstances are set out in sections 114 and related provisions of the Town and Country Planning Act 1990.

OTHER INFORMATION

The Planning Portal contains a wide range of helpful planning-related guidance and services. You may wish to view their website (www.planningportal.gov.uk).

Reference 10

Department of the Environment, Waste Management Paper No 27, Landfill Gas: A Technical Memorandum Providing Guidance on the Monitoring and Control of Landfill Gas, 2nd Edition, 1991

DEPARTMENT OF THE ENVIRONMENT

Waste Management Paper No 27

Landfill Gas

A technical memorandum providing guidance on the monitoring and control of landfill gas

HMSO

Wastes Technical Division

CHAPTER 9

Development on or around landfill sites

Introduction

9.1 Decisions on development are matters for the relevant planning authorities. The advice given in this Chapter serves to highlight the difficulties that may be encountered where development is proposed near to or on landfills. Whatever form of development is proposed on or adjacent to any landfill site, it should not compromise the pollution control measures. Therefore, it is essential that all prospective developers undertake a comprehensive investigation as part of any proposal.

Development on landfill sites

9.2 As well as providing a disposal route for a wide range of wastes, controlled landfill also offers the possibility of restoring derelict land and mineral extraction sites to a beneficial after-use. Whatever form this takes, the integrity of the cap and the leachate and gas management systems should be maintained for as long as they are required. In many instances a landfill may not become stabilised for periods well in excess of 15 years. Agricultural, public open space, recreation or conservation are therefore the most appropriate after-uses until the site has stabilised.

9.3 It is accepted that in many cases there may be pressures to introduce other forms of development before the landfill has stabilised. Many landfills, originally outside urban areas, have become prime locations as development has encroached upon them. In recent years the demand for former landfills to be used as building plots has increased. Department of the Environment Circulars 21/87 and 17/89 outline the measures needed to conduct a survey of a completed landfill to assess its suitability for development. The Inter-Departmental Committee on the Redevelopment of Contaminated Land Guidance Note 17/78 "Notes on the Development and After-use of Landfill Sites" and approved building Codes of Practice should also be consulted. Information on the steps to be taken during construction on landfills has also been presented in Waste Management Paper No 26. Developments such as supermarkets, warehouses and blocks of flats have taken place on sites which are still evolving gas. These developments have been undertaken with expert advice and proper precautionary measures incorporated in the design and construction stages. Equally there are examples of developments that have run into difficulty by failing to take all relevant factors into account. It is also difficult to ensure that protective measures are maintained in private housing. Such measures may be defeated or breached by the actions of occupiers outside the control of developers, landowners and local authorities. In addition, adequate provision of protective measures may not be made in outbuildings, extensions, garden sheds, greenhouses etc. Domestic housing should not therefore be built on landfills which are gassing or have the potential to produce significant quantities of gas.

Development of land adjacent to landfill sites

9.4 Where development is proposed within 250 metres of a landfill site, whether operational, awaiting restoration or restored, the developer will need to take account of the prox-

imity of the proposed development to the landfill and investigate the geology and topography of the area. Under the Town and Country Planning General Development Order 1988, planning authorities are now required to consult Waste Disposal Authorities on development within 250 metres of a landfill site either active or closed within the last 30 years. Local authority registers of land which may be contaminated, compiled under S.143 of the Environmental Protection Act, will record the locations of both closed and operational landfills and will provide an additional aid to identify such sites. Whilst for operational sites, all gas should be controlled as provided in Paragraph 2.4, it is possible that some minor escape, which may originally have been acceptable, could become significant by a change in use of the land around the site.

9.5 For all sites where retrospective action has been taken to control gas or at closed sites where no gas control measures have been implemented, it is possible that migrating landfill gas has filled the pore space of the adjoining strata outside the site. In such circumstances the effectiveness of control measures should be examined at the site, and specialist advice should be obtained on whether the strata should be cleared of the gas by active pumping, or whether the strata should be left to vent naturally.

9.6 When no gas is found in strata, but there are significant quantities of gas within the site or there is the potential for evolution of large quantities of gas, consideration should be given to possible gas migration pathways between the site and the development, especially through underground services. The proposal for the development should include measures to prevent gas using these pathways.

9.7 It is recommended that where landfills are actively producing large volumes of gas, or have the potential to produce large quantities of gas, and housing development is proposed, that no house, garden shed, greenhouse or any domestic extension should be constructed within 50 metres of the boundary of the infilled wastes, and no garden should extend to within 10 metres of the wastes.

Highways on or adjacent to landfill sites

9.8 There are various risks associated with all roads running over or adjacent to landfill sites where quantities of gas are being evolved. Consideration needs to be given to the accumulation of gas in underground services, especially where there are possible ignition sources such as in lamp-posts. When roads are constructed over former landfill sites, specialist advice should be sought to ensure safe control of any gas that may be present. Care also needs to be taken in the feasibility, design and location of any space with public access where ventilation might be restricted eg pedestrian underpasses.

Conclusion

9.9 Whenever development is proposed on or adjacent to a landfill site, a comprehensive investigation of the site, the development, and the possible effect of the development on the landfill is essential, which should be supported by monitoring as described in Chapters 6 and 7.

Reference 11

http://www.ourloscoe.co.uk/history.asp Landfill gas explosion, 1986

Loscoe is a small village near Heanor in Derbyshire, England. Denby Common and Codnor Breach are outlying hamlets on the western edge of Loscoe.

The research for Highfield House dates back to 1650 or possibly as early as 1630. This may now be the oldest surviving house in Loscoe as many houses in the village were demolished due to subsidence.

1986 landfill gas explosion

Loscoe was the site of a landfill gas migration explosion on 24 March 1986. Although there were no fatalities, one house was completely destroyed by the blast and the three occupants injured. On the night of the explosion the atmospheric air pressure fell 29 hPa (29 mbar) over a 7 hour period, causing the gas to be released from the ground in much greater quantities than usual. In the four hours before the explosion, which occurred at approximately 6.30am, the local meteorological office had recorded average falls of 4 hPa (4 mbar) per hour. Several cubic metres of landfill gas (consisting of a 3:2 mixture of methane and carbon dioxide) collected under the ground near 51 Clarke Avenue and as the gas expanded it flowed into the space beneath the floor from where it was drawn by convection to the gas central heating boiler and ignited.

This disaster led (in Britain) to the introduction of key legislation and government guidance and much research into landfill behaviour[3] and best practice at landfill sites. Over time, these were designed to vent gas to atmosphere, then to burn off methane and eventually in the most productive, to turn the gas into electricity using gas turbines which supply the national grid.

Taken From Wikipedia, The Free Encyclopedia
http://en.wikipedia.org/wiki/Loscoe

Reference 12

BBC News, Gorebridge homes to be demolished after carbon dioxide gas leak, 2014
http://www.bbc.co.uk/news/uk-scotland-edinburgh-east-fife-27905611

Gorebridge homes to be demolished after carbon dioxide gas leak

18 June 2014 | Edinburgh, Fife & East Scotland

Councillors have approved the demolition of 64 homes on Gorebridge's Newbyres Crescent and Gore Avenue after high levels of carbon dioxide were recorded

Plans to demolish 64 homes in Midlothian after gas was discovered seeping into them from old mine workings have been approved.

Reference 13

The Incident Team (Central and Eastern Cheshire NHS, Vale Royal Borough Council and the HPA), Report into the circumstances around two cases of Acute Myeloid Leukaemia, 2008

Remembering
Sharon and Rebecca

Report
into the circumstances around
two cases of
Acute Myeloid Leukaemia

The Incident Team

July 2008

The names and pictures of the girls are printed at the request of the parents and with the support of the community and the Incident Team

Incident Team Affiliations

Rupert Adams, *Vale Royal Borough Council*
Russell Keenan, *Alder Hey Children's Hospital*
George Kowalczyk, *Health Protection Agency, Chemical Hazards & Poisons Division*
Hugh Lamont, *Health Protection Agency, North West Region*
Wendy Meredith, *Central Cheshire Primary Care Trust*
Lorraine Shack, *North West Cancer Intelligence Service (formerly Merseyside and Cheshire Cancer Registry)*
Alex Stewart, *Health Protection Agency, Cheshire & Merseyside Health Protection Unit*

Presented initially to the residents & thereafter to the Board of Central and Eastern Cheshire Primary Care Trust

The Incident Team wishes to thank
the parents and the community
for their support and patience
during this long and exhaustive investigation.

The facts included in this report have been shared with the parents of
Sharon and Rebecca
and are printed here with their consent.

All facts and interpretations have been discussed with, and commented on by, the families and local residents.

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EXECUTIVE SUMMARY

The deaths of two young girls in Leftwich, Northwich, Cheshire, from acute myeloid leukaemia led to an intensive Public Health investigation into the epidemiology and environment of the local community.

The multi-disciplinary Incident Team was very aware of community concerns, particularly when it was discovered that their houses had been built on an old landfill in the mid-90s. It knew that it was very unlikely that it would uncover the cause of the children's deaths; instead, it set out to discover what was known about AML, the local epidemiology and health, the landfill and anything else that appeared relevant to anyone, including the residents, and to do what could be done to ensure that living in the estate was safe.

The Incident Team was guided by two very clear principles: firstly, that the local community should be fully informed and wherever possible, involved in the investigation; secondly that the team would keep a collective "open mind".

Good relationships were developed and maintained between the local community and the professionals. The Incident Team involved the local residents in the epidemiological studies and environmental surveys, including the analysis and interpretation of all results.

There were no other cases of childhood AML locally, and no other cases of cancer in the children of the estate. The general health of the community was unremarkable and a review of GP records of long-term residents showed no diagnosis that could be attributed to landfill toxins or stress from the investigation.

The air and water supply of the community was not contaminated. The contaminants found in the ground were typical of those found at many contaminated sites in the UK, although levels at Leftwich were significantly lower. None were related to acute myeloid leukaemia.

The main problem found on the site was the risk of explosion from landfill gas (methane) and the risk of asphyxiation from carbon dioxide, again from the landfill (neither methane nor carbon dioxide cause cancer). These risks were compounded by the failure of the under-floor membranes that had been fitted when the houses were built. Examination of these membranes showed that no house had a fully functioning membrane.

All twenty four houses on the estate were owned and managed by a Social Housing Landlord. When the council formally determined the land as contaminated, to remove the risks of explosion and asphyxiation, the landlord undertook remediation work: replacement of gas membranes under the ground floors of each house, improvement of the ventilation systems of the walls and the under-floor voids and excavation and disposal of contaminated soils from some gardens.

The principles of openness and transparency were upheld by the Incident Team at all stages of the enquiry. Information was freely available to the residents and nothing was held back. All environmental results were shared with residents in printed form at the same time that they became available to the Incident Team. Because of the personal and sensitive nature of health data, the epidemiological information was summarised and orally presented to the residents by the Incident Team at the next residents' meeting, held 6-weekly initially.

A local Council representative was known to, and respected by, the residents and provided the conduit for communication between the Incident Team and the community when new information became available.

An open-door policy was maintained by the Council for all partner organisations and residents of the estate, allowing the discussion of questions or concerns at any time. One of the parents provided the same service to the residents.

Considerable thought and effort went into explaining all the findings, putting them in proper context, exploring any danger that existed, engaging the community in shaping the interpretation and developing the risk assessment process. Residents were encouraged to explore the data and ask questions that helped direct the investigation.

A draft press release was discussed at each residents meeting and agreed by all parties for release to the local news media. The press were seen as key partners in helping the Incident Team and the residents explain complex issues to the wider public.

Suspicion and mild hostility towards the investigating agencies at the outset of the investigation in March 2005 has been replaced by friendship and co-operation between the local community and the agencies involved. Even though the residents did not always feel that the investigation had answered their concerns, they recognised that it was not for want of trying – a tribute to all parties concerned.

The lessons identified at the end of the report from the incident and the resulting recommendations of the Incident Team are reproduced on the next page.

Lessons identified include:

- Community engagement at all levels of an investigation is not only desirable but possible.
- Community engagement goes well beyond communication and consultation.
- The community can understand anything the professionals can; they just need clear explanations using plain language and the careful description of complex issues.
- Professionals need to listen to and accept the position of the community as valid, relevant, essential, important and contributing to both process and outcome.
- Professionals should not assume that only they have an understanding of risks.
- Inappropriate risk comparisons should be avoided.
- A senior point of contact showing honesty and integrity is of first importance.
- Very little should be confidential.
- Engagement in the real world is time consuming; do not underestimate the commitment required.

Recommendations

- Involve the community in all aspects of future work like this, from the inception of the investigation, through the investigative and analytical process, to the determination of outcomes and the audit of the work.
- Undertake epidemiological and toxicological studies using tissue bank material on AML and linked disorders to address possible influences on the disease process, including deprivation, chemicals (including mixtures and pesticides), infection and antenatal exposure.
- Include the cost of the work in future Public Health investigations, including (a) more carefully tracking of costs in the Local Authority to ease applications to DEFRA for funding, (b) estimates of time and costs of all incident team members.
- Produce through the public and CHAMPS (Cheshire and Merseyside Public Health Network) a toolkit on community engagement that will be useful for the Health Protection Agency, Primary Care Trusts and local authorities. This should not be driven by professionals but in line with the ethos of this investigation.
- Include expertise in social sciences in the multi-disciplinary membership of future Incident Teams investigating big incidents.

1. Introduction

The girls, the Incident Team and the local community

Two young girls, Sharon and Rebecca, died from a rare type of acute myeloid leukaemia (AML) one year apart (February 2004 and February 2005) in Leftwich, a suburb of Northwich, Cheshire (map 1; Appendix D figures 1-2). Concern was raised by the parents and doctor who attended both girls because of the following facts:

(i) AML is uncommon in children
(ii) the AML in both girls was of the same rare subtype, AML M7
(iii) the girls died one year apart after similarly short illnesses
(iv) they were of similar age when they died
(v) they had lived in houses with adjoining gardens
(vi) clusters of AML are not usual

An investigation was therefore mounted.

The investigation included epidemiological studies and environmental surveys. The Incident Team running the investigation involved the local residents in their work and in the analysis and interpretation of all results. Good relationships were developed and maintained between the local community and the professionals on, and those working with, the Incident Team.

The Incident Team was aware from the beginning that it was very unlikely that it would uncover the cause of the children's disease and death. However, there was a high level of anxiety in the local community, particularly when it was discovered that their houses were built on an old landfill site (Appendix D: figures 3-7). The Incident Team set out to discover what was known about AML, about the local epidemiology and health, about the landfill and anything else that we were asked by the residents, and to do what could be done to ensure that living in the estate was safe.

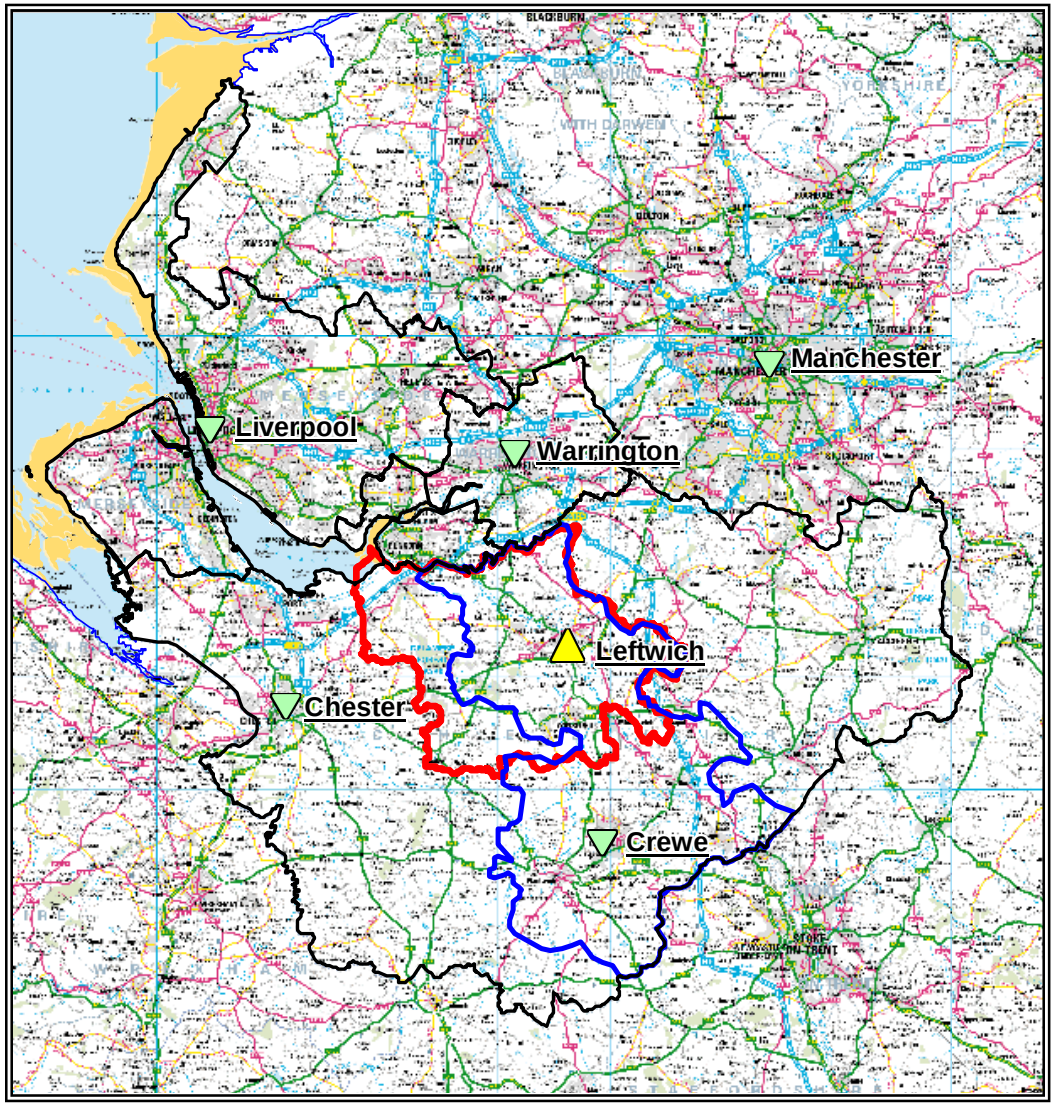
Acute Myeloid Leukaemia with relevance to the cases in Leftwich.

Leukaemia is the most commonly diagnosed cancer in children with about 350 cases per year in children in England aged under 15 years at diagnosis (Cancer Research UK, 2007) (with 31 deaths in England in 2007 (Compendium of Clinical and Health Indicators, 2007)). Of these 350 cases, only 50 cases are acute myeloid leukaemia, a rare sub-type of leukaemia (ONS, 2007).

Acute myeloid leukaemia is a rare cancer of the blood. It presents with varying symptoms including tiredness, infections and bleeding problems usually over a short period. AML is most common in older adults and is very rare in childhood.

Several risks factors have been investigated – the chemical ones are exposures to hydrocarbons, pesticides, alcohol use, and cigarette smoking – but without clear evidence of a role. Only one environmental risk factor, ionising radiation (e.g. X –rays during pregnancy), has been significantly linked to acute lymphoblastic leukaemia or AML in

Map 1: Leftwich, Northwich, lies within Vale Royal Borough Council and Central Cheshire Primary Care Trust



Leftwich

Cheshire & Merseyside local authorities

Central Cheshire Primary Care Trust (2003-2006)

Vale Royal Borough Council (1974-2009)

childhood. Otherwise the causes are unknown (Belson et al 2007). A recent report strengthens the idea that domestic use of pesticides might also play a causal role in the development of childhood cancers of the blood, including AML (Rudant et al 2007).

AML has several different subtypes. In these two cases in Leftwich the type was AML M7, which is also known as acute megakaryoblastic leukaemia. This type of leukaemia is very rare, representing about 10% of all AML patients. The exception to this is in children with Down's syndrome, where AML M7 is around 20 times more common than the rest of the population. The children in Leftwich did not have Down's syndrome or any other previous diagnosis.

