



Department
of Energy &
Climate Change

UK Greenhouse Gas and Air Quality Pollutant Inventory Improvement Programme: Analysis of volumes of landfill gas flared in the UK between 1990 and 2013

Department of Energy and Climate Change
3 Whitehall Place
London SW1A 2AW
Website: www.gov.uk/decc

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Information about this publication is available from:

GHG Statistics and Inventory Team
Department of Energy and Climate Change
Area 6A, 3 Whitehall Place
London SW1A 2AW

Email: Climatechange.Statistics@decc.gsi.gov.uk

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Final Report to the Department of Energy and Climate Change

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Executive Summary

Introduction

The UK ratified the United Nations Framework Convention on Climate Change (UNFCCC) in December 1993, and the Convention came into force in March 1994. Parties to the Convention are committed to develop, publish and regularly update national emission inventories of greenhouse gases (GHGs) to the Intergovernmental Panel on Climate Change (IPCC).

The UK has recently revised its approach to evaluation landfill gas methane flaring emissions in the light of feedback from the UNFCCC. Because of the significance of landfill methane emissions in the UK, it is important for the UK to take account of landfill gas flaring to the maximum extent permitted by available data. Data for currently operational sites has been provided by the Environment Agency (data for 2009 to 2013) and the Scottish Environmental Protection Agency (data for 2013).

This project was designed to gather all available data for other landfill sites, in order to enable landfill gas flaring emissions to be accounted for as fully as possible. The data to be obtained were primarily specified to meet the requirements of the UK GHG inventory. The specific aims of this project were:

- To gather information from the Scottish Environmental Protection Agency (SEPA), and where necessary operators, on the volumes of gas flared at Scottish landfill sites between 1990 and 2012.
- To gather information from the Environment Agency on the volumes of gas flared at landfill sites in England & Wales between 1990 and 2007.
- To collect information on landfill sites in all three countries which would allow them to be categorised in terms of methane production and methane recovery.

DOENI has confirmed that no flaring takes place at landfill sites in Northern Ireland.

Methodology

Data on landfill methane flaring were obtained or derived from direct contact with site operators and contractors in Scotland, and by reviewing Environment Agency public records for sites in England and Wales. Sites in England and Wales were classified as “Review” sites (currently operational sites for which permits are under review), “Closing” sites (which are currently going through a managed closure programme) and “Closed” sites (sites which closed prior to 2001). Data for “Review” sites and “Closed” sites are presented below. Data for “Closing” sites will be provided subsequently by the Environment Agency.

Landfill methane flaring estimates were classified as high, medium and low confidence, reflecting the availability of site-specific data, and the need to make further assumptions in order to develop estimates of the quantities of methane flared.

Results

In order to comply with the requirements of the review panel, it is recommended that the UK Greenhouse Gas inventory should use “High Confidence” data only, as set out in the following table.

	1990	1995	2000	2001	2002	2003	2004	2005
Methane flared at Environment Agency “Review” sites (tonnes)	0	0	0	0	0	0	0	0
Methane flared at Environment Agency “Closed” sites (tonnes)	0	0	0	0	639	0	0	0
Methane flared at SEPA sites (tonnes)	0	0	0	0	0	0	0	0
Total methane flared (tonnes)	0	0	0	0	639	0	0	0

	2006	2007	2008	2009	2010	2011	2012	2013
Methane flared at Environment Agency “Review” sites (tonnes)	0	0	0	0	0	441	0	2077
Methane flared at Environment Agency “Closed” sites (tonnes)	208	0	0	0	0	0	288	2311
Methane flared at SEPA sites (tonnes) (additional to SEPA 2013 dataset)	5976	2463	832	980	1849	2455	2599	3854
Total methane flared (tonnes) (additional to SEPA and Environment Agency datasets)	6195	2463	832	980	1849	2896	2886	8241

Because of data quality constraints, the quantities of methane flared set out in the table above are low compared to the quantities of methane flared set out in the Environment Agency and SEPA databases for operational sites. It was possible to obtain High confidence data for only a small number of sites – three, one or zero Closed or Review sites in England and Wales, in any year. For context, in 2013, the Environment Agency dataset indicates 101,000 tonnes of methane flared at operational sites, and the SEPA dataset indicates 18,800 tonnes of methane flared.

Medium confidence data was additionally available for “Review” sites. Medium and Low confidence data was additionally available for “Closed” sites, as set out in the following table.