It is not usually possible to find a cause for AML or AML-7 in an individual patient, especially children. Known risk factors in adults include previous exposure to chemicals including benzene and some chemotherapy agents, particularly etoposide, some rare blood diseases including aplastic anaemia and Fanconi's anaemia. Risk factors in children include Downs Syndrome, high energy radiation exposure and a family history. Neither of the girls had any of these risk factors.

AML is a difficult disease to treat. Complex chemotherapy offers a potential chance of cure. The chances of cure depend on the age of the child at diagnosis as well as other factors, including genetic abnormalities within the leukaemia and the response to chemotherapy. The treatment has considerable risk and sadly was not successful in either of the two girls investigated here.

The housing estate

The housing estate where the girls lived was formally part of a farm and was originally marshy fields. During the 1960's the adjacent land to the west, toward the main road, was covered with a wide range of wastes from a variety of sources, including demolition wastes. Some of this waste was also deposited beyond the original tip, onto the site where the houses would later be built.

The waste tip was levelled in the 1970's. During the 1990's planning permission was given for the development of social housing on the site. Ground gasses (methane and carbon dioxide) were known to be a problem and all 24 properties on the site were designed to include gas protection measures in their construction.

These measures included the installation of gas resistant membranes within the ground floors and passive ventilation systems such as bricks with holes. The houses have been occupied since June 1996.

2. How the problem was tackled: the investigation

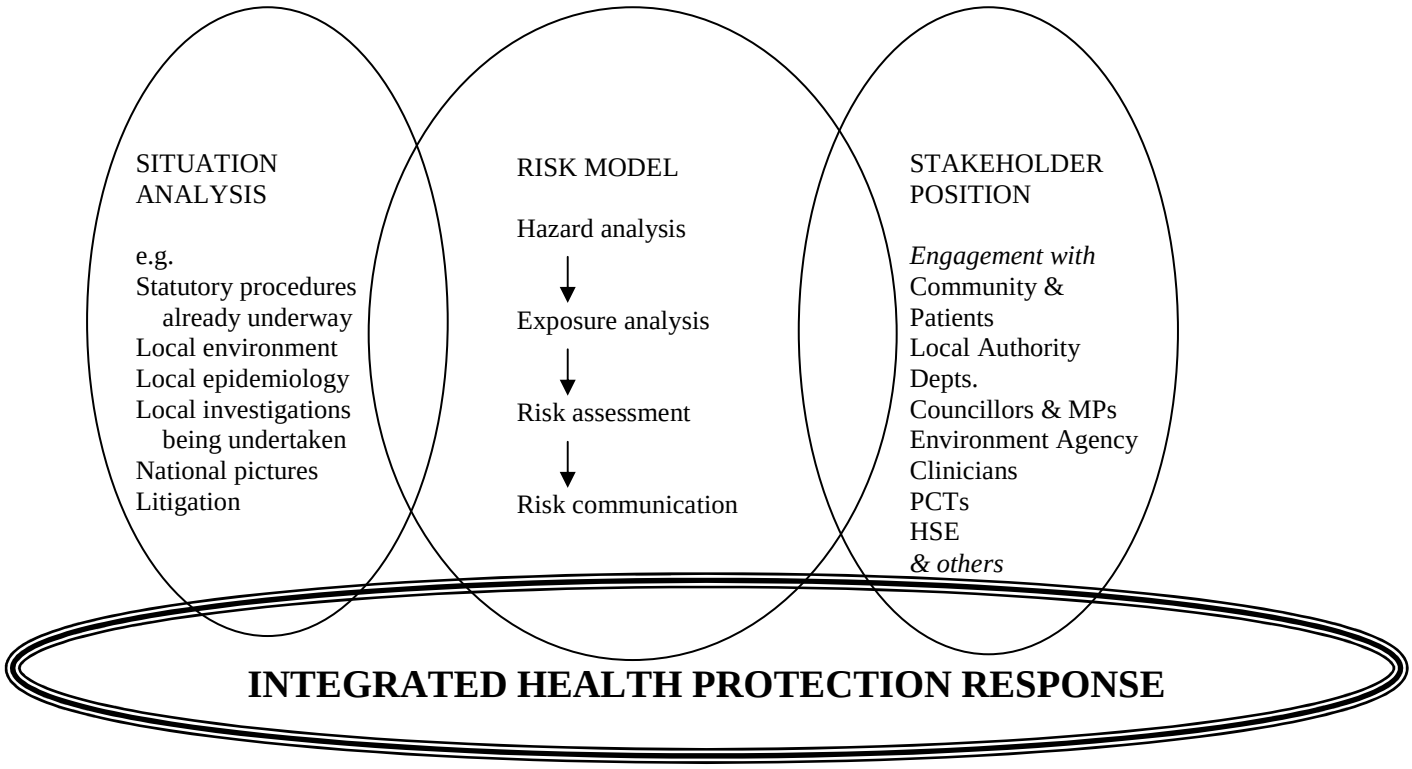
Why we called an Incident Team

Concerns regarding the deaths of two young girls living in adjacent housing from AML were brought to the attention of the Cheshire and Merseyside Health Protection Agency in March 2005 by the Consultant Haematologist at Alder Hey Children's Hospital who cared for both children. A team of people with expertise in haematology, cancer epidemiology, environmental health, toxicology, health protection and communication was pulled together, chaired by the Director of Public Health in the local Primary Care Trust. The team is referred to throughout this report as the Incident Team.

The team worked together to:

[a] understand the situation
[b] explore the causes and results by examining the risks
[c] involve everyone who might have a part to play (figure 1).

Figure 1
Building an Integrated Health Protection Response



HSE = Health & Safety Executive; MP = Member of Parliament; PCT = Primary Care Trust.
Source: Reid et al. 2005

The Incident Team was guided by two very clear principles throughout the investigation: firstly, that the local community should be fully informed and wherever possible, involved in the investigation; secondly that the team would keep a collective "open mind". This involved casting a wide net for information and understanding, including looking at a lot of different things that turned out not to be relevant.

The Incident Team met regularly to discuss and guide the progress of the investigation. Detailed notes of these meetings were kept and made available to the local community, after removal of any personal details.

Who did what?

Three working groups were established to undertake the epidemiological studies, the environmental studies and ensure effective communications.

The Incident Team asked national experts for advice, including the Committee on Carcinogenicity of Chemicals in Food, Consumer Products and the Environment (COC), which advises Government on the potential of chemicals to cause cancer, and the Soil Guideline Value (SGV) Task Force, which informs the Department of the Environment, Food and Rural Affairs (DEFRA) on soil contamination issues. Experts on AML were also consulted for their experience and knowledge.

A regular residents' meeting was also held, usually in the local Evangelical Church on the edge of the housing estate. A local resident chaired the meeting, with support provided by the Council. The local residents were supported at these meetings by their Vale Royal Councillors & on occasions, their MP. Officers of the landlords, Muir Housing Trust, and communication specialists with professional links to the media also attended. The residents chose their own independent expert on environmental issues and chose the environmental consultants, who were paid for by the local authority.

What the Incident Team looked at

There are many pieces of information that are collected routinely, which are available to the health community for examination and analysis. Based on clinical advice, the Incident Team decided to look at AML and related diseases and searched each dataset for any of the names (table 1). These conditions were chosen because of their relationship with AML; for example, aplastic anaemia and AML are not completely distinct diseases, but each can become the other.

The Incident Team looked at all the routine sources of data that were considered relevant:

- the North West Cancer Intelligence Service (formerly Merseyside and Cheshire Cancer Registry) population-based register of cancer cases

- the Eastern Cheshire Primary Care Trust data on deaths (from death certificates) and hospital admissions for cancer
- the Congenital Abnormality Register

All were examined by postcodes and ages of patients, comparing the number and type of cases in the postcodes surrounding the girls' homes with the wider situation across Cheshire to identify anything unusual.

Table 1
Disorders related to AML, possible alternative names and morphological code

Disease Name	**Code Number**
Acute myeloid leukaemia	M98613
Acute myeloid leukaemia subtype M7	
Acute myelogenous leukaemia	M98613
Acute myelogenous leukaemia subtype 7	
Acute megakaryocytic leukaemia	M98613
Acute myelofibrosis	M99323
Malignant myelosclerosis	M99323
Acute myeloid leukaemia	M98613
Acute myelogenous leukaemia	M98613
Acute promyelocytic leukaemia	M98663
Acute erythroblastic leukaemia	
Erythroleukaemias	M98403
Myelodysplasia	M99891
Refractory Anaemia	M99801
Refractory Anaemia with excess blasts	M99831
Refractory Anaemia with excess blasts in transformation	M99841
Refractory cytopenia	
Refractory anaemia with sideroblasts	M99821
Refractory anaemia without sideroblasts	M99811
Aplastic anaemia	M75400
Hypoplastic anaemia	
Infantile Monosomy 7	

Source: Morphological code from ICD-10, WHO 1993.

With permission from the two mothers, the hospital records concerning the pregnancy and delivery of the girls were examined for any relevant information. The records of local General Practitioners were searched for any other cases of AML and related disorders.

Scientific literature was searched for information about AML and AML M7, including the causes, or known risk factors, and information on any previous clusters.

With the realisation that the houses were built on an old, unrecorded landfill an environmental investigation was undertaken, looking at the air, land and water for pollutants (chemicals and radioactivity) that might move from the landfill into the houses, gardens and surrounding areas at concentrations that could be harmful to health.

After the environmental investigation was completed the GP records of long-term residents were examined, with permission, for conditions of skin, liver, blood and kidney (for toxic effects of living on landfill) and depression and anxiety (for possible stress arising from the investigation). Residents included in the study were older than two years of age, had lived on the site for most of the time since the houses were occupied, or most of their life if young, and agreed to be included.

Other data sets were also searched for information to examine whether there was anything unusual about the local area. This included the Vale Royal Borough Council library of maps and plans and the British Geological Survey information on the soils, sediments and radioactivity locally. West Cheshire College was asked for records of the weather covering the years before the girls' deaths (i.e. 2003 and 2004 data).

NHS Direct was asked for information comparing the calls from the local postcodes with the regional and national call pattern. The local virology laboratory was asked for similar information comparing the viruses found locally with the regional picture but was unable to supply this information.

Records of previous environmental investigations (soil, water, air, non-ionising and ionizing radiation), Foot and Mouth burial sites from the 1967 outbreak and farm records were examined. Local people were asked for their memories about the site on which the houses were built. Records of nearby properties were examined, particularly for leaks of fuel, including petrol, a known source of benzene.

Muir Housing's and the council records of the use of weed killers and pesticides around the estate were examined for exposure to insecticides, pesticides and herbicides. The families were also asked about the use of these compounds.

Community involvement

The most important key to the successful management of the investigations and remediation of the site has been the extensive involvement of the local community

throughout the process. Community meetings for residents were held 6-weekly initially. Community concerns and ideas expressed at these meetings have been listened to and addressed by the partner organisations.

Importantly, the community took an active role in the investigation by selecting the environmental consultant - RSK (paid for by the Council), influencing the monitoring procedures and participating in a workshop which examined and fixed the model used to determine local exposures to toxins by local children and adults. Detailed questions about the movement of the girls while healthy were also answered by the families. All this led to a highly developed, site specific assessment of exposure.

The community has also commented on the health investigations, suggesting a number of inquiries which have been undertaken.

In addition, any personal information in the minutes of the Incident Team meetings was removed. The minutes were shared with the community in time to enable discussion of any point at the residents' meetings.

The Muir Group Housing Association attended the community meetings, appointed highly qualified environmental consultants to act on their behalf, undertook voluntary investigation and assessment beyond that

3. What we found: the results

Epidemiology

Cancers

There were only two patients diagnosed with AML M7 (ICD-10 C94.2), both adults, registered in the Merseyside and Cheshire region (map 1) between 1997 and 2003 (the most recent period available - population based follow-up to 2004/05 was not available at that time). The Incident Team also considered a further person with a related diagnosis who lived, not in the immediate locality, but nearby. The team found it impossible at any point in the investigation to decide whether or not there was any relationship with the AML in the girls.

In order to ensure completeness neighbouring registries (Wales, Trent and North Western) and the National Childhood Cancer Registry were searched for cases. No additional cases were found.

This part of the investigation found:

Children with AML (ICD-10 C92.0; this excludes AML M7) in children under-5 years of age at diagnosis:

- the Merseyside and Cheshire region – four cases, all older and none in the vicinity
- Central Cheshire Primary Care Trust (map 1) - none
- postcodes CW8 and CW9 where Leftwich is located (map 2) – none
- Merseyside - all four cases in Cheshire and Merseyside

Due to the small numbers of AML, further analysis could only be done on all cancers combined and leukaemias for all ages.

All cancers (excluding non-melanoma skin cancer), in all ages (tables 2 (from 1997 to 2003) and 3 (from 2000 to 2003)):

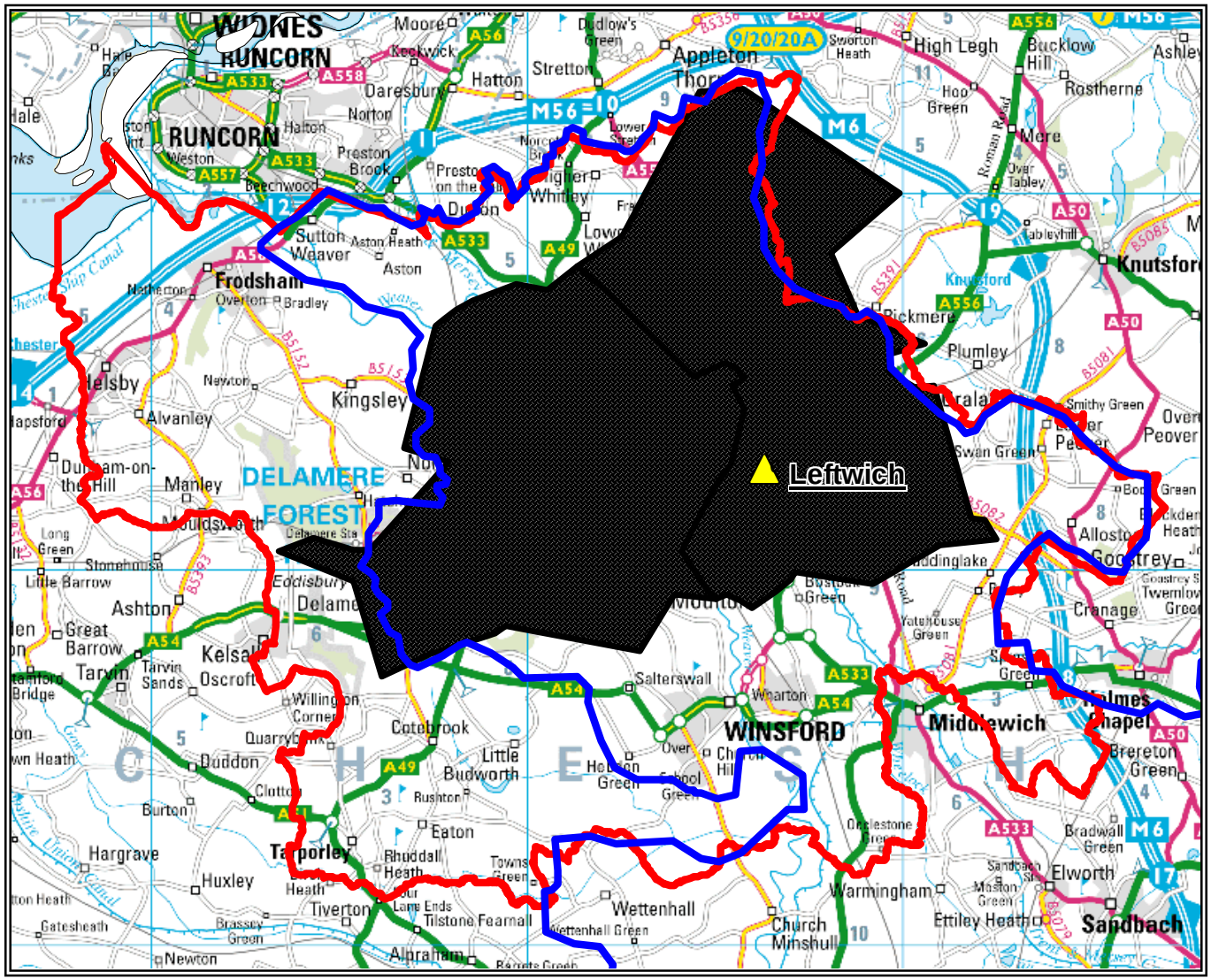
- the Merseyside and Cheshire region – stable number and rate
- Central Cheshire Primary Care Trust – stable numbers and rate; statistically significantly lower rate than in Merseyside and Cheshire
- postcodes CW8 and CW9 – stable numbers and rates

All leukaemias, in all ages, from 1997 to 2003 (tables 3 and 4):

- the Merseyside and Cheshire region – stable number and rate
- Central Cheshire Primary Care Trust – stable numbers and rate; statistically significantly lower rate than in Merseyside and Cheshire
- postcodes CW8 and CW9 – numbers too small for comparison

There is a lower rate for all cancers and leukaemia in Central Cheshire Primary Care Trust than in the whole of the Merseyside and Cheshire Cancer Registry (table 3). This is likely to be due to the overall better living conditions in the PCT compared with the average across the two counties.

Map 2: Postcodes CW8 and CW9, Northwich



We calculated this as follows: the expected number of cases of all cancers and leukaemia in Central Cheshire Primary Care Trust (table 3) are calculated according to the number of people in different age groups from the observed number of cases in the whole of Merseyside and Cheshire. The O/E (or Standardised Incidence Ratio) for the Primary Care Trust is lower than the O/E for the MCCR region (e.g. 94.1 *vs* 100 for all cancers). This is confirmed by the fact that the 95% confidence intervals for the PCT do not include the O/E of the whole of Cheshire and Merseyside.

Table 2
Number of cases of all cancers (excluding non-melanoma skin ICD-10 C44) for all ages

	Year of Diagnosis						
	1997	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
M&C	11,082	11,378	11,961	11,816	12,080	11,655	11,004
C. Cheshire PCT	1,037	1,104	1,068	1,167	1,159	1,050	988
CW8 & CW9	265	265	298	306	317	304	277

M&C = Merseyside and Cheshire

Table 3
Numbers and standardised incidence rates of all cancers (excluding non-melanoma skin ICD-10 C44), 2000-2003

	All cancers				Leukaemia (ICD-10 C91-C95)			
	Observed	**Expected**	**O/E**	**95% CI**	**Observed**	**Expected**	**O/E**	**95% CI**
M&C	46,554	-	100	-	900	-	100	-
CC PCT	4,363	4633.5	94.1	91.4-96.0	57	89.7	63.6	47.1-80.1

M&C = Merseyside and Cheshire
CI = confidence interval, a measure of where O/E is likely to be, 95% of the time
This data is taken from tables 2 and 4 for the relevant years

Table 4
Number of leukaemias (ICD-10 C91-C95) cases for all ages

	Year of Diagnosis						
	1997	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
MCCR	246	241	238	241	221	219	219
C. Cheshire PCT	22	18	14	15	19	13	10
CW8 & CW9	6	5	3	5	4	3	4

MCCR = Merseyside and Cheshire Cancer Registry

There were no obvious increases in incidence in Central Cheshire or CW8 & CW9 for all cancers or leukaemias (see tables comparing Central Cheshire and CW8 & CW9 with Merseyside and Cheshire).

Additionally, the names and dates of birth of all children resident on the estate at any point since it was first occupied were noted. The local and national cancer registries were searched for all resident children for any diagnosis of any cancer. No additional cases were found. Finally, the coroner was asked about records of unexplained death in children in Northwich, particularly in CW8 or CW9, which might be related to AML. There were none.

Other health information

Hospital admissions for leukaemias showed the expected pattern by age (numbers increased with age) (Appendix B), with any geographical cluster being due to the large number of older people living in the locality. No other cases below the age of 16 years were noted. There was no seasonal pattern to the adult leukaemias.

The illnesses identified through the death certificates were similar to those found in the hospital admission information, although there were a smaller number of deaths than admissions. There was nothing unusual in the pattern of calls made to NHS Direct (Appendix B).

The examination of the Congenital Abnormalities Register did not show anything unusual in the local community. Examination of the GP and hospital records of the girls' families did not show anything unexpected or unexplained that might be linked to AML.

The review of the GP records (Appendix E) of 24 long-term residents (25 were invited into the study) showed no unexpected conditions of skin, liver, blood or kidney. Only two residents had been diagnosed with depression, both prior to the children's deaths or the resulting investigation, and none had been diagnosed with anxiety. No diagnoses of other malignancies were recorded.

Twenty residents out of the 24 had one or more previous dermatological diagnoses; of these, 14 had previous diagnoses of common skin conditions (eczema, dermatitis, urticaria or non-specific rash). The majority of the residents with skin conditions came from two families, indicating the underlying cause of their problems was linked to their genes or lifestyle and not to the environment. The remainder of the residents had a variety of diagnoses of unrelated but common skin disorders (skin tags, sweat rash and molluscum contagiosum).

Skin disorders are amongst the commonest conditions seen in General Practice and the range and type of conditions seen in long-term residents is not unusual. There is no reason to believe that any of these conditions were caused by exposure to the landfill toxins.

Environment

The British Geological Survey reported that, in the local soils and stream sediment around Northwich, there were no local irregularities in any of the 33 elements (table 5) routinely measured. The weather data did not show any unusual pattern in the months before the girls died. There were no relevant spills of petrol or diesel locally and the nearest Foot and Mouth burial sites were several kilometres away.

Table 5
Chemical elements routinely measured in soil and stream sediments by the British Geological Survey

Ag	Silver	Ga	Gallium	Sb	Antimony
As	Arsenic	K	Potassium	Se	Selenium
Ba	Barium	La	Lanthanum	Sn	Tin
Bi	Bismuth	Mg	Magnesium	Sr	Strontium
Ca	Calcium	Mn	Manganese	Th	Thorium
Cd	Cadmium	Mo	Molybdenum	Ti	Titanium
Ce	Cerium	Nb	Niobium	U	Uranium
Co	Cobalt	Ni	Nickel	V	Vanadium
Cr	Chromium	P	Phosphorus	Y	Yttrium
Cu	Copper	Pb	Lead	Zn	Zinc
Fe	Iron	Rb	Rubidium	Zr	Zirconium

Local memory indicated that the waste tip was not confined to the west of the field; the local maps were incomplete. There were strong reasons to believe the tip would be found to continue under the houses.

There was nothing unusual in the answers to the questions concerning exposure to insecticides, pesticides and herbicides.

A wide range of environmental investigations were done around the estate, including assessments of radiation (alpha, beta, gamma, radio and electro magnetic) (table 6). Nothing untoward was found in the radiation assessments.

Due to the history of waste disposal in the ground on which the houses were later built, consultants (selected by the community and paid by the Borough Council) concentrated on ground contaminants, especially those in soils and ground waters. Particular attention was paid to soil gasses. Extensive and prolonged monitoring was undertaken within properties and the associated gardens (table 6; appendix D figure 8). Further details of the findings of this investigation and the residents input to the exposure assessment can be found in the RSK report (Frost 2007).

Table 6
Environmental investigations and results

What was looked for	How it was investigated	What was found
Baseline soil contamination study	Bio-toxicity sampling of a large number of near surface soil samples	Some "hot spots" worthy of detailed & more traditional chemical analysis
Radiation (gamma, beta, alpha)	A range of tests on background environmental and soil samples	At or around background levels / the norm. for the area
Electromagnetic radiation	Physical search for supply cable >30KV	No source within several 100 metres
Radiofrequency radiation	Physical search for transmitters	No transmitter within 250 metres
Hidden services	Maps, aerial photos, utility records	Sewer and mains electricity cables (in use and redundant)
Ground gas (initial studies)	Flame Ionisation Device (FID)	Elevated flammable gas readings detected
Ground Gas (further studies)	Chemical analysis supported by FID	Elevated flammable gas readings detected
Ground Gas (within gardens)	Borehole monitoring for levels and flow	Elevated levels with high flow rates
Gas membrane integrity check	Use of, and tests for, inert gasses within buildings	Defective and poorly installed gas protection measures
Soil contaminants	Chemical analysis of many 100's of samples from across the site and at varying depths	Mostly within acceptable parameters but some elevated
Drinking water contaminants	Chemical analysis of mains samples at taps in 4 houses and service reservoir	Below drinking water standards
Ground water contaminants	Chemical analysis of many 100's of samples from across the site and at varying depths	Within acceptable parameters
Contamination found during remediation	Physical and chemical examination of items discovered	Nothing of significance discovered.
Air monitoring inside houses	Passive diffusion tubes and pumped samples	Mostly within acceptable parameters but some elevated

The drinking water supply was examined in four houses on nine dates between 4/11/05 and 20/3/06. Twenty six water samples were taken and 256 separate analyses were done. The concentrations of various chemicals (1,2 di-chloro-ethane, benzene, benzo(a)pyrene, tri-tetra-chloro-ethene, tetra-chloro-methane, tri-halo-methanes, PAHs) in the house taps samples were compared with the concentrations of the same chemicals in the supply reservoir. Benzo(a)pyrene and PAHs were higher in one house than at source, tetra-chloro-methane was higher in another house, while the tri-halo-methanes were higher in all four houses. However, all test concentrations were far below drinking water standards.

Low, but nevertheless raised, levels of a range of organic compounds, including benzene, were discovered in soils and ground gases. Most of this was concentrated in a small area of the site adjacent to the houses where the two girls had lived.

The next step is to use what is known as the source-pathway-receptor model to examine the link between the chemical(s) and the people:

- The source is the landfill under the gardens and houses
- The pathway is by swallowing, skin contact or breathing the chemical into the lungs
- The receptor in Leftwich is the person living on the estate

The Incident Team examined the situation for both a one year old child, like the two girls, and an adult, who has the longest exposure over life.

The assessment of whether the chemical contaminants found in the soils were of any health concern was carried by first estimating the exposure for both a one year old child and an adult resident. This exposure level was then compared with the relevant Health Criteria Value (HCV), which is an exposure level that is without a risk to health.

The Health Criteria Values were calculated according to the accepted approach used for the assessment of contaminated land in the UK. Estimates of exposure were calculated using characteristics of the occupied properties agreed with the residents at a workshop arranged for that purpose. An example of how the assessment was carried out is shown in Box 1.

If the exposure exceeds the Health Criteria Value (i.e. the ratio is greater than 1) then there may be a potential health concern. Ratios for key contaminants at the site are given in Table 7 and further details are given in Appendix B.

Three chemicals (namely B(a)P, nickel and mercury) had particularly elevated ratios in children and exceeded their respective Health Criteria Values by factors of 5 of more. Additionally, naphthalene exceeded the Heath Criteria Value for adults by inhalation. These facts need further consideration.

Box 1
Example of an Exposure Assessment

EXPOSURE PATHWAY – INGESTION OF SOIL BY A CHILD

This example assumes that a contaminant is found in soil at a level of 1ppm (1mg /kg soil) and assesses whether the exposure of a 1 year old child arising from accidental ingestion of soil is of concern. The contaminant in question has a Health Criteria Value (HCV) of 0.04µg/kg body weight/day

Exposure assumptions

- Soil ingestion rate for a child = 200mg soil per day
- Child body weight = 10kg

Exposure calculation

A child ingesting 200mg of soil which contains the contaminant at a level of 1mg/kg of soil will ingest 0.2micrograms of contaminant per day (0.2µg/day). For a child with a bodyweight of 10kg the ingested dose is therefore 0.02µg/kg bodyweight/day

Comparison with HCV

The ratio of the exposure to the HCV of 0.04 is

Exposure / HCV = 0.02 / 0.04 = 0.5

Conclusion

As the ratio is less than one, this means that the exposure to the contaminant is well within the HCV and so is without risk to health. For this contaminant the exposure from accidentally ingesting contaminated soil is unlikely to be of health concern.

However, a couple of important things need to be understood about Health Criteria Values in judging what these exceedances mean for health:

- Health Criteria Values are acceptable levels for a **lifetime of exposure** to that chemical (typically every day for 60 years)
- Health Criteria Values have built in safety factors and are set at levels between 100 and 10,000 times below levels which are known to be harmful to health after long term exposure

Because Health Criteria Values have very large margins of safety, a five fold exceedance of the Health Criteria Value in a single year is still a long way away from an exposure which is known to be harmful. It would require continued exposure over several years or decades at this exposure level before there were real health concerns. When considering a single year of exposure, exceedances of the Health Criteria Value would need to be up to 100 fold before they would be considered a health concern.

Table 7
Chemicals found in soil above site specific human health criteria values

	Ratio of chemical to HCV			
	Child under 1 year		Adult	
Chemical	**Swallowing and skin exposure**	**Breathing into the lungs**	**Swallowing and skin exposure**	**Breathing into the lungs**
Arsenic	1.0	-	0.3	-
B(a)P - benzo[a]pyrene	5.0	-	1.2	-
Benzene	0.1	-	0.01	1.3
DB(ah)A - dibenz[ah]anthracene	1.5	1.1	0.5	-
Ethylbenzene	-	0.01	-	0.02
Fluoranthene	1.9	-	0.6	-
Mercury	5.6	-	0.3	-
Naphthalene	-	1.2	-	8.5
Nickel	6.1	-	0.1	-
Phenol	-	<0.01	-	<0.01
Toluene	-	0.1	-	0.2
Xylene	-	0.2	-	0.2

NOTES:
HCV = Health Criteria Value, specific for each chemical and calculated separately for a one year child and an adult.
Ratio = calculated child or adult exposure level divided by HCV. So, a ratio of 1 means the calculated exposure is the same as the HCV, a ratio of 2 means the calculated exposure is double the relevant HCV, while 0.5 means it is half.
Where a chemical has no value listed, then there is no significant exposure by that route.

Additionally, the health effects of these chemicals are not linked to any type of leukaemia; B(a)P is known to cause cancer after being swallowed, but the cancers it is linked to are specifically cancers of the skin. Naphthalene has been associated with cancers but not with leukaemia. It can affect the blood red cells but is not linked to leukaemia, which is a disease of the blood white cells. Exposure to naphthalene was not an issue for children, nor was it smelled during the investigation. It is possible that the value calculated for outdoor air is too high; at these concentrations naphthalene should be detectable by smell. The levels measured indoors warranted action to minimize the exposure; the removal of soil from some gardens dealt with this.

The mercury and nickel exposures are a slight concern but these pollutants are not a cause of AML. Any health effects of mercury and nickel at the levels found would take many years to produce significant health effects.

Moreover, exposures at these levels are unlikely to continue beyond the early childhood years as older children and adults have much lower exposure opportunities than young children and they also have much greater bodyweights and so proportionately they receive lower doses.

The types of the various contaminants found at the site are typical of those found at many contaminated sites in the UK, although levels at Leftwich are significantly lower. At these more contaminated sites, where families have been living for decades unaware of the contamination, there has been no evidence of any health effects in children and, in particular, no excess of leukaemia of which we are aware. This is further reassurance that the levels of contaminants seen at Leftwich are not a likely the cause of AML.

Whether the mixture of chemicals found in Leftwich could be the cause of the girls' leukaemia must remain an open question. Our understanding of mixtures is limited. All that can be confidently stated is that, since the chemicals found in the highest concentrations are chemicals that are often found in landfill and other contaminated sites, any mixture effect should be observed in other places. The Incident Team remains unaware of any reports of this happening.

Furthermore, in Leftwich, the removal of landfill and soil from some gardens, down to the original ground underneath, has removed any of these pockets of slightly raised concentrations and any risk associated with them.

The main problem found from the site investigations was not exposure to toxic chemical pollutants but the risk of explosion from landfill gas (methane) and the risk of asphyxiation from carbon dioxide, again from the landfill. Neither methane nor carbon dioxide causes cancer. However, the risks from the presence of these gases were increased by the failure of the ventilation and under-floor membranes that had been fitted when the houses were built. Examination of these membranes showed that they had not been fitted properly in many places and no house had an intact membrane.

4. What we did about all this

Communications

The Incident Team decided at the outset that it was essential that residents of the housing estate would be involved as partners in the investigations. Residents were kept fully informed of developments and that their questions and concerns responded to promptly.

The principles of openness and transparency were upheld by the Incident Team at all stages of the enquiry. Information was freely available to the residents and nothing was held back. During the first year residents' meetings were held initially at six weekly intervals. Later they were held at agreed, more widely spaced intervals, until the whole investigation was complete.

It was recognised at the outset that information would become available in between the six-weekly meetings. Fortunately, a local Council representative was known to, and respected by, the residents and provided the conduit for communication between the Incident Team and the community when new information became available.

All environmental results were shared with residents in printed form at the same time that they became available to the Incident Team. Because of the personal and sensitive nature of health data, the epidemiological information was summarised and orally presented to the residents by the Incident Team at the next residents' meeting.

An open-door policy was maintained by the local Council for all partner organisations and residents of the estate, allowing the discussion of questions or concerns at any time. One of the parents provided the same service to the residents.

The Incident Team agreed to hold meetings with the residents every six weeks to report on progress, answer questions, take feedback and provide an opportunity for discussion and debate. One of the residents agreed to chair the public meetings, a local councillor served as advocate and an environmental consultant donated his time and expertise to the residents. The Housing Trust who owned the properties also sent representatives to these meetings.

Considerable thought and effort went into explaining all the findings, putting them in proper context, exploring any danger that existed, engaging the community in shaping the interpretation and developing the risk assessment process.

Early in the investigation a leaflet explaining the concept of contaminated land and its investigation was distributed to all the residents. During the course of the investigation Soil Guideline Values and other technical terms were explained in lay terms with discussion until everyone was satisfied that they had understood the concept or term being used.

A draft press release for the local news media was discussed at each residents' meeting and agreed by all parties. The press were seen as key partners in helping the Incident Team and the residents explain complex issues to the wider public. A local public relations company supported the communications team of the Council and the Health Protection Agency in maintaining and developing media relations. Press releases were not issued after every residents' meeting but only when there was something to report.

The accessibility and commitment to openness went a long way towards ensuring that residents and the wider public really understood the issues – even if they did not always agree with the expert analysis of a given situation.

Suspicion and mild hostility towards the investigating agencies at the outset of the investigation in March 2005 has been replaced by friendship and co-operation between the local community and the agencies involved. Even though the residents did not always feel that the investigation had answered their concerns, they recognised that it was not for want of trying – a tribute to all parties concerned.

The Incident Team believes that the involvement of the community in the investigation and remediation has assisted the residents with their grieving after the loss of the girls.

Housing issues

All twenty four houses on the estate were owned and managed by a Social Housing Landlord (Muir Housing Group Association). This provided the Incident Team with one point of contact and one source of information, in respect of, both past and present occupation, the design and the maintenance of the properties. Undoubtedly, when it came to undertaking the remediation works one responsible organisation, rather than 24 individual households, simplified procedures.

When some residents with young children were offered an opportunity to relocate to alternative residential accommodation away from the estate, a great deal of time and effort went into explaining to them, to other residents and to the wider public that relocation was being offered on compassionate grounds, to remove from them the burden of anxiety, and not because anything had been discovered that would be detrimental to the health of these families.

Tenants were found alternative accommodation during the works to their properties and some have been re-housed permanently on the recommendation of the Incident Team. The owners of the estate are a Housing Association and although they were not part of the Incident Team they co-operated with the investigations and attended the meetings with the residents.

Contaminated land legal issues

Applying its legal powers under Part IIA of the Environment Protection Act (1990) (see box 2) the Council formally determined the site as contaminated land because of the ground gasses found. The legal test is to establish that there is "significant harm, or significant potential for harm"; in this case the explosion and asphyxiation risks justified the action.

Box 2
Contaminated Land

Part IIA of the Environmental Protection Act 1990 and the Contaminated Land (England) Regulations 2000 provides the legislative framework for the management of contaminated land.

Contaminated land is defined in the legislation as:

> "any land which appears to the local authority in whose area it is situated to be in such a condition, by reasons of substances in, on or under the land that-
> (a) significant harm is being caused or there is a significant possibility of such harm being caused; or
> (b) pollution of controlled waters is being, or is likely to be, caused."

For a site to be 'contaminated', a pollutant linkage must always exist. A pollutant linkage requires each of the following to be identified:

- a contaminant
- a receptor
- a pathway capable of exposing a receptor to the contaminant

If there is a break in this pollutant linkage (*e.g.* there is a source of contamination and a receptor, but no pathway) the site cannot be defined as 'contaminated land'.

The environmental investigations had identified that ground gasses remained an issue for the houses and that the gas protection measures that had been installed when the houses were first built were sub-standard and / or were not working.

Fortunately, the close-working relationships with residents, consultants and the Registered Social Landlord made undertaking the environmental investigation and remediation works much easier. The remediation works included

- the fitting of gas alarms in the houses
- the provision of a call out response if the alarms triggered

- the replacement of the gas membranes under the floors
- improving the ventilation systems of the walls and the gaps under the floors
- the excavation and disposal of soils from six gardens where the landfill was deepest, in order to remove the source of methane and carbon dioxide

Whilst these works were aimed at addressing the ground gas issues, which presented the greatest health risk to the community from the old landfill, they have also dealt with the other chemicals present at the site.

5. Conclusions of Incident Team

Aetiology (cause of AML)

No cause for the girls' AML was found. There was no family history of illness that indicates any links there. It remains possible that the girls suffered a rare reaction to a childhood virus.

Environmental issues

The environmental investigations were extensive and wide ranging. They included investigations of radiation, pesticides, phone masts and other environmental hazards. The air, water and soils around the houses were investigated with a special focus on ground gasses. The range of compounds looked for was based upon advice provided by health professionals and the location. The frequency and duration of sampling was designed in conjunction with the residents. The investigations were conducted in an open and inclusive manner and results were released, with interpretation, as soon as they became available. In the words of one resident they had left "no stone unturned"

No environmental link to AML was found, although a few chemicals had concentrations above the site-specific Health Criteria Values. The chemicals found were common chemicals in landfill sites and the mix of chemicals is unlikely to have been the cause.

There are no significant health risks to adults living on the site. The contaminant exposures that were raised were only marginally above health criteria values, which are set with high levels of safety. Additionally, the contaminated soil has now been removed.

The review of GP notes of long term residents indicates that ***there has been no health effect from the contamination under the estate***.

There are three questions about the local environmental contamination:

1. *Did early childhood exposure to soil contaminants have a role in the development of AML?* The answer is "no".
2. *Are there any health issues from soil contaminant for adults who have been living at housing estate for some time?* The answer is "no".
3. *Are there any health issues from soil contaminant for families (children and adults) who may in future live at the housing estate?* The answer is "no".

Working with the public

The most important key to the successful management of the investigations and remediation of the site has been the ***extensive involvement of the local community***

throughout the process. Community concerns and ideas have been listened to by the partner organisations and subsequently addressed.

Importantly, the community selected the environmental consultant (paid for by the Council), influenced the monitoring procedures and participated in modelling workshops, all leading to a highly developed site specific assessment of exposure scenarios. They have also commented on the health investigations, suggesting a number of investigations that have been undertaken.

Without the residents' input the investigation would have go nowhere. ***The Incident Team wish to record their appreciation for the time and effort that the residents and the local church put in, to support and focus the whole response to the girls' deaths***: to the Incident Team itself and to the investigation and remediation.

The Incident Team strongly supports this inclusive approach in all similar investigations.

Operation of Incident Team

The whole investigation once again shows the ***importance of a multi-disciplinary team*** in such a situation, bringing together the right range of skills and expertise. The individual members put aside all personal and organisational differences and formed a cohesive Incident Team very quickly.