Site type	Annual CH ₄ combusted in flares (tonnes)								
	1990	2000	2005	2008	2009	2010	2011	2012	2013
“Review” sites (high confidence only)	0	0	0	0	0	0	441	0	2077
“Review” sites (high and medium confidence)	0	0	0	0	246	246	688	1507	2324
“Closed” sites (high confidence only)	0	0	0	0	0	0	0	288	2311
“Closed” sites (high and medium confidence)	6600	11600	10800	8800	7900	6900	5900	5900	6300
“Closed” sites (high, medium and low confidence)	33000	65800	58500	38200	32100	28100	22900	19600	16600

This record should be updated when further data for “Closing” sites are received from the Environment Agency. When compiling the UK GHG Inventory for 2013, the Environment Agency landfill gas flaring datasets for 2009 to 2013, and the SEPA landfill gas flaring dataset for 2013 should also be taken into account. These datasets are not included in the tables above.

The UNFCCC Review Panel suggested an alternative approach based on classification of sites. Our review indicates that there is no realistic prospect of developing an estimate of landfill gas combustion in flares using this approach. It is recommended that this approach should not be pursued further.

For applications other than compilation of the UK GHGI, it may be appropriate to use the “Medium confidence” or “Low confidence” data set out above.

Further method development

It is recommended that further consideration could be given to the default approaches for estimating landfill methane combustion set out in the 2006 Guidelines, rather than using this country-specific approach. However, this approach would have significant disadvantages which would need to be taken into account.

1) Introduction

1.1) Study context

The UK ratified the United Nations Framework Convention on Climate Change (UNFCCC) in December 1993, and the Convention came into force in March 1994. Parties to the Convention are committed to develop, publish and regularly update national emission inventories of greenhouse gases (GHGs) to the Intergovernmental Panel on Climate Change (IPCC). In the UK, this responsibility lies with DECC. Ricardo-AEA has been commissioned to calculate UK GHG emissions, and to compile the National Inventory Report (NIR) on behalf of DECC.

Historical and ongoing reliance on landfill for residual biodegradable waste in the UK means that emissions of methane from landfill make a significant contribution to the UK Greenhouse Gas (GHG) inventory. The 2014 NIR¹ indicates that methane from landfill sites accounted for 3.2% of UK GHG emissions in 2012. This substantial contribution from a single sector, landfill, places the UK in a unique position for a major economy, because of the more intensive past and ongoing use of landfill in the UK compared to other comparable countries. While this contribution is likely to decline slowly in the future, landfill will continue to make a significant contribution to the UK GHG inventory. The contribution of landfill to the UK GHG inventory has been the subject of considerable attention during recent UNFCCC reviews. The significance of this contribution and the need for ongoing improvement is acknowledged in the 2014 NIR, which highlights changes made in the GHG inventory: *“Following a recommendation from the 2013 UNFCCC review the UK estimates for landfill methane flaring and use in gas engines, used to update the 6A1 emission estimates in the 2014 submission, have been revised using new metered methane capture data from the Environment Agency.”* The revisions implemented in the 2014 NIR are described in Section 8.2.2.3 of the NIR, and represented a significant improvement on previous methods for calculating the quantity of landfill methane which is combusted in flares. The need for ongoing improvements in this area was identified in the NIR, which highlighted a high priority improvement item for the 2015 submission: *“Landfill gas flaring data – review of past operator returns to acquire further historical metered landfill flaring data.”*

As highlighted in the ITT, the most recent feedback from the UNFCCC has accepted the UK approach to accounting for landfill gas flaring in England and Wales with modern permit conditions for 2009 to 2012². For 2008, the UNFCCC Review Panel considered that a reasonable estimate of the volumes of gas flared at operational sites in England and Wales could be obtained from data provided by the Environment Agency for 2009 to 2012.

However, the review panel has rejected the UK’s approach for sites in Scotland and Northern Ireland, and for periods prior to 2008 which adopted a calculation and interpolation approach. Because of the significance of landfill methane emissions in the UK, it is important for the UK to take account of landfill gas flaring to the maximum extent permitted by available data. The UNFCCC review panel highlighted two ways in which this could be carried out:

- (a) periodic collection of the amounts of methane flared at older permitted landfills, local authority controlled closed landfills in Scotland and Wales, and landfills in Scotland and Northern Ireland, together with evidence that these landfills are equipped with gas collection systems. This is referred to as the “comprehensive monitoring method”;

¹ DECC, “UK Greenhouse Gas Inventory, 1990 to 2012: Annual Report for Submission under the Framework Convention on Climate Change,” Report ref. 978-0-9573549-4-4 prepared by Ricardo-AEA on behalf of DECC

² UNFCCC, “Report of the individual review of the annual submission of the United Kingdom of Great Britain and Northern Ireland submitted in 2013,” Draft report ref. FCCC/ARR/2013/GBR, 23 May 2014

- (b) categorisation of all landfills with gas collection systems and flares, except modern permitted landfills, into categories; survey and investigate gas recovery systems and amounts of methane flared for a representative sample of landfills in the relevant categories. This is referred to as the “sampling and categorisation method.”