The ***open and honest approach*** of the clinician who had cared for the girls during their final illness was fundamental, bringing ***commitment*** to the community and a willingness to be inconvenienced for them so that their concerns were heard and dealt with fully. As well as bringing a wealth of experience and expertise, the council representative provided a ***support*** and a link between the community and the Incident Team, again being willing to be put to some trouble for the community.

The ***Public Health involvement*** of the Cheshire and Merseyside Health Protection Unit of the Local and Regional Services Division of the Health Protection Agency was crucial, bringing an understanding of a wide variety of sciences and operational issues with an ability to integrate them, in order to help the Incident Team and the community achieve the best possible outcomes and results from the investigation.

If there was something missing from the Incident Team, it was expert sociological guidance beyond that available from the Public Health members of the team.

Cost effectiveness

The investigation lasted over three years and took up a lot of expert time and commitment during that time. At the beginning of the investigation some of the Incident Team members did very little other work for some weeks, giving the investigation first priority.

The Incident Team does not regret spending their resources. Cost was never an issue in finding answers to the community's concerns. The ***investigation was undertaken as a legitimate Public Health use of time and resources*** to bring reassurance to the community that living in the estate was safe.

Known costs of the investigation include:

- Environmental investigation, including analysis of samples - £170,000
- Council staff - 10% of salary of senior Environmental Health Officer each year
- Other Incident Team members' time
- Costs of epidemiological and other scientific analysis

The total cost of the investigation is unknown but is estimated to be of the order of £250,000, or £10,000 per household. It is unlikely to have been greater than £500,000, or £20,000 per household.

In addition, the social landlord's renovation of houses and remediation of land cost £25,000 per house (total £600,000).

These costs should be compared with the value of two girls' lives and the removal of a potential risk of explosion or asphyxiation.

Very little is known about the costs of Public Health investigations such as this one. It is of interest that one month's inpatient treatment (without surgery) for AML in Alder Hey Hospital, Liverpool costs £12,176 per child (2008-2009). ***Future Public Health investigations of this kind should consider a more detailed accounting of costs***. Opportunity costs (costs of alternatives that are not done in order to undertake an action such as the investigation) should also be included in this accounting.

Confidentiality issues

Every effort was made to ***maintain confidentiality*** of personal and health information during the investigation, following the Caldecott Guidelines. Since this was a Public Health investigation, ethical permission to examine health records was not needed.

The Incident Team did not divulge personal information about the girls. Some such information became public knowledge (e.g. BBC and local papers). Members of the Incident Team gave media interviews, but did not discuss personal issues.

The family of the possible third case requested anonyminity, which was maintained throughout the investigation. This did not affect the investigation nor did it affect the assessment of the relationship between this case and the girls.

In such an investigation there are problems of small numbers of cases. This affects any statistical calculation, weakening some calculations and making reporting of data difficult. Confidentiality was maintained, even when reporting the epidemiological investigations to the community, with explanations of why data was not being shared. The community was very comfortable with this.

Studies needed

Most studies into childhood leukemia in the scientific literature do not report AML separately. Because acute lymphoid leukaemia (ALL) is the commonest leukaemia in children, studies tend to group AML with other non-ALL disease. There is ***a need for studies into AML*** from both a toxicological exposure perspective and an epidemiological perspective (*cf.* Germaine Buck Louis, 2006).

Further work, such as a case control study on tissue bank material from children (under 16 years of age) diagnosed with AML or linked disorders, could address the following aspects:

- Although some scientists discount a chemical cause for AML, communities such as the Leftwich one are not so convinced. Thus, it would be wise to continue to include chemical exposure in future studies until such time as the cause of AML is more clearly understood.
- Possible causes, including infection, pollution and mixtures of chemicals (in particular (a) petrol and traffic fumes and (b) petrol and benzene vapour in the home (c) pesticides; these need to be considered by individual types of leukaemia rather than total leukaemias).
- Strength of evidence should be considered (as in the order randomised controlled trial; cohort; case-control).
- Meta-analysis, if possible, should examine exposure levels and disease outcomes.
- Adult and occupational studies should be excluded.

***Community audit*:**

This report has been prepared by the Incident Team. The final draft was presented to the community at the last Residents' Meeting and comments made by the residents' and professionals at this meeting and thereafter have been included in this, the final version of the report.

An audit of the organisation, process and outcomes of the investigation will be undertaken after the distribution of the final report. This will be reported to the community separately.

6. Lessons identified include:

Many lessons have been identified:

- Community engagement at all levels of an investigation is not only desirable but possible
- Community engagement goes well beyond communication and consultation
- The community can understand anything the professionals can; they just need clear explanations using plain language and the careful description of complex issues
- Professionals need to listen to and accept the position of the community as valid, relevant, essential, important and contributing to both process and outcome
- Professionals should not assume that only they have an understanding of risks
- Inappropriate risk comparisons should be avoided
- A senior point of contact showing honesty and integrity is of first importance
- Very little should be confidential
- Engagement in the real world is time consuming; do not underestimate the commitment required
- Gas protection measures already installed might not be adequate despite certification
- Mitigation work needs to be tested and shown to be effective

7. Recommendations

- Involve the community in all aspects of future work like this, from the inception of the investigation, through the investigative and analytical process, to the determination of outcomes and the audit of the work
- Undertake epidemiological and toxicological studies using tissue bank material on AML and linked disorders to address possible influences on the disease process, including deprivation, chemicals (including mixtures and pesticides), infection and antenatal exposure
- Include the cost of the work in future Public Health investigations, including (a) more carefully tracking of costs in the Local Authority to ease applications to DEFRA for funding, (b) estimates of time and costs of all incident team members
- Produce through the public and CHAMPS (Cheshire and Merseyside Public Health Network) a toolkit on community engagement that will be useful for the Health Protection Agency, Primary Care Trusts and local authorities. This should not be driven by professionals but in line with the ethos of this investigation
- Include expertise in social sciences in the multi-disciplinary membership of future Incident Teams investigating big incidents.
- Address the testing of the competence of gas membranes and ventilation systems when building on landfill through planning and building controls
- Include simple property maintenance advice, covering extensions, future development and the like, in properties built on remediated sites
- Track how the progress of an investigation affects the development of the investigation – *e.g.* how do the results of epidemiological investigations affect the community and subsequent questions; similarly, what effects does information about concentrations of volatile organic compounds and heavy metals have?
- Address the needs of tenants to have access to the same information about housing and the local environment as is available to buyers of property

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9. Acknowledgements

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Jan Peters – PA, Chester
Richard Nuttall – PA, Chester
Lynn Sutcliffe – PA, Kirby
Karen Hogan – Training Administrator
Dr Paul Cleary – Specialist Registrar
Dr Imran Choudhury – Specialist Registrar
Dr Chris Whiteside – Specialist Registrar
Dr Fiona Neely – Specialist Registrar
James Wilson – Senior Scientist
Professor Virginia Murray – Consultant Medical Toxicologist
Myfanwy Cook – Environmental Scientist
Robie Kamanyire – Senior Toxicology Scientist
Francis Pollitt – Principal Toxicologist
Robin Fielder - Principal Toxicologist
Maria Davies - Analyst
Dr Nick Phin – Consultant in Communicable Disease Control
Dr Richard Jarvis - Consultant in Health Protection
Dr John Reid – Director, Cheshire & Merseyside Health Protection Unit
Lorraine Lighton - Consultant in Communicable Disease Control
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Local GPs

Vale Royal Borough Council:

Martin Wright - Scientific Officer
Richard Hallows - Director Social & Community Services
Julia Thorley - Communications
Councillor (former) Dennis Ford - Lead Councillor Community Safeguards

Profile Communications, Winsford, Cheshire:

Mhari Oakes - Managing Director (former)

Environmental Consultants:

Peter Witherington - RSK
Nick Frost - RSK
Dr Chris Eccles – Terraconsult, St Helens
Dr Phil Crowcroft – Environmental Resources Management (ERM), Manchester
Dr Lucy Perry – Environmental Resources Management (ERM), Manchester

Muir Housing:

Sam Scott
David Hull

Emmanuel Church, Leftwich:

Rev. Alistair Simms, Church Minister
Heidi Simms

Others:

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Alan Godfree – Principal Public Health Scientist, United Utilities
Keith Osborn – Chief Scientist, United Utilities
Ray Castle – Operations Duty Manager, United Utilities
Dr Chris Johnson, British Geological Survey
Members of the Committee on Carcinogenicity of Chemicals in Food, Consumer Products and the Environment (COC)
Members of the Soil Guideline Value (SGV) Task Force

10. Appendices:

A. Time line of girls' lives and investigation

B. Epidemiological results

C. "Assessment of exposures to soil contaminants at Muir Housing Estate, Leftwich, Cheshire." George Kowalczyk. 22 August 2007.

D. Leftwich: photos and maps of site

E. Review of GP records of long-term residents: "Health status of long term residents in a community with two linked cases of fatal childhood AML". Dr Alex Stewart, Dr Imran Choudhury, Dr Paul Cleary. August 2008.

F. Acknowledgment of work undertaken

TIME LINE
relating to AML cases in Leftwich, Northwich

Date	Event
1938	Old brickfield to SW of public space fully developed
1947	Site is green-field on aerial photograph
u/k	Northwich Urban District Council acquire land
1950s	Leftwich Estate developed to the south
Pre 1964	Ambulance Depot developed to NE, on green-field site
Pre 1964	Tipped land within and towards W & S of the public space, shown on old maps
1976	Tipping site "completed", Waste Authority Cheshire County Council letter 8/11/1994
1979-1980	Witness recalls incident of drums tipped on site prior to development (Source: Merseyside Regional Ambulance Service)
Feb 1987	"Design work on the site was terminated" VRBC internal memo (Tech/Rw/1/1/53/18/1/26) Doc. 1
1992	Muir Housing Association began to acquire site
1993	No tipping marked on local map
1994	Ambulance depot: ambulances originally petrol driven (one pump on site until early 90s); from 1994 only diesel run ambulances used.
1994	Planning application by Muir Group Housing Association Ltd submitted
1996	Certificates of Completion of Work issued by VR BC, with audit trail, including methane mitigation measures
8 Nov 94	Waste Authority Cheshire County Council advises in letter that records indicate the presence of a landfill site centred on GR SJ 661 723; "site was completed in 1976 & covered 7.5 acres"
11 Nov 94	Report (no. 7861) on ground investigation for Muir Group, prior to development, by Strata Surveys Ltd.
19 Nov 94	Site investigation sampling done by Strata Surveys Ltd
Feb 1995	Muir Housing finalise conveyancing of site
24 Jun 96	First residents move into houses
26 Sep 02	Case I born
10 Jul 03	Case II born
17 Nov 03	Case I moves with mother to Leftwich
10 Feb 04	Case I diagnosed with AML
26 Feb 04	Case I dies of AML (age 518 days or 1.4 years)
31 Jan 05	Case II diagnosed with AML
11 Feb 05	VRBC informs HPA of two cases; internal discussion begins
26 Feb 05	Case II dies of AML (age 597 days or 1.6 years)

8 Mar 05	1st Incident team Meeting
9 Mar 05	Letter to GPs in Northwich from PCT
11 Mar 05	Visit to ambulance station by VRBC; only known spill of fuel occurred in last year.
11 Mar 05	Press Release: "Experts look into possible causes for rare leukaemia cases" http://www.hpa.org.uk/webw/HPAweb&HPAwebStandard/HPAweb_C/1231836554238?p=1158945065175
15 Mar 05	Cheshire coroner informed by PCT
16 Mar 05	Northwich Guardian reports on death of two girls from leukaemia
22 Mar 05	2nd Incident Team Meeting
23 Mar 05	Northwich Guardian reports on possible third case
23 Mar 05	Coroner offers help to CC PCT
23 Mar 05	Press release: "Environmental Studies in Leftwich"
24 Mar 05	1st letter to residents of Muir Housing concerning situation and invitation to 1st residents' meeting
24 March 05	Deaths mentioned in House of Commons debate by Mike Hall (Department of Health; Weaver Vale, Labour). http://www.theyworkforyou.com/debates/?id=2005-03-24a.1037.0
30 Mar 05	2nd letter to residents, concerning start of environmental investigation on 4th April
30 Mar 05	Northwich Chronicle reports on cancer scare in local housing estate
30 Mar 05	Northwich Guardian reports on tipping under Muirfield Close
1 Apr 05	Press Release: "Meeting to inform and involve Residents"
6 Apr 05	1st Residents' Meeting
7 Apr 05	Press release: "Residents' meeting at Pillar of Salt, Northwich" http://www.hpa.org.uk/webw/HPAweb&HPAwebStandard/HPAweb_C/1231836556048?p=1158945065175
10 Apr 05	Sunday People reports on toxic link to cancer tot deaths
13 Apr 05	3rd Incident Team Meeting
18 Apr 05	Press release: "Strata Surveys Report"
April 05	Environmental sampling undertaken: ❖ Background gamma radiation ❖ Indoor Gas Tests ❖ ROTAS review of soils ❖ Electromagnetic radiation ❖ Radio frequency radiation ❖ Radon
09 May 05	4th Incident Team meeting
13 May 05	4th letter to residents, progress report
17 May 05	Press release: "Update on current investigations in Leftwich Leukaemia cases" – leukaemia rates, flammable gas, radiation nearby, solvent smell
23 May 05	Residents' Meeting

24 May 05	5th Letter to residents, concerning terms of reference for residents' meetings
End May 05	Information leaflet for residents on contaminated land distributed
May 05	Environmental monitoring: ❖ Further indoor gas tests
15 Jun 05	Letter to residents
20 Jun 05	Residents' Meeting – environmental consultants (RSK ENSR) approved
27 Jun 05	Press release: "Consultants Appointed to undertake land investigation"
18 Jul 05	Letter to residents
21 Jul 05	Confirmation from a former district council engineer that waste from the Town Centre (1965) redevelopment, including the gas works demolition, was dumped at Leftwich.
02 Aug 05	Environmental investigation started by RSK ENSR
12 Aug 05	8th letter to residents, update on environmental monitoring, particularly air sampling
Aug 05	Environmental monitoring: ❖ Probeholes ❖ Indoor Air Monitoring ❖ Cavity Monitoring ❖ Outdoor Air Monitoring ❖ Near Surface Soils - BAP slightly elevated; chloripherous slightly elevated. ❖ Borehole Soils ❖ Groundwater ❖ Radioactivity Survey ❖ Soil Gas
05 Sep 05	Residents' Meeting
12 Sep 05	Letter to residents with minutes of meeting of 5th Sept 05
22 Sep 05	Letter to residents
28 Sep 05	Letter to residents
Sep 05	Environmental monitoring: ❖ Soil gas – elevated benzene and methane ❖ Near surface gas – elevated benzene ❖ Cavity monitoring ❖ Outdoor air monitoring ❖ Indoor air monitoring
03 Oct 05	Residents' Meeting
06 Oct 05	Benzene noted in borehole
6 Oct 05	Press release: "Environmental Consultants share initial findings"
11 Oct 05	5th Incident Team meeting
12 Oct 05	Press release.
	John and Lynda Watts interviewed by BBC GMR radio
18 Oct 05	Reactive press statement released due to extra sampling being undertaken
20 Oct 05	Dr Alex Stewart interviewed by BBC GMR radio

24 Oct 05	Decision to offer relocation to affected families on humanitarian grounds
24 Oct 05	Press release: "Results Update" – nothing in water or household air
27 Oct 05	Dr Alex Stewart interviewed live with John Watts on phone link on BBC GMR radio 8am. Dr Alex Stewart interviewed live on NW Tonight at 6:30pm
27 Oct 05	BBC website carries AML story, subsequently removed due to inaccurate statement but later found in BBC archive at http://news.bbc.co.uk/1/hi/england/manchester/4381086.stm "Child death homes on 'toxic' land"
28 Oct 05	Press release: benzene found. Hugh Lamont gives telephone interview to Northwich Chronicle
28 Oct 05	" 'Cancer' estate deemed safe" – Manchester Evening News 28/10/05. http://www.manchestereveningnews.co.uk/news/s/179/179694_cancer_estate_deemed_safe_.html
Oct 05	Environmental monitoring: ❖ Cavity monitoring ❖ Outdoor air monitoring ❖ Indoor air monitoring
2 Nov 05	"Cancer death families await move decision"- Northwich Chronicle 02/11/05. http://fadetheblog2.blogspot.com/2005_11_01_archive.html & http://iccheshireonline.icnetwork.co.uk/0100news/0100regionalnews/tm_objectid=16322076%26method=full%26siteid=50020%26headline=cancer-death-families-await-move-decision--name_page.html
3 Nov 05	Letter to residents with updates prior to meeting on 7th November 2005
7 Nov 05	Residents' Meeting
7 Nov 05	Press release: "Further testing in progress"
11 Nov 05	Possible third case identified and seen by medical consultant – not AML but related condition; family wants no publicity
29 Nov 05	6th Incident Team meeting
Nov 05	Environmental monitoring: ❖ Soil gas ❖ Void monitoring ❖ Cavity monitoring ❖ Outdoor air monitoring ❖ Indoor air monitoring ❖ Spike tests - some elevated volatile organic compounds ❖ Service monitoring – slightly elevated levels ❖ Near surface gas ❖ Drinking water monitoring
05 Dec 05	Letter to residents
08 Dec 05	Incident Team Environmental Subgroup meeting
09 Dec 05	Gas membranes fail tests
12 Dec 05	BBC website has further news

12 Dec 05	Residents' Meeting, explaining SGVs
13 Dec 05	Press release: "'No stone will go unturned' in environmental investigation"
21 Dec 05	Letter to residents
21 Dec 05	Offer of pastoral support to community from Emmanuel Church staff
Dec 05	Environmental monitoring: ❖ Gas membrane tests – flaws identified throughout 1-3 Muirfield ❖ Void monitoring ❖ Cavity monitoring ❖ Outdoor air monitoring ❖ Indoor air monitoring ❖ Drinking water monitoring
03 Jan 06	Confirmation that contamination in land is man-made, from petrol-type and other sources such as diesel fall out
09 Jan 06	7th Incident Team meeting
31 Jan 06	Letter to residents
Jan 06	Environmental monitoring: ❖ Probeholes ❖ Void monitoring ❖ Drinking water monitoring
Feb 06	Letter from Vale Royal Borough Council to HPA for clarification around Part 2A Environment Act
03 Feb 06	Muir press release concerning remediation of houses
06 Feb 06	Informed that possible third case has died – family wants no publicity
06 Feb 06	Residents' Meeting: health and environmental update and discussion
07 Feb 06	Letter to residents
07 Feb 06	Letter from Vale Royal Borough Council to Soil Guideline Taskforce for clarification around Part 2A Environment Act
09 Feb 06	Press release
10 Feb 06	Merseyside & Cheshire Cancer Registry confirms that no resident child from the estate has been diagnosed with a cancer in the Merseyside and Cheshire region other than the two girls.
14 Feb 06	Confirmation from Childhood Cancer Research Group (national register) of no further cases of childhood cancer of any kind in residents under 15 years of age up to 2004.
17 Feb 06	Response from SGV Task Force
22 Feb 06	Letter to residents
Feb 06	Environmental monitoring: ❖ Indoor CH4 alarms & logging equipment installed ❖ Drinking water monitoring ❖ Air monitoring
2 Mar 06	Manchester Cancer Registry confirms that no resident child from the estate has been diagnosed with a cancer in the Manchester region.

06 Mar 06	Residents' Meeting, including limited information on possible third case; gas alarms in 10 properties with others being fitted; cancer registry findings discussed.
07 Mar 06	Press release: "Leftwich investigation: latest information". http://www.hpa.org.uk/webw/HPAweb&HPAwebStandard/HPAweb_C/1231836555960?p=1158945065175
08 Mar 06	Manchester Evening News item on AML investigation
08 Mar 06	8th Incident Team meeting
23 Mar 06	Hint of possible seasonal fluctuation in diagnostic dates of childhood AML in Alder Hey data
28 Mar 06	Letter to residents
Mar 06	Environmental monitoring: ❖ Drinking water monitoring ❖ Air monitoring
10 Apr 06	Residents' meeting; all gas alarms fitted; update on health reviews.
13 Apr 06	Press release: "April residents meeting in Leftwich"
Mar-Apr 06	Correspondence with various internationally renowned toxicologists concerning a chemical cause to AML, to little effect
Apr 06	Environmental monitoring: ❖ Air monitoring
11 May 06	9th Incident Team meeting
16 May 06	Letter to residents
22 May 06	Residents' meeting: updates on environmental and health investigations; all houses have failed gas membrane checks.
24 May 06	Muir Housing press release
25 May 06	All children who moved away from Muir housing finally identified
May 06	Environmental monitoring: ❖ Air monitoring
16 Jun 06	Letter to residents
26 Jun 06	Residents' meeting: ground gas methane levels elevated significantly. Work on new membrane in 3 Muirfield completed. Other properties to be started. Excavation of gardens to depth of 4m of 1 and 3 Muirfield and 7 and 9 Greenlaw to start within a week.
26 Jun 06	Report from United Utilities on the potential for chemicals to pass into plastic pipes such as supply Muir housing.
Jun 06	Local GP records – no other child with relevant disorder
30 Jun 06	Merseyside and Cheshire Cancer Registry confirm no other cases of childhood cancer in children who were previously resident in Muir housing estate.
30 Jun 06	Childhood Cancer Research Group (national database) confirms no other cases of childhood cancer in children who were previously resident in Muir housing estate.
Jun 06	Environmental monitoring: ❖ Air monitoring

28 Jul 06	Gas report confirms the need not only for the building works (new membranes/ventilation etc) but also for the garden excavations that are taking place between 1,2,3 Muirfield and 7,8,9 Greenlaw
Jul 96	Environmental monitoring: ❖ Air monitoring
03 Aug 06	Letter to residents
06 Aug 06	RSK ENSR - Technical Executive Summary and RSK ENSR - Plain English Non-Technical Summary delivered to residents and incident team members.
14 Aug 06	Press release: "August residents' meeting in Leftwich"
17 Aug 06	10th Incident Team meeting
04 Sep 06	Muir housing estate determined as contaminated under Part2A of the Environmental Protection Act 2000.
11 Nov 06	11th Incident Team meeting
04 Sep 06	Press release: "Land determined as contaminated"
16 Jan 07	RSK-ENSR "AML Leftwich - Factual Environmental Report (Sample Results etc)" distributed to residents.
22 Jan 07	Letter to residents
24 Jan 07	Letter to residents
24 Jan 07	RSK-ENSR "AML Leftwich - Factual Environmental Report (Sample Results etc)" available electronically to incident team and other involved professionals.
06 Feb 07	Residents' meeting: RSK's report and site model presented. Remediation work at 1-3 Muirfield and 7-9 Greenlaw complete and the land reinstated. Houses tested showed no ingression of landfill gas over a two week period.
03 Mar 07	Workshop held by RSK for residents to discuss and review exposure criteria, conceptual model of site and a detailed Qualitative Risk Assessment process to aid RSK in their assessment of exposure risk to the two girls.
30 Apr 07	Residents' meeting: exposure summary presented by RSK. Discussion about the effect of mixtures.
01 May 07	Press release: "Report on land contamination in Leftwich estate will be completed by Mid May"
09 May 07	Report in Northwich Chronicle: "Ex-waste tip risk report due soon" http://iccheshireonline.icnetwork.co.uk/0100news/0100regionalnews/tm_headline=ex-waste-tip-risk-report-due-soon%26method=full%26objectid=19073437%26siteid=50020-name_page.html#story_continue
06 Jun 07	RSK Exposure Assessment draft report released.
16 Jul 07	Residents meeting: draft exposure report discussed; site remediation update.
17 Jul 07	Press release: "The Health Protection Agencies views on land contamination on a Leftwich estate will be known by late August"
17 Sep 07	Residents meeting: HPA summary of exposure discussed: "Summary of the health effects from soil chemicals at Muir Housing Estate, Leftwich, Cheshire".

18 Sep 07	Press briefing - Northwich Chronicle, Guardian, Manchester Evening News, BBC North West Tonight and Granada Reports invited. Press release: “Muir Housing residents are assured that their homes are safe” http://www.hpa.org.uk/webw/HPAweb&HPAwebStandard/HPAweb_C/1231836550620?p=1158945065175 Reported on BBC web site: “Toxic soil 'unlikely' cancer link” http://news.bbc.co.uk/1/hi/england/manchester/7000376.stm
Oct 07	Review of GP records of estate residents initiated.
21 Feb 08	Final Incident Team meeting.
Apr 08	John Watts’ presentation at a Brownfield Briefing risk seminar in London is very well received.
11 Aug 08	Letter to residents
29 Aug 08	Final residents’ meeting: GP review and Incident Team reports presented and discussed; residents comments noted and further comments promised
01 Sep 08	Letter to residents
06 Oct 08	Letter to residents
13 Oct 08	Silver award given at NW Public Health conference
2 Dec 08	Residents’ comments on Incident Team report received
21 Jan 09	John Watts, Rupert Adams and Alex Stewart joint presentation to the oncology staff in Alder Hey children’s hospital.
Aug 09	Final Incident Team report issued.

Appendix B

Epidemiological results

Table 1
Acute Myeloid Leukaemia & related diseases, 1997 – 2004, Northwich area

	In-patients	Deaths
Myeloid leukaemia	27	18
Other specific leukaemias	<5	<5
Non-specific leukaemias	11	<5
Other related cancers	<5	<5
Related refractory anaemias	65	12
TOTALS	108	34

Note: all of these are aged over 16 years.

Table 2
Telephone inquires from CW8 and CW9 to NHS Direct when girls were neighbours

Complaint	Average Calls Per Day	Maximum Calls in a Day
Cold/Flu	1.00	1
Cough	1.21	3
Diarrhoea	1.00	1
Difficulty breathing	1.00	1
Eye problems	1.00	1
Fever	1.55	6
Lumps	1.00	1
Rash	1.10	2
Vomiting	1.25	2

Note: of the six calls for fever, four were probably from the same individual.

Table 3
Calls to NHS Direct: CW8 & CW9 *vs* Manchester

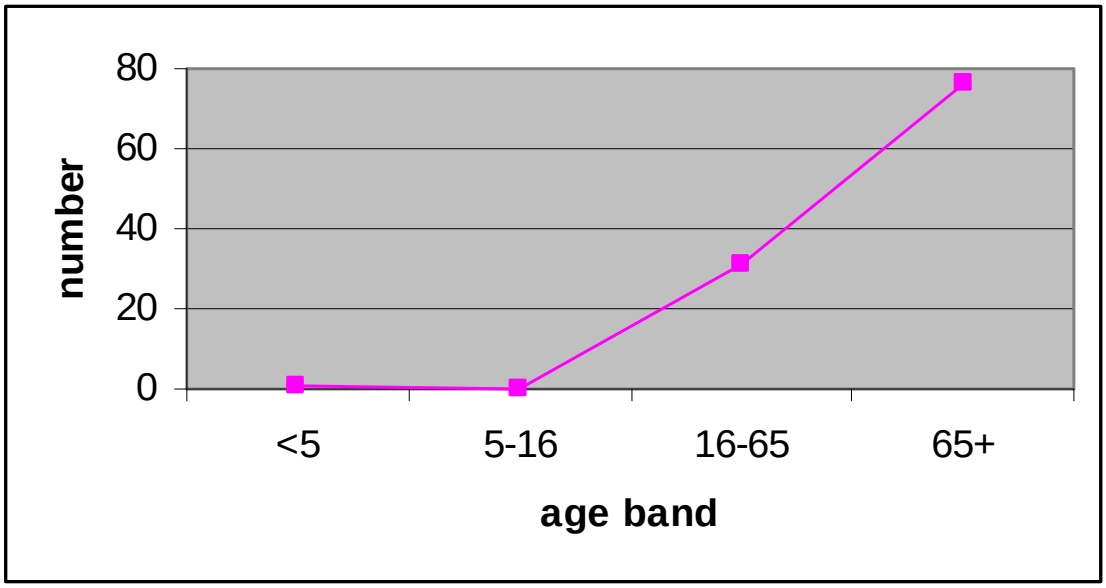
Analysis	Symptoms	Results
Monthly Pattern	Cough and fever	CW8 & CW9 = Manchester
	Diarrhoea and vomiting	CW8 & CW9 = Manchester
	Lumps, rash and cold / flu	CW8 & CW9 = Manchester
Percentage of calls	Diarrhoea and vomiting	CW8 & CW9 less than Manchester
	Lumps, rash and cold/flu	CW8 & CW9 less than Manchester
No analysis	Difficulty breathing and eye problems	[only collected from 2004]

Note: nothing outstanding in CW8&9

Appendix B

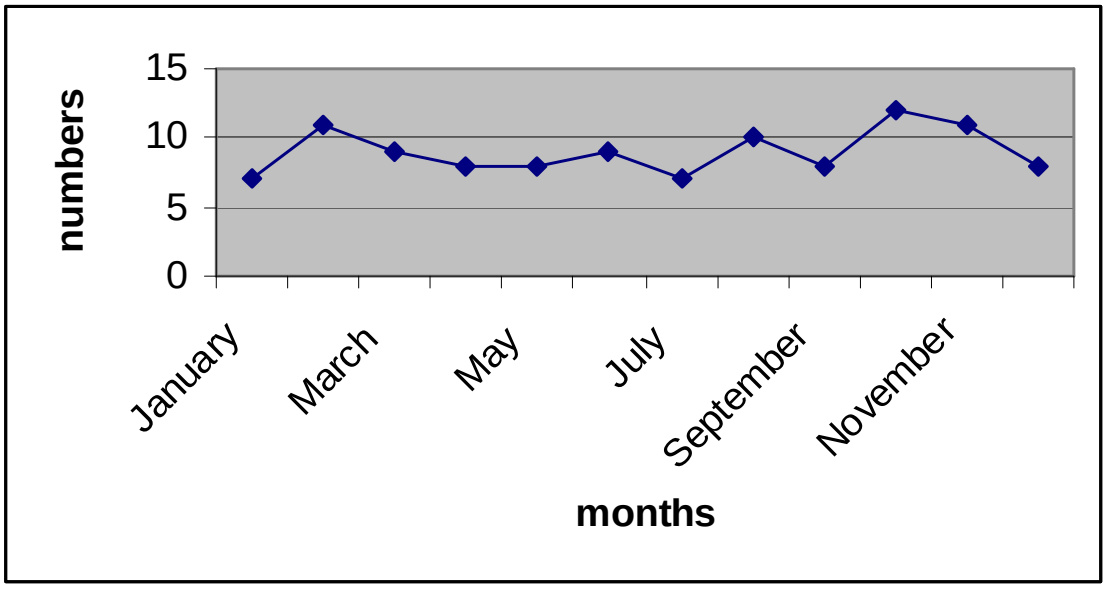
Epidemiological results

Figure 1
AML inpatients 1997 – 2004 by age band, Cheshire



Note: no other cases in children

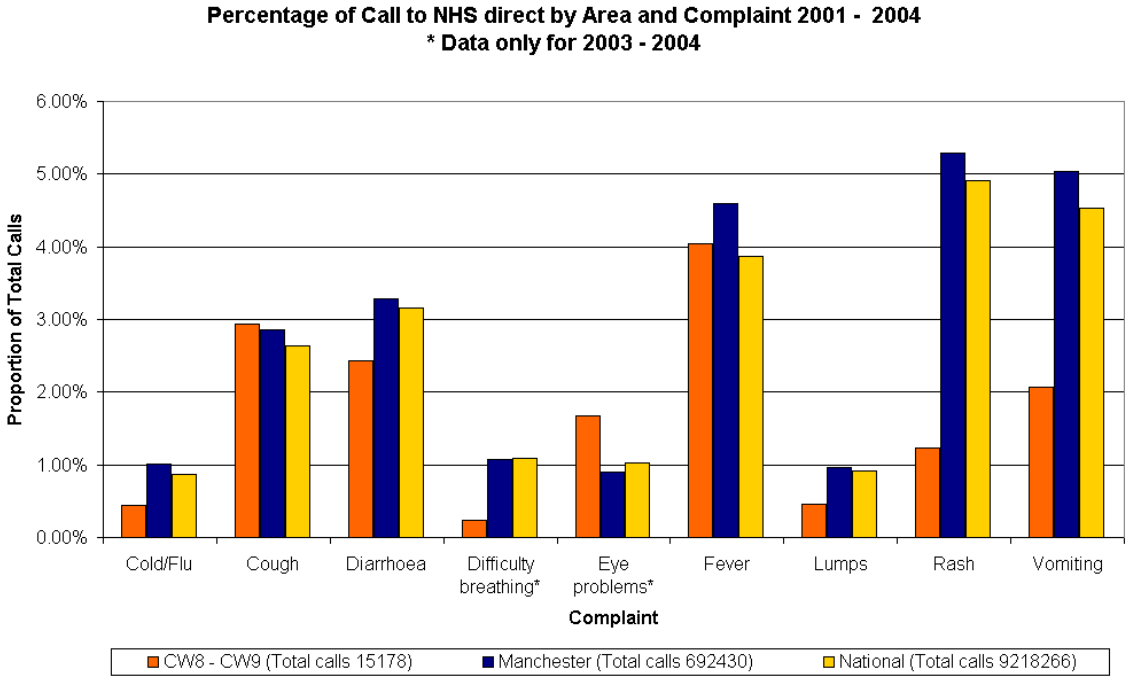
Figure 2
AML inpatients 1997 - 2004 by month of diagnosis, Cheshire



Appendix B

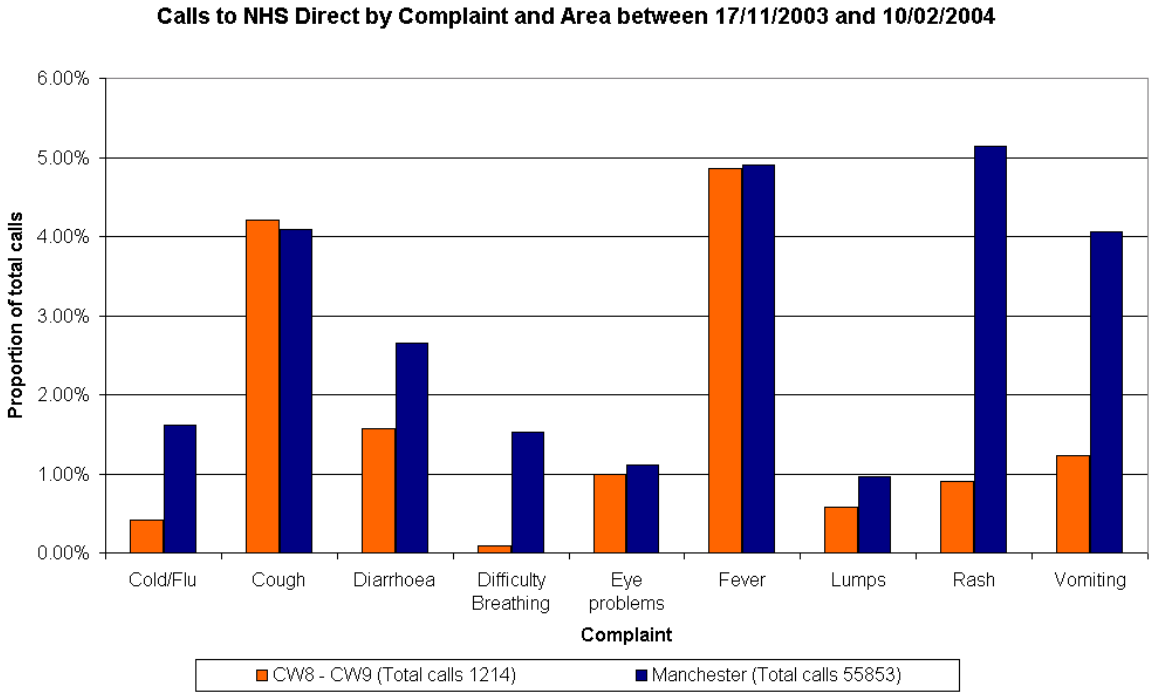
Epidemiological results

Figure 3



Note: Only eye problems higher in CW8 & CW9 [data for 2003-2004]

Figure 4

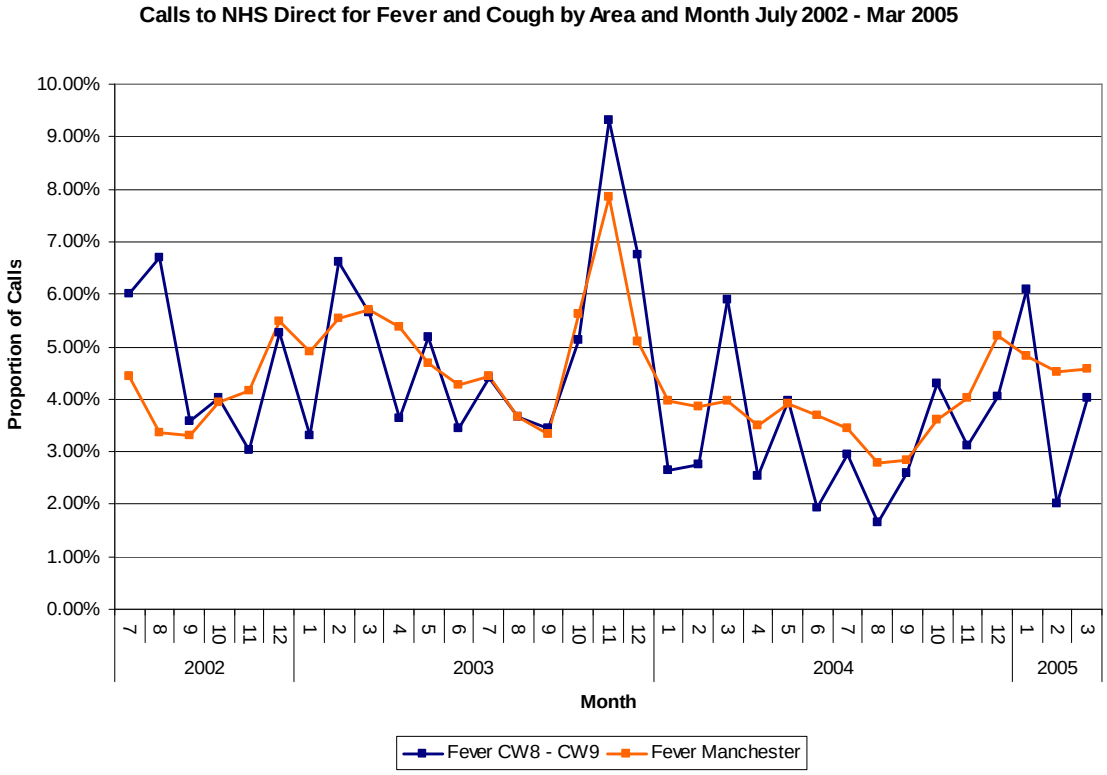


Note: There was no difference in type of percentage of calls to NHS Direct when the girls were living as neighbours [17/11/03 – 10/2/04].

Appendix B

Epidemiological results

Figure 5



Note: There were no differences in the pattern (time and percentage) of calls to NHS Direct from CW8&9 and Manchester overall; nor was there any difference in calls when the girls were living as neighbours [17/11/03 – 10/2/04].

Appendix B

Epidemiological results

Figure 6
Exposure of a one year old child by breathing
Ratios [exposure / health criteria values] of all substances

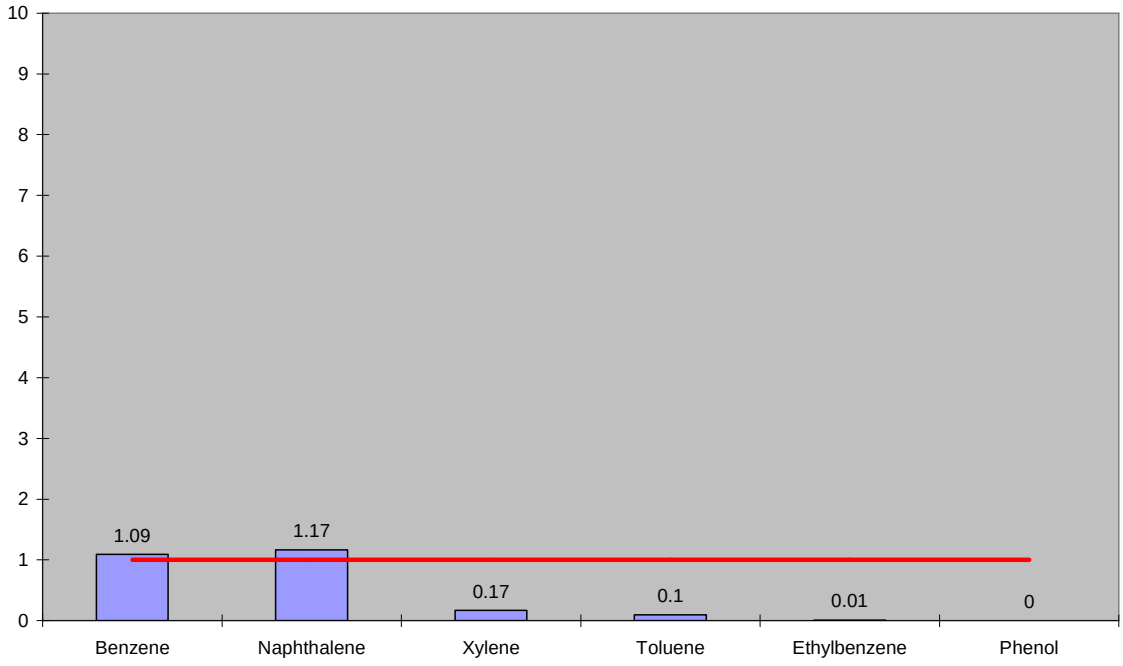
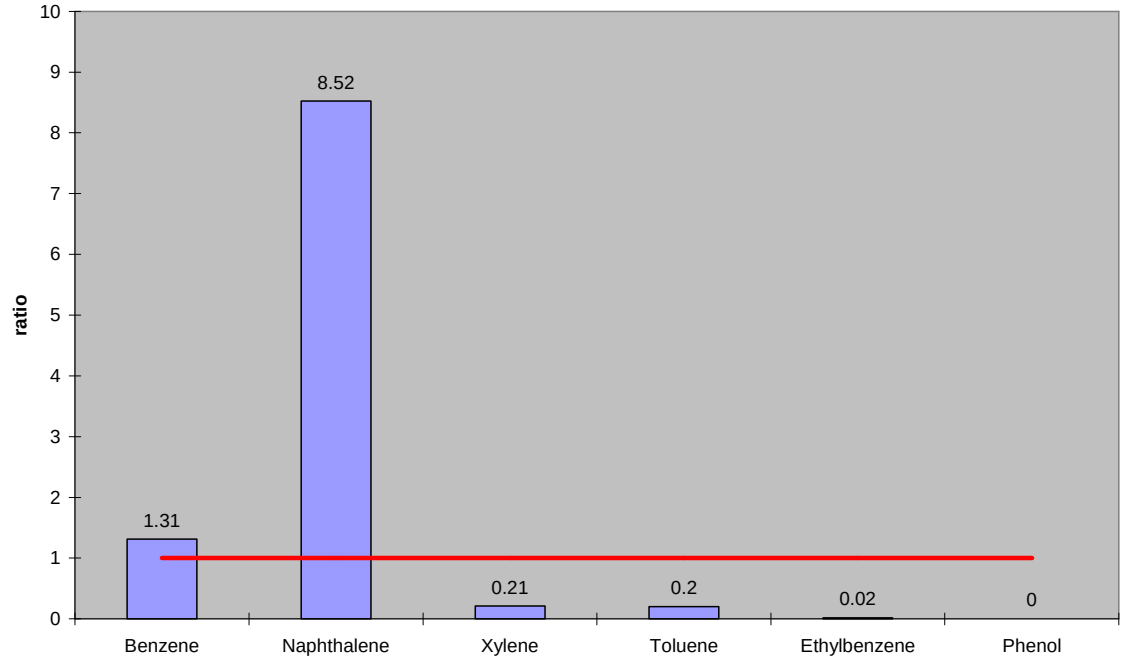


Figure 7
Exposure of an adult by breathing
Ratios [exposure / health criteria values] of all substances



Epidemiological results

Figure 8
Exposure of a one year old child through swallowing and skin contact
Ratios [exposure / health criteria values] of all substances

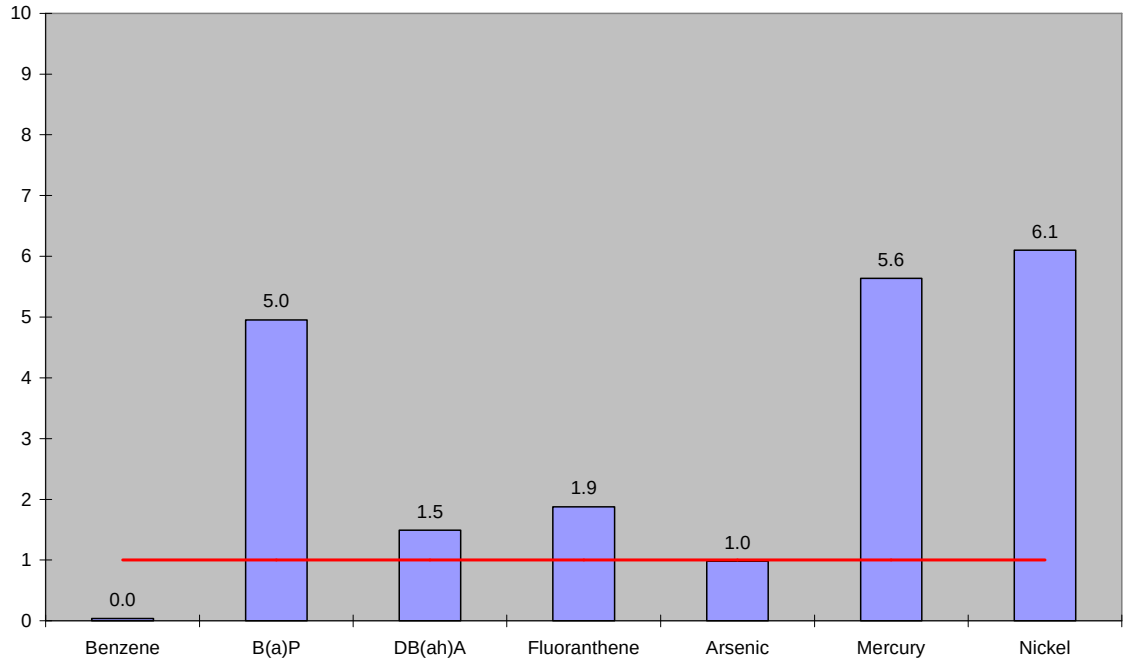
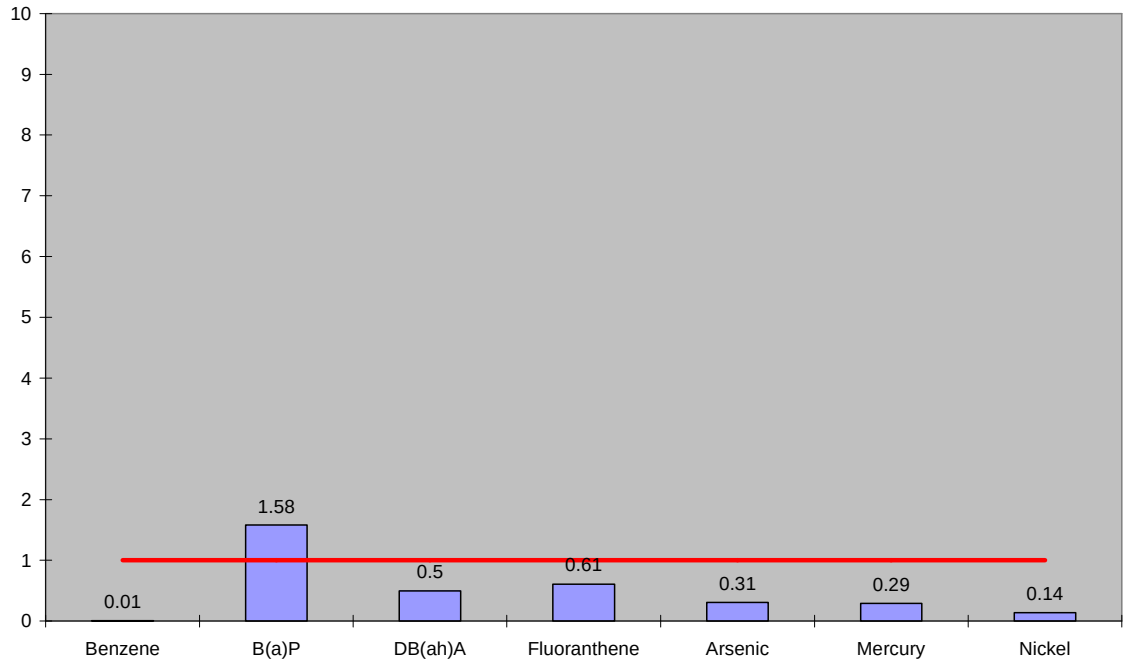


Figure 9
Exposure of an adult through swallowing and skin contact
Ratios [exposure / health criteria values] of all substances



ASSESSMENT OF EXPOSURES TO SOIL CONTAMINANTS AT MUIR HOUSING ESTATE, LEFTWICH, CHESHIRE

INTRODUCTION

Detailed site investigations have been conducted at the Muir Housing Estate at Leftwich and results have been presented in comprehensive reports by the consultants RSK Group PLC. The "Exposure Assessment Report" (Ref 10810-R03(00) dated June 2007) combines the site investigation data (soil and air sampling results) with information provided by Muir Housing Estate residents at a workshop held on March 3rd 2007 about local features of their exposures to soil contaminants. The residents' information has been used in the RSK report to calculate site-specific exposure doses for children (aged 1 year and 6 years) and for adults living at the site.

The Health Protection Agency has reviewed the exposure calculations in terms of potential implications for human health, in particular trying to ascertain whether there is anything unusual about the chemical exposures from soil contaminants, especially in early childhood. In doing so the Agency has also tried to address three important questions:

1. *Did early childhood exposure to soil contaminants have a role in the development of acute megakaryoblastic leukaemia (AML)?*

2. *Are there any health issues from soil contaminant for adults who have been living at housing estate for some time?*

3. *Are there any health issues from soil contaminant for families (children and adults) who may in future live at the housing estate?*

HOW THE HPA ASSESSMENT WAS CARRIED OUT

The RSK calculated possible exposures (expressed as doses in terms of microgrammes of soil contaminant taken in per kilogram of body weight, on average on each day i.e. μg/kg/day) were compared to a relevant Health Criteria Value (HCV) also expressed as μg/kg/day. HCVs were calculated for each contaminant and separate HCVs were defined for children and adults. Consideration was then given as follows

- where calculated exposures were below the HCV (ratio of exposure to HCV less than 1) there is no significant concern about health.
- where calculated exposures were above the HCV (ratio of exposure to HCV greater that 1) there may be a concern about health.

Where the HCV is exceeded, an important consideration is understanding that there is much uncertainty in calculating both exposures and the health criteria value. Consequently very imprecise estimates are made of both – exposures tend to reflect reasonable worse case situations, rather that what might be actually happening. Also, Health Criteria Values are loaded with safety factors so they err on the side of caution and may indeed be set be too low. Because of these uncertainties, HCVs are not a boundary between "safe" and "unsafe" levels of exposure - a small to moderate exceedance of the HCV does not automatically

indicate that health is being affected – this may just be reflection of the safety margins used and assumptions that have been made in the assessment.

Health Criteria Values are normally calculated for lifetime exposures to chemicals. They are usually a daily average value, covering both the exposures in childhood (which will tend to be higher than the average because children are exposed more) and in adulthood (when exposures will tend to be lower than the average). HCVs calculated by the HPA for 1year old children have been derived from lifetime HCVs adjusted to take account of the special exposure characteristics of children (e.g. different breathing rates, bodyweights etc).

Because the health effects of chemicals depends on whether they are breathed in, or taken in through the mouth or through the skin, separate assessments need to be made of "non inhalation" and "inhalation" exposures

A detailed description of the methods and approaches used by the HPA is provided in the Appendix to this report (page C - 9).

CONSIDERING THE KEY QUESTIONS

<u>Question 1:</u> Did early childhood exposure to soil contaminants have a role in the development of acute megakaryoblastic leukaemia (AML)?

Tables 1 and 2 below show how the calculated exposures from contaminants detected at the Muir Housing Estate for a during the lifetime of a 1 year old compare to a calculated HCV for a one year old child.

Non inhalation exposure

For the "non inhalation" exposures (that is through direct skin contact and uptake and from ingesting soil contaminants), results are shown in Table 1 below where some exceedances of the HCV are noted (shown in bold).

Table 1
NON INHALATION EXPOSURE – 1 YEAR OLD CHILD

Substance	µg/kg bw/day		
	TOTAL EXPOSURE	**Health Criteria Value**	**Ratio (exposure /HCV)**
Benzene	0.064	1.50	0.04
B(a)P	0.52	0.11	**4.95**
DB(ah)A	0.156	0.11	**1.49**
Fluoranthene	1.97	1.05	**1.88**
Arsenic	1.47	1.50	0.98
Mercury	1.24	0.22	**5.64**
Nickel	6.1	1.00	**6.10**

Early life exposures to **arsenic** and **benzene** are within the HCV and do not indicate a significant concern for health.

Exposures to **B(a)P, DB(ah)A** and **fluoranthene** exceed the HCV by upto five fold. While these exposures are moderately high, and indicate a risk above a Minimal Risk Level, it would require continued exposure over several years or decades at this higher exposure level before there were real health concerns. Exposures for one year in childhood in itself, while undesirable, do not on their own indicate that there is a significant health risk that would be evident in a one year old child. While the long term health effects from these types of chemicals are linked to cancer, the types of cancer are mainly those of the skin, lung and bladder – there is no evidence that these types of chemicals are linked to the development of leukaemias.

Regarding **mercury** and **nickel,** the calculated exposures indicate elevations above the health criteria values and indicate some cause for concern, particularly if this level of exposure was to continue for several years. The levels are however well below exposures that are known to be immediately poisonous in children and so there is some reassurance there. Of note is that calculated exposures of children to these substances is greater through the skin than through the ingestion route (see Appendix (page C – 9) for detail), which is difficult to understand, as the penetration of metal compounds through the skin is usually quite low. There may be, therefore, a serious overestimation of exposure because of that. Additionally, for the purposes of the exposure estimate, very generous estimates were used for soil ingestion and skin contamination so total calculated exposures are 2 – 4 times more than those which would have been calculated using conventional assessment assumptions. In the conventional case the excess risk would almost disappear.

While early life exposures indicate a possible concern from these two substances for young children, a longer term evaluation does not indicate that exposures from these substances would be sustained and that a long term risk to health does not appear to arise (see table 3 and discussion below).

The known toxic effects of inorganic mercury and nickel by skin and oral exposure do not include cancer and while the calculated exposures are relatively high there is no evidence to indicate that these substances are involved in the development of leukaemia.

Inhalation Exposure

The calculated exposures by the inhalation route, that is the combined exposures from an infant spending time being potentially exposed to soil contaminants in both an outdoor and indoor environment, are shown in Table 2 below. Exceedances of the HCVs are shown in bold.

There are minor exceedances of the HCV for benzene and for naphthalene. These are not considered to be significant and do not indicate a cause for concern.

Indeed, the HCV used for **benzene** is based on a value which is 5 times lower than the current air quality standard operating in the UK, so very young children all over the country are currently potentially exposed to levels of benzene in air much higher that the doses calculated for children at Leftwich. Likewise, RSK investigations of individual houses show relatively high indoor benzene levels in a few properties, most of which are within the proposed new outdoor air quality standard for benzene of 3.2 μg/m3, but all of them are within the current benzene standard of 16 μg/m3. For these reasons the benzene exposures in children are not considered to be unusual. The link between benzene and leukaemia is

limited to occupational exposure [in adults] at much higher levels over decades than found in Leftwich. It is also possible that AML in children is a different disease from AML in adults.

Table 2
INHALATION EXPOSURE – 1 YEAR OLD CHILD

Substance	µg/kg bw/day		
	TOTAL EXPOSURE	**Health Criteria Value**	**Ratio (exposure /HCV)**
Benzene	1.74	1.60	**1.09**
Naphthalene	1.75	1.50	**1.17**
Xylene	18.2	110.00	0.17
Toluene	19.1	200.00	0.10
Ethylbenzene	4.06	290.00	0.01
Phenol	1.52	345.00	<0.01

The health effects of **naphthalene** are well known in children where exposures from excessive use of mothballs has resulted in poisoning in susceptible infants. Potential exposures of children at Leftwich are several thousand times below these exposure levels and so there are no concerns about the small exceedance of the HCV. There is no evidence linking naphthalene to leukaemia in children.

Conclusions to Question 1

While some small concerns remain about the potential mercury and nickel exposures for young children living at the Muir Housing Estate, Leftwich, there is no evidence to identify these exposures or other exposures as a possible cause of AML. Other calculated exposures at the Housing estate are not considered unusual or of significant heath concern for children upto one year of age. Overall the evaluation of early childhood exposures to various soil contaminants at Leftwich does not identify any unusual exposures which could be linked to the development of AML in young children.

However the causes of AML in children are in the most part unknown, but a chemical exposure role in the development of AML in young children has not been identified.

<u>Question 2</u>: Are there any health issues from soil contaminant for adults who have been living at housing estate for some time?

To address this concern we compared calculated exposure for adults with an adult HCV and again separate assessment were carried out for “non inhalation” and “inhalation” routes of exposure. Results are shown in tables 3 and 4

Non Inhalation exposure

As can be seen for adults from Table 3 below, the only exposure that is identified as a possible health concern is that from BaP exposure, where a small exceedance of the HCV is noted.

Table 3
NON INHALATION EXPOSURE – ADULT

Substance	µg/kg bw/day TOTAL EXPOSURE	Health Criteria Value	Ratio (exposure /HCV)
Benzene	0.0039	0.29	0.01
B(a)P	0.0315	0.02	**1.58**
DB(ah)A	0.0099	0.02	0.50
Fluoranthene	0.122	0.20	0.61
Arsenic	0.089	0.29	0.31
Mercury	0.075	0.26	0.29
Nickel	0.037	2.70	0.14

The health criteria value for adults for **B(a)P** is based on a minimal risk level and the small exceedance does not indicate significant health concern considering the large assumptions made in the exposure and health criteria evaluations. It does indicate that some action should be taken to minimise these potential exposures to ensure that they are as low as reasonably practicable and a simple way would be to remind residents of simple hygiene precautions (such as washing hands after gardening activities, etc).

It should be noted however that there is everyday exposure to B(a)P from roadside vehicle exhaust emissions, cigarette smoke (active and passive), barbecued foods, and drinking water is of the same order as could possibly be experienced from living close to contaminated soil. In this context, the exposures from B(a)P and other soil contaminants are not considered to be of any concern to residents who have lived at the Housing Estate for several years.

It is worthwhile noting that in longer term, potential exposures to **mercury** and **nickel,** which were undesirably high for very young children (table 2), are not of concern for adults.

Inhalation exposure

Table 4 below identifies shows the excedances of the HCVs for adults for both benzene and naphthalene.

For **benzene,** a small exceedance of the HCV is recorded for adult exposures but as has been discussed above the HCV is based on a value 5 times lower than the current air quality standard. For this reason, and the fact that all measured indoor levels were below the current air quality standard for benzene, and given other everyday environmental exposures to benzene, these exposures are not considered to present a health concern.

For **naphthalene** the calculations indicate that long term exposures could be significantly over the HCV. The calculated values are however most part due to a high calculated outdoor exposure which may not reflective of true outdoor exposure, as at this exposure level the concentration of naphthalene in air could possibly be detectable by smell (it has a distinctive smell of mothballs). In the absence of evidence of noticeable odours it is possible that the outdoor naphthalene exposures (and so the total adult exposure) have been significantly overestimated. Actual results from individual houses confirm this to be so – all recorded outdoor values indicate exposures are less than half of the generic assessment criterion (GAC) of 3 $\mu g/m^3$ which indicates personal exposure would be half of the HCV.

Nevertheless the levels measured indoors indicate some concern (several are above the GAC of 3 $\mu g/m^3$) and so warrant action to minimise this exposure. However, both the calculated and observed levels are still thousands of times lower that levels which have shown definite health effects in particularly susceptible individuals, and so do not indicate that that a significant impact on health is likely.

Table 4
INHALATION EXPOSURE – ADULT

Substance	µg/kg bw/day		
	TOTAL EXPOSURE	**Health Criteria Value**	**Ratio (exposure /HCV)**
Benzene	1.2	0.91	**1.31**
Naphthalene	7.3	0.86	**8.52**
Xylene	13	61.00	0.21
Toluene	14.2	72.00	0.20
Ethylbenzene	2.9	170.00	0.02
Phenol	1	690.00	<0.01

Conclusions to Question 2

For adults who have lived on the housing estate for several years, calculated exposures do not indicate that there are significant health concerns arising from the chemical contaminants found in the soil. Two contaminants, B(a)P and naphthalene, could have produced higher than desirable exposures, but these exposures are unlikely to be sufficient to cause direct or detectable health effects. Nevertheless some attention is required to reduce their potential for human exposure.

Question 3: Are there any health issues from soil contaminants for families (children and adults) who may in future live at the housing estate?

While assessment of historic exposures to children and adults revealed no significant concerns that health was being affected, some subsequent remedial work at the Housing estate, e.g. the reinstatement of an effective vapour intrusion membrane and removal of some contaminated soils, has meant that potential exposures from any remaining soil contaminants will be even lower than the historic exposures. Consequently, in terms of potential chemical exposures there is no significant risk to the health of future residents, be they infants children or adults, from living at the Muir Housing estate in Leftwich.

A SHORT DISCUSSION ON AML AND WHAT IS KNOWN OF ITS CAUSES

If chemical exposures from soil contaminants at the sites were not sufficient to be considered a contributory cause to acute megakaryoblastic leukaemia what other causes could there be?

This is a difficult question to answer as our understanding of the origins and causes of leukaemias in general, and acute megakaryoblastic leukaemia in particular, is very poor. To gauge the current understanding of these issues it is worthwhile reviewing key points from some recent published opinions on this topic.

Risk Factors for Acute Leukaemia in Children: A Review
M Belson et al (2007)

- leukaemia is the most common type of childhood cancer (30% of all cancers)
- Acute lymphoblastic leukaemia is five times common than acute myelogenous leukaemia [acute megakaryoblastic leukaemia is a sub-type of this latter]
- Only one environmental risk factor, ionising radiation (e.g. X –rays), has been significantly linked to childhood acute lymphoblastic leukaemia or acute myelogenous leukaemia
- Several risks factors have been investigated – chemical ones are exposures to hydrocarbons, pesticides, alcohol use, and cigarette smoking – but without clear evidence of a role

Committee on Carcinogenicity
Statements on childhood leukaemia and related topics (2005 –2007)

- Insufficient evidence of a link of childhood leukaemia (mainly acute lymphoblastic leukaemia) and living close to petrol stations, garages and road traffic (COC 2005).
- Further studies warranted, though, to distinguish between exposure to traffic fumes and petrol vapours and on leukaemia subtypes (COC 2005).

COMARE Eleventh report (2006)

- Causes of the vast majority of cancers unknown including acute lymphoblastic leukaemia
- There is an increased risk of acute lymphoblastic leukaemia in children with Down's syndrome
- Three main theories of causes of acute lymphoblastic leukaemia are a) population mixing b) involvement of infectious agents and c) immature immune system from lack of exposure to infectious agents in first year of life
- Childhood cancers have been shown to occur in a non-random fashion – there is a tendency for them to cluster. Reasons for this unknown
- Development of childhood cancer is a multi-step process – the COMARE study supports an infective process (including immature immune competence) being associated with one of the steps

Conclusions from published review papers in respect of AML

While leukaemia is the commonest childhood cancer, AML is only a small percentage of this. Childhood cancers tend to be found in clusters, which may be due to the effect of infections. The only environmental factor to have been shown to be linked to childhood leukaemia is ionising radiation. Otherwise, the causes are largely unknown.

OVERALL REPORT CONCLUSIONS

The investigations of the ground [soil, soil gas and soil water] and the air above the ground and in the houses in the Muir Housing Estate in Leftwich have shown a few exceedences of the site-specific Health Criteria Values for the following chemicals:

- B(a)P, DB(ah)A, fluoranthene, mercury, nickel for 1 year old children by oral and dermal exposure routes
- Benzene and naphthalene for 1 year old children by inhalation

- B(a)P for adults by oral and dermal exposure routes
- Benzene and naphthalene for adults by inhalation

It is possible that the site-specific exposure calculated for the Estate for the oral and dermal exposures is too conservative; if this is so, then there is no exceedance of the Health Criteria Values for B(a)P, DB(ah)A, fluoranthene. The mercury and nickel exposures would remain a slight concern but these pollutants are not a cause of acute megakaryoblastic leukaemia. Any health effects of mercury and nickel at the levels found would take many years, at these exposure levels, to produce significant health effects.

The health risk falls for children over 1 year of age who continue to live on the site. This is because children grow and become less vulnerable to the levels of contaminants on the site.

There are no significant health risks to adults living on the site. The contaminant exposures that are raised are only marginally so.

The remediation undertaken on the site already, e.g. the replacement of the gas-tight membranes in the houses and the removal of some contaminated soil, will have a major impact on the levels of contaminants that long-term residents are exposed to.

- There is no reason to believe that the chemical contamination of the soil of the Estate has caused the leukaemias that started this investigation.
- Nor is there any reason to believe that the health of other residents has been adversely affected by the contamination found.
- There is every reason to believe that the remediation undertaken is making a vital improvement to the Estate and will render the Estate safe to live in for everyone, both young and old.

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APPENDIX TO ASSESSMENT REPORT

CALCULATIONS OF HEALTH CRITERIA VALUES (HCVs)

For the assessment of the significance of exposures to soil contaminants calculated in the RSK report, comparison was made with specially derived heath criteria values using assumptions and toxicological information as outlined in this appendix.

1. HCV FOR A ONE-YEAR OLD CHILD

Health criteria values (HCVs) for a 1 year old child were calculated separately for non-inhation (i.e. combined oral and dermal) and inhalation exposure pathways.

1.1 Non Inhalation HCV calculations

a) Non threshold substances

For non-threshold substances (i.e. such as polycyclic aromatic hydrocarbons,PAHs) the HCV was calculated using the procedure established for setting Index Doses in the Defra TOX series of reports.
The process assumes that the dose from exposure at the drinking water standard (expressed in µg/litre) represents a minimal risk and that the same dose from soil contaminants, similarly, represents a minimal risk; this dose is the HCV.

To arrive at HCV representing this minimal risk level, the drinking water standard (DWS) is multiplied by the water consumed per day (litres/d) and divided by an appropriate body weight (kg) to arrive at the HCV is expressed in µg/kg body weight. WHO default assumptions for drinking water intake are normally used in calculating the HCV (WHO 2002)

WHO assumptions for a 1 year old child are

- Water consumption : 0.75 litres per day
- Body weight : 5kg

Example
Calculation for Benzene (UK drinking water standard 10mcg/litre)

HCV = DWS x Water consumption / Bodyweight
HCV = 10 (µg/l) x 0.75 (litres/day) / 5 (kg)
HCV = 1.5 µg/kg bw/day

b) Threshold substances

For threshold substances, HCVs specifically for children have been calculated for many soil contaminants, which take into account the background intake the relevant contaminant. These values are known as TDSIs (Child) and have been calculated in various Defra TOX

series reports for childrens exposure during the ages 0-6. In the absence of a specific TDSI for children aged 1, these TDSI values have been used as the HCVs for 1 year old children

1.2 Inhalation HCV calculations

a) Non- threshold substances

For non threshold substances (i.e. such as benzene) the HCV was calculated, following the procedure established for setting Inhalation Index Doses. This assumes that the allowable exposure at the air quality standard (expressed in µg/m3 air represents minimal risk and that the same level of exposure from soil contaminants arising in air similarly represents a minimal risk.

For a year old child the HCV is the dose received by one year old child (expressed in µg/kg/day) breathing in air containing the relevant substance at the air quality standard. The inhalation rate for a one year old child has bee taken from standard active and passive breathing rate values in Defra report CLR 10 (Table 5.9) adjusted for a body weight of 5kg (using equation 5.6 in the same report). It is assumed that an equal time is spent inhaling passively and actively. A composite respiration volume (RV) for a 5 kg child of 2.5 m3 air /day is calculated (equation 5.7)

Calculation of RV (CLR 10 table 5.9 and equations 5.6 and 5.7).

Active hourly respiration rate (RRact) = 0.03 x 5kg = 0.15m3/hr
Passive hourly respiration rate (RRpass) = 0.011 x 5kg = 0.055m3/hr

Daily respiration Volume (RV) = (RRact x 12 hours) + (RRpass x 12hours) m3/day

RV = 1.8 + 6.6 m3/d = 2.46 m3/d (rounded to **2.5m3/d)**

To arrive at a HCV representing this minimal risk level, the air quality standard (AQS) is multiplied by the daily respiration volume (m3/d) and divided by an appropriate body weight (kg) to arrive at the HCV (expressed in µg/kg body weight)>

Example calculation for benzene
(based on future Air Quality Standard 3.2 µg/m3)

HCV = AQS (µg/m3) x RV (m3/d) / bodyweight (kg)

HCV = 3.2 x 2.5/5 = 1.6 µg/kg/d

b) Threshold substances

For threshold substances, inhalation HCVs, specifically for children have been calculated for many soil contaminants and these also take into account background intake of the relevant contaminant. These values are known as TDSIs (child) and have been calculated in various Defra TOX series reports for childrens exposure during the ages 0-6. In the absence of a specific TDSI for children aged 1, these TDSI values have been used as the HCVs for 1 year old children.

2. HCVs FOR AN ADULT

HCVs for Adults have been taken directly from Defra TOX series reports where available. Values have been derived for DB(ah)A and Fluoranthene (see 3.2 below)

3. SUBSTANCE SPECIFIC CONSIDERATIONS

Some additional explanation of the derivaton of HCVs for some chemicals encountered in the soils at Leftwich are provided below.

3.1 Benzene Inhalation HCV

The HCV is based on the most stringent identified standard in the UK for Benzene in the UK which is a value of 3.2 μg/m3 (running annual mean) which is a **future** air quality objective to be achieved by 2010 in Scotland and Ireland and is assumed to be in line with a 10-5 excess lifetime cancer risk. (nb the standard for England and Wales from 2010 will be 5 μg/m3). The current standard operating in the UK is 16.25mcg/m3 which is 5 times higher – and if the HCV was based on current standards it would be 5 times higher than the value used in the report.

3.2 Oral HCVs for DB(ah)A and Fluoranthene

Assumptions are made in line with international convention that DB(ah)A has the same carcinogenic potency as B(a)P while Fluoranthene is 10 times less potent. Hence the drinking water values for DB(a)A and Fluoranthene used in the calculations are 0.7 μg/litre and 7mcg/litre respectively in line with these potency weightings.

3.3 Phenol Inhalation TDSI

For phenol these is no published inhalation TDSI so the oral TDSI published in the TOX reports has been used instead.

3.4 Naphthalene Inhalation TDSI

The very low inhalation TDSI is published in TOX 20 but is regarded as being a very conservative value (it is derived form a reference concentration of 0.6ppb). Much higher health protection values have been used by regulatory authorities elsewhere as shown in table1 below.

Table 1 CONCENTRATION PROFILE FOR NAPHTHALENE IN AIR

Conc ppb	Species	Duration	Effect	Comments
15,000	Human	15 minutes	Eye and respiratory irritation	Former HSE STEL – now withdrawn
10,000	Mouse	6hr/d, 5d/wk 2 years	Chronic nasal and lung inflammation	LOAEL in key study chosen by USEPA
1,800	Mouse	Continuous	As above	Equivalent continuous value from mouse LOAEL
960	Rat	6hr/d, 5d/wk 4weeks	Mild olfactory irritation (5mg/m3)	Study not quoted in IRIS evaluation – noted in CTSEE 2003 review
154	Humans	Continuous	Levels in homes after high mothball usage	Data in CTSEE review
100	Human	Continuous 1year average	EAL IPPC H1 Guidance value	Derived from now withdrawn HSE long term OEL of 10ppm divided by 100
84	Human		Odour threshold	Lower values have also been reported
24	Human	8 hour	AALG – USA	
20	Human	Continuous – unknown	Several symptoms including anaemia – disappeared when mothballs removed from home.	1983 CDC report. Naphthalene concentrations likely to have been higher than this
6	Human	24 hr average	Maximum allowable concentration for humans	Propose 24 hr max in Sampling strategy for Cadishead site
0.6	Human	Continuous	No effect level for humans	Derived from RfC of 3 µg/m3 - quoted in TOX20
0.2			Ambient urban levels	EPA review

GK 22 Aug 07

Appendix D
Leftwich - Photos and maps of the site of the AML investigation

Figure 1 – The site (in red) and surrounding area during the investigation

Appendix D
Leftwich - Photos and maps of the site of the AML investigation

Figure 2 – The site (in red) during the investigation

Appendix D
Leftwich - Photos and maps of the site of the AML investigation

Figure 3 – The site (in red) in 1947, showing the ambulance depot (4/869), ‘tip’ (4/752) and brickfield (4/209).

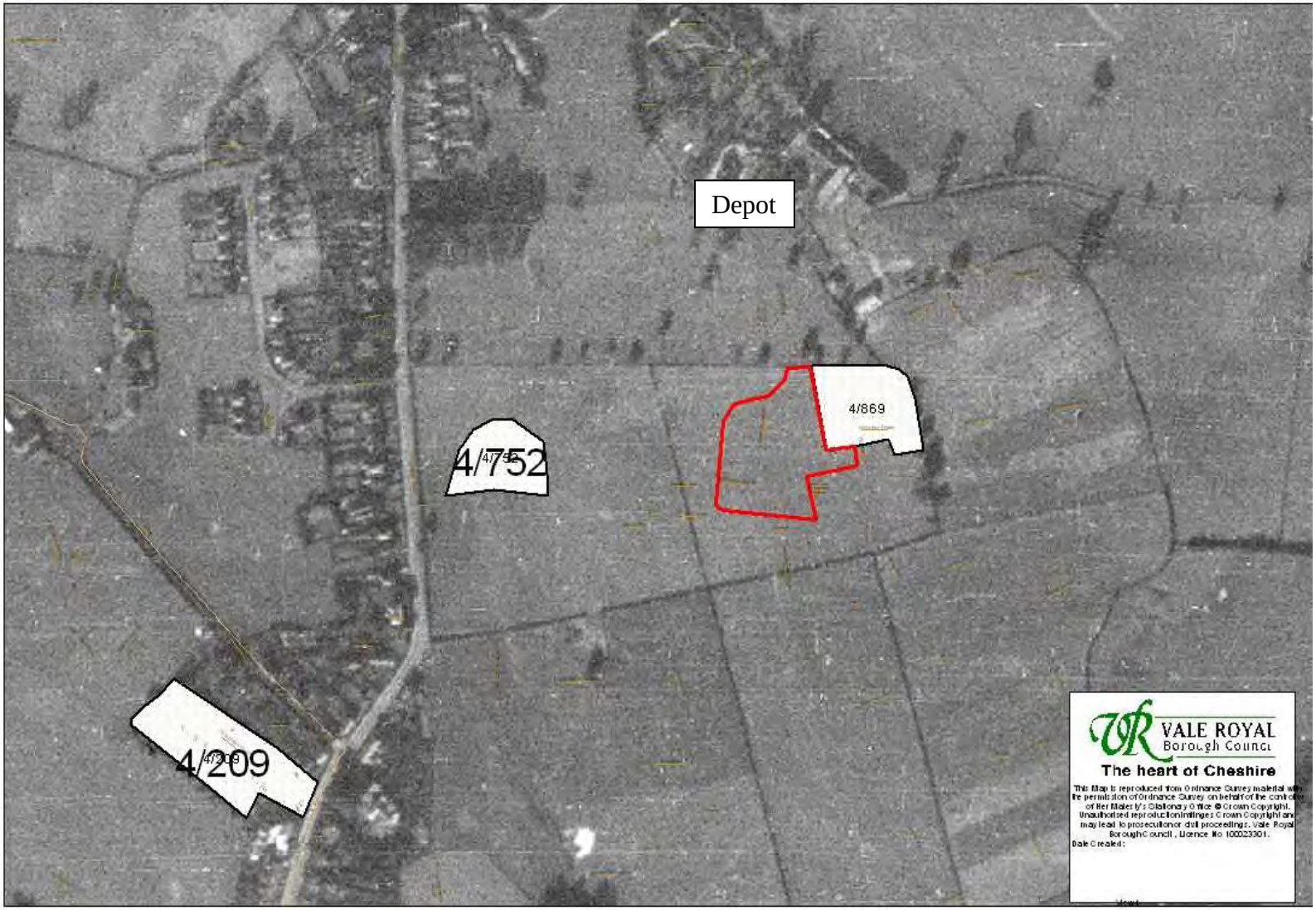

Figure 4 - The site (in red) in 1971 aerial photograph

Appendix D
Leftwich - Photos and maps of the site of the AML investigation

Figure 5 –The site (in red) in relation to the tip (black outline) as shown on Ordnance Survey map (c1971)

Figure 6 - The site (in red) in 1985 aerial photograph

Figure 7 - The site (in red) in 2006 aerial photograph

Figure 8
Boreholes in Muir Housing, Leftwich.

The children lived in 2 Muirfield Close and 9 Greenlaw Close.

Source: RSK

Appendix D
Leftwich - Photos and maps of the site of the AML investigation

Figure 9 – Residents' meeting

Appendix D
Leftwich - Photos and maps of the site of the AML investigation

Figure 10 – Drilling boreholes in gardens

Health status of long term residents in a community with two linked cases of fatal childhood AML

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Summary

A review of the health of long-term residents was requested and undertaken through an examination of GP records. This follow the deaths of two young children in the community from acute megakaryoblastic leukaemia (AML-M7), a rare subtype of acute myeloid leukaemia (AML), and a detailed investigation into the situation around the deaths. The detailed investigation had compared the patterns of AML and other diseases in the community with known patterns in other communities. It had also investigated the landfill under the houses.

The GP records were examined, with the consent of the long-term residents, for conditions of skin, liver, blood and kidney (for toxic effects of living on landfill) and depression and anxiety (for possible stress arising from the investigation).

The review of the health records of long-term residents showed no unexpected illness.

The earlier investigations showed that there were no epidemiological links between the children, no other cases of childhood AML and no other cases of childhood cancer. The health of the community was not unusual in any way, since there was no difference epidemiologically between the local community and elsewhere. No chemical risk to health was identified.

There is, therefore, no suggestion that living on the landfill had affected the health of the community or that the investigation had raised stress levels unduly.

Introduction

A detailed epidemiological and environmental investigation has been undertaken following the deaths of two children of about 18 months of age from acute megakaryoblastic leukaemia (AML-M7, a rare subtype of acute myeloid leukaemia (AML)) in a small community in Leftwich where the houses had been built on an old landfill. The causes of AML are unknown in children.

Local residents requested that some attempt be made to look more widely at any other adverse health effects that may have occurred in relation to the incident. The Incident Team agreed with local residents that one way to address this was through a review of local resident's primary care health records.

The aim of this study was to examine routine health records of local residents to identify possible health effects from living in the same estate as the children had lived. Specific objectives were to identify primary care consultations arising from conditions affecting the skin, liver, kidney or blood, and to identify diagnoses of anxiety and depression as possible markers of stress.

Methods

The study used a retrospective cohort design, abstracting data from routine health records of identified persons and held in local General Practices, to identify lifetime risk of selected conditions. The inclusion criteria were:

1. Age greater than two years
2. Living in the Muir Housing estate in Leftwich
3. Providing consent for inclusion in the study

The Environmental Health Department of Vale Royal Borough Council provided the Health Protection Agency (HPA) with a list of 30 local residents in the affected area. Of these one individual was not registered with a GP and four children were considered too young to be have been affected by the incident.

After obtaining clearance from the Director of Public Health that this was a legitimate Public Health investigation, a letter was sent to all 25 eligible residents or their guardians explaining the study and requesting written consent for participation.

Health records (mostly electronic) of consenting participants were obtained from local general practices and examined for diagnoses of conditions affecting the skin, liver, kidney or blood, as well as diagnoses of anxiety and depression. Results were collated and tabulated.

Results

The response rate was 96% (24/25). The age of participants ranged from 2 to 62 years.

No residents had previously been diagnosed with conditions affecting the liver, kidney or blood. Only two residents had been diagnosed with depression, both prior to the

children's deaths or the resulting investigation, and none had been diagnosed with anxiety. No diagnoses of other malignancies were recorded.

Table 1
Numbers of long-term residents with particular diagnoses

	Skin	Liver	Kidney	Blood	Anxiety	Depression
Diagnosis	20	0	0	0	0	2
No diagnosis	4	24	24	24	24	22
Total	24	24	24	24	24	24

Twenty residents had one or more previous dermatological diagnoses; of these 14 had previous diagnoses of eczema, dermatitis, urticaria or non-specific rash. Three of these were under 16 years of age. The majority came from two families, who accounted for all but five of the cases.

The remainder had a variety of diagnoses of other unrelated (but common) skin disorders, such as skin tags, sweat rash and molluscum contagiosum.

Discussion

This study did not find any unusual conditions affecting the skin, liver, kidney, or blood in long-term residents, nor did it find any diseases that are related to the toxins found in the landfill on which the houses were built. There was little or no evidence of increased community stress manifesting itself as new diagnoses of anxiety or depression.

Several residents had previously been diagnosed with skin conditions, mostly eczema or dermatitis, but as this is a common condition, this is not unexpected. The point prevalence of contact dermatitis or endogenous eczema (excluding atopic eczema) in the United Kingdom is about 9% at any point in time. [1]For atopic eczema, lifetime estimates of cumulative incidence of up to 20% have been reported. [2]Both skin conditions are, therefore, very common. Depression in also not uncommon: 5% -10% of persons seen in primary care have major depression.[3]

This investigation was undertaken in response to concerns from residents living in an area where the land may be contaminated and where two related deaths from leukaemia had occurred, and its results are useful for responding to these concerns. It uses data from the UK primary care system, which maintains for each individual a complete record of contacts with the health care system.

However, this study does have limitations: the numbers involved were too small to calculate rates of disease that could be compared with national rates. On the other hand, the investigation was not undertaken to calculate rates of any disease but to identify possible diagnoses that could be related to the contamination of the land. No such diagnoses were found.

Only diagnoses made in primary or secondary care were examined, and therefore non-

specific health effects which are not likely to come to medical attention could have been overlooked.

Conclusion

This study did not identify any health effects in long term residents which would warrant further investigation.

References

1 Stevens A, Rafferty J. Health Care Needs Assessment. Radcliffe Publishing 1996.
2 Kay, J.; Gawkrodger, D. J.; Mortimer, M. J. & Jaron, A. G. The prevalence of childhood atopic eczema in a general population. J Am Acad Dermatol, 1994, 30, 35-3
3 Katon, W. & Schulberg, H. Epidemiology of depression in primary care. Gen Hosp Psychiatry, 1992, 14, 237-247.

Conference Speech

John Watt's speech to the Contaminated Land: Risk Assessment 2008 conference, recounting his experiences of the investigation in the light of the death of his daughter was very well received by the delegates. Many commented that it opened their eyes to aspects of their professional work that they had not considered before.

Assessment for Charter Mark status, February 2008

During the reassessment of Vale Royal's Charter Mark status (for customer service excellence) the assessor identified as best practice the way the consultation had influenced service delivery.

The Remediation Innovation Awards 2007

The contaminated land industry has established the Brownfield Briefing Remediation Innovation Awards to recognise new and effective approaches to tackling real life problems with contaminated land.

Two of the seven national awards for 2007 were presented to partners for their work at the Leftwich site.

- In the category of Best Conceptual Design the judges said the following about the risk assessment process of the environmental consultants: "An extremely valuable contribution to providing confidence in development of brownfield sites".

- In the Best Verification Project they said of the process to check the remediation work: "Demonstrably robust verification – as required to gain the stakeholder acceptance".

http://www.brownfieldawards.com/Portals/5/downloads/pdf/BBRIA%20Winners%202007%20for%20screen.pdf (see figure 1)

Figure 1: Remediation Innovation Awards 2007

WINNERS

Best conceptual design:
Traffic light risk assessments for ground gases

RSK

RSK has developed a risk-based tool that pre-empts the risks associated with ground gases and directs developers towards safe, sustainable and cost-effective remediation solutions. Its main innovation is a conceptual risk model known as the 'Traffic Light' system, which presents a scientific rationale for assessing risk for certain types of residential housing. Although this entry does not address one specific remediation project, it was felt that the guidance it represents fulfils the relevant criteria in this category. The concept of the Traffic Light system in itself reflects excellence in design, but will also help to ensure the best selection of remedial method for those who apply it.

Guidance on Evaluation of Development Proposals on Sites Where Methane and Carbon Dioxide are Present was developed in response to a commission from the **National House Building Council** to devise practical guidance on ground gas risk assessment on development sites. The data has been adopted by the **Construction Industry Research and Information Association** and widely disseminated among the industry, enabling the unlocking of brownfield land that would previously have been considered unusable.

Best practice
Previous risk determination processes for ground gases have been laborious and often inappropriately applied. The Traffic Light system provides a robust, risk-based approach which uses 'Typical Maximum Concentrations' to facilitate initial screening purposes, and then presents risk-based 'Gas Screening Values' where these are exceeded. This determines the scope of protection required.

"An extremely valuable contribution to providing confidence in development of brownfield sites" John Campbell

Cost effectiveness and durability
This method has largely precluded developers overcompensating for a lack of definitive data by installing superfluous protection measures. This eliminates unnecessary remediation costs and ensures that rigid controls only occur in situations of significant risk. Peer review and testing have shown that it provides reliable results that will be effective for the foreseeable future.

Pollution reduction and wider benefits
By identifying the most appropriate measures to bring brownfield land back into use, this tool helps reduce the number of derelict sites. Previously, statutory consultees would frequently insist on cost-prohibitive protection measures that result in clients turning to easier options such as greenfield.

Stakeholder acceptance
Developers have made clear that they appreciate the tool for the security it provides them both in the fact that they are not carrying out unnecessary engineering works and that the land is safe. An example of the tool's acceptance is seen in the case of the residents of a Cheshire community which faced faced significant anxiety and blight after the deaths of two children from a rare strain of leukaemia, (see **ERM**'s winning entry for category 6). The ensuing investigation offered residents the chance to appoint an environmental consultant of their choosing, which brought in RSK. An early version of the Traffic Light model was applied to determine adequate mitigation of the risk from ground gases, enabling a clear understanding of what work was necessary and leaving residents happy.

WINNERS

Best verification project:
Gas protection works, Leftwich, Cheshire

Environmental Resources Management

Remediation of a housing estate in Leftwich, built in 1994 on landfilled ground, was sparked by the deaths of two 18-month-old children from acute myeloid leukaemia (AML).

Consultants **RSK** undertook site investigation works for **Vale Royal Borough Council**. No links have been identified between ground contamination and the deaths, but background testing for VOCs (in particular, benzene) that might be linked to AML is ongoing on a precautionary basis. RSK did however report high concentrations of methane and carbon dioxide and site owner **Muir Group Housing Association** appointed **Environmental Resources Management** to design and oversee remediation. The primary focus of the works was to define the degree to which the houses were vulnerable to gas emissions, eliminate this risk, and provide a high level of confidence to residents that the houses were safe.

Best practice
Although the houses had been designed to resist ingress of ground gases by including vented subfloor voids and gas-resistant membranes, the application of tracer gas testing by **Prestige Air Ltd** showed the membrane to be ineffective. The membranes in all 24 houses were replaced by Prestige, following which further testing demonstrated the new membranes to be fully sealed and certification was issued. The tracer gas technique was shown to be far superior to simple visual inspection, as undertaken by the contractor who had laid the original membranes.

Made ground in the gardens of the six worst-affected homes was removed down to natural ground and replaced with clean infill over barriers. There was no question of any excavated fill being put back on site, irrespective of its quality, as a key objective of the works was to bring confidence back to the estate.

Civil engineering works were undertaken by **Joy Plant. Barlow Contractors** undertook the building works on houses.

"Demonstrably robust verification – as required to gain the stakeholder acceptance" Clive Boyle

Monitoring
Post-excavation gas monitoring was key and this was achieved via large-scale fluxbox tests on the subfloor voids of blocks of houses; the air bricks on all four sides of the blocks were sealed, and the resulting unvented atmosphere monitored over two weeks using a GA2000. This showed that a significant build-up of gases did not occur.

Stakeholder acceptance
Works were characterised by a strong spirit of cooperation by all involved (consultants, site owners, contractors, the Local Authority and residents). In order to assure residents that the estate was safe, simple measures were required that would achieve the highest standard of protection for the properties. Risk assessments were undertaken by RSK together with the residents, who were able to agree input parameters which only they could define on a site-specific basis, e.g. behaviour patterns and exposure duration, as an aide to predicting past exposure and defining residual risk. Remedial measures were designed to be passive and robust; nonetheless, Muir undertakes regular checks on the houses, and ensures all new residents are briefed on the past situation. Residents are provided with a list of dos and don'ts, which include a prohibition on drilling holes in the floor and blocking off air vents. Ultimately, confidence in the site has been restored.

National House-Building Council guidance, March 2007

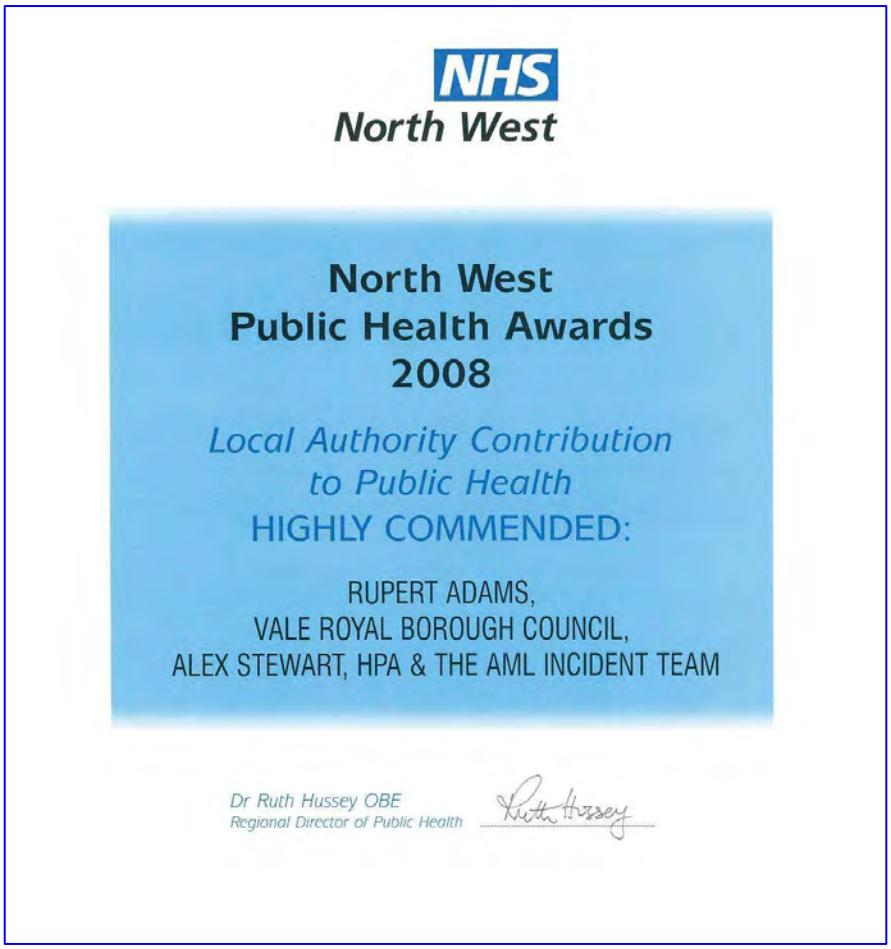
The work done at the site has contributed to the latest national guidance on gas protection measures for houses.

North West Public Health Awards 2008

Category 2 – Local Authority contribution to Public Health: *Highly commended*: Rupert Adams, Vale Royal Borough Council, Alex Stewart, HPA and the AML Incident Team

The judges said "A model of partnership and peer process in the context of uncertainty, fear and initial mistrust. Exemplifies individual and collective responsibility and the values of openness and transparency. A lesson for government". (See figure 2)

Figure 2: North West Public Health Awards 2008



Sharon

26 Sept 2002 - 26 February 2004

Rebecca

10 July 2003 – 26 February 2005

A memorial to Sharon and Rebecca is being constructed in Leftwich

Reference 14

The Independent, Chemical dump village faces total disintegration, 2000, http://www.independent.co.uk/environment/chemical-dump-village-faces-total-disintegration-710457.html

Independent 2000

Chemical dump village faces total disintegration

As fears over toxic seepage prompt an exodus, the Government considers extending homeowners' rights to stop building projects

- By Ian Herbert, Northern Correspondent
- Sunday 13 August 2000 23:00 BST
- 0 comments

The village of Weston, Cheshire, is slowly disintegrating eight months after people there were told that a chemical dumped 25 years ago by the local ICI plant was seeping into the foundations of buildings.

The village of Weston, Cheshire, is slowly disintegrating eight months after people there were told that a chemical dumped 25 years ago by the local ICI plant was seeping into the foundations of buildings.

Only 21 of Weston's 467 houses are affected by the toxic gas but fears over the safety of the whole community, and the level of compensation offered by ICI, have started an exodus. Soon, one-third of residents will have moved; the bus company is considering pulling out and the 100-year-old Scout hut is deserted. Now villagers are awaiting the fate of their shop.

The chemical hexachlorobutadiene (HCBD) was found by chance when ICI, whose Castner Kellner plant is next to the village, did routine tests on possible effects of old chlorine production methods.

HCBD affects plants and wildlife and is believed to cause kidney and liver cancer in humans. Tests have suggested it might also cause foetal abnormalities but there is no evidence of the effects of long-term exposure.

The chemical had been poured into pools in Weston's old north quarry in the Fifties and Sixties, only to seep out through the sandstone which had sustained the mining village for 100 years from 1820.

ICI has said it accepts that the scare would damage already paltry property prices and has offered to buy homes for up to twice what they would have fetched on the open market, as well as paying removal and solicitors' costs.

Rex Merry's five-bedroom Grade II listed former quarrymaster's house failed to fetch £120,000 two years ago but ICI is prepared to pay him £250,000. Mr Merry, a retired local-government officer, said: "They are saying they want to keep the village together but are paying out most money to those who want to go rather than stay."

Mr Merry's house is not even classified as unsafe: the HCBD levels are 0.020 parts per billion (ppb), well below the 0.6 ppb decreed safe by the Department of Health. But it is in what ICI has defined as the "green zone" of properties most affected, standing above the south quarry, where HCBD was also dumped in drums. Mr Merry said: "It's surely a question of how long the drums will remain intact." He says he will probably move a few miles down the road.

It is part of Weston's predicament that Mr Merry finds himself envied by others. Some neighbours have been consigned to ICI's "blue zone" of homes not monitored by the company because they are farther from the quarry. The chemical company has used its zoning system to work out compensation for the villagers, regardless of whether they stay or go: out of the 480 households, the 100 in the green zone get £5,000; those in the blue zone get £2,500; and those further away get nothing. Mr Merry said the system was "divisive".

Kenneth and Lynda Farrow and their four children, one of the 21 families immediately offered alternative accommodation when the HCBD was found, have been told to find an £80,000 property, although their house was valued at £48,000. This week, Mr Farrow said that he could find nothing suitable and threatened to return to Weston. "We never wanted to leave our home in the first place," he said.

Village rumour has it that the contamination could have triggered cancer, stillbirths and miscarriages. Malcolm Peacock, 35, who runs the village shop, is in remission from throat cancer and his mother, Rhiannon, has her doubts. "He has never smoked and is as fit as he has ever been," she said.

Laura Brown, 16, who works in the shop and lives in the "blue zone", had to drop some of her GCSE exams after missing seven weeks of the past school year with kidney problems, for which she has been having hospital treatment.

Many villagers are determined to remain, such as the owner of the filling station, Christina Finney, who moved from her native Germany in 1956. A dual carriageway separates her house from the ICI plant, in a "green zone" street where 10 out of 25 houses are empty, including the property next door. "The reading was 0.009ppb, so I'm happy," she

said. "It's actually nice and quiet now because all this has forced some rowdies up the road to move on but I'm not happy about the bus service. I need it to get to the shops."

ICI, which acknowledges the threat to Weston's social fabric, says it is working with villagers and Halton Borough Council to provide "additional community facilities". Although a new children's playground is planned, the village noticeboard shows no more evidence of community life than two playgroups. Everyone fears Mr Peacock, whose shop business has suffered, may be the next to go. Mr Merry said: "If they're offered compensation for loss of trade it may be too much to resist. If the shop goes, it really is the end for Weston."

Reference 15

15 Timeline for the old Hancock tip in Boothstown - Manchester Evening News

NEWS

Timeline for the old Hancock tip in Boothstown

Hancock tip timeline.

BY MANCHESTER EVENING NEWS
09:45, 5 AUG 2011 | **UPDATED** 23:10, 11 JAN 2013

Pic by Chris Gleave. Houses on Birchfield Crescent in Boothstown that may have to move out for 6 months due to gas from land fill. Pic shows

1964-6: site operated as a tip with planning permission from Worsley District council.

1969 onwards (until 2000): Salford council leases the covered-over tip as open public space.

Early 1970s: houses built on edge of tip.

Late 1970s: two houses have to be demolished due to subsidence.

1984: houses rebuilt (approved by council).

1985: Peel Holdings buy the land.

1980s: Council and Peel investigate site.

1990: Council finds gas is migrating into gardens.

1991: Peel granted permission to vent land and cap landfill. This is believed to have solved the problem.

2003: Resident at number 39 reports smell of methane. Similar problem found at number 41. These are the two that were rebuilt. British Gas rule out mains leak and it is decided it is landfill gas.

2004: monitors and alarms installed into 39 and 41. Affected rooms require windows to be kept open.

2005: Peel and council discuss investigating the site. Council report says 'gas build up in residential property could theoretically lead to explosion if ignited' – and contaminated soil might harm health.

2006: Investigation starts. Council has to get a second contractor because the first doesn't have the necessary expertise. Gas is still entering the houses.

2008: Peel and council form joint working party to assess the landfill and manage work.

July 2010: Second investigation finds chemicals in the soil of two gardens that are 'potential significant risks to human health and property' and potentially explosive gases under seven houses.

Nov 2010: planning permission granted to excavate seven gardens and demolish four extensions. Work to start in new year.

May 2011: joint working party disbanded and the council takes over.

July 2011: council signs off rehousing of residents. residents given until (today) Aug 5 to agree.