1.2) This project

This project was designed to gather all available data to enable landfill gas flaring emissions to be as fully accounted as possible in the 2015 submission using either the comprehensive monitoring method, or the sampling and categorisation method, as data permits. This leads to the specific aims of this project, as described in the ITT:

- To gather information from the Scottish Environmental Protection Agency (SEPA), and where necessary operators, on the volumes of gas flared at Scottish landfill sites between 1990 and 2012.
- To gather information from the Environment Agency on the volumes of gas flared at landfill sites in England & Wales between 1990 and 2007.
- To collect information on landfill sites in all three countries which would allow them to be categorised in terms of methane production and methane recovery.

DOENI has confirmed that no flaring takes place at landfill sites in Northern Ireland.

The information obtained from this study will be used to inform the calculations of landfill methane emissions in the 2015 NIR. The intention is to implement updated calculations of landfill gas flaring emissions alongside other planned revisions to the landfill gas inventory relating to changes in the landfill gas engine efficiency in the light of a research project carried out on behalf of Defra.³ The results of the Defra research suggest that around 220,000 tonnes of methane per year could be abated by flaring on sites not using gas utilisation, and highlighted the need for further quantification of landfill methane flaring.

The study was carried out by Ricardo-AEA and CRA Europe. Valuable support and co-operation from the Environment Agency, SEPA, DECC and site operators and contractors is gratefully acknowledged.

³ Defra (2014), “Review of landfill methane emissions modelling.” Report prepared by Golder Associates ref. 13514290381.503/B.0

2) Study methodology

As described in Section 1, the focus of the project was on gathering information on landfill gas flaring volumes and other relevant site information held by the UK regulatory authorities, and operators in Scotland. The study focused on gathering data on the quantities of methane flared at three categories of sites:

1. Open landfills: Scotland - 1990-2012
2. Open landfills: England & Wales - 1990-2007
3. Closed and historical sites: all countries - 1990-present

2.1) Data collected

The data to be obtained were specified in the project ITT and were designed to meet the requirements of the UK GHG inventory, supplemented by data which would be needed to implement the recommendations in the UNFCCC draft review report.

Excerpt from Invitation to Tender

In order to tackle the aims above, the following information needs to be gathered, where available.

- A. Total numbers of sites in England, Scotland and Wales in the following categories:
 - i. Modern, open, permitted sites (i.e. sites with a permit requirement to report annual volume of gas flared)
 - ii. Non-operational permitted sites
 - The proportion of these sites with gas collection systems
 - The proportion of gas collection systems with engines; flares; both engines and flares; and no combustion plant
 - iii. Historical landfill sites
 - The proportion of these sites with gas collection systems
 - The proportion of gas collection systems with engines; flares; both engines and flares; and no combustion plant
- B. For modern, open, permitted sites, the following is required, listed by site:
 - i. The mass or volume of methane, or mass or volume of landfill gas flared for each year for which data are available between:
 - 1990 and 2012, for Scotland, and
 - 1990 and 2007, for England and Wales.
 - ii. If gas volumes are reported above, the temperature of the gas, if available.
 - iii. If gas volumes are reported above, the percentage methane content of the gas, if available.
 - iv. The mass or volume of methane, or mass or volume of landfill gas combusted in an engine for each year for which data are available between:
 - 1990 and 2012, for Scotland, and
 - 1990 and 2007, for England and Wales.
 - v. The methods used to measure, calculate or estimate items i-iv, if applicable.
- C. For all three categories of sites listed in 'A' above:
 - i. Date at which the landfill was opened and (if appropriate) closed.
 - ii. The amount and type of waste landfilled each year since the site was opened.
 - iii. Leachate management arrangements

- D. Finally, the following information would be good to have, but is unlikely to be found in the databases of either the EA or SEPA. It will be necessary to confirm this assumption:
- i. The landfill liner type, thickness and date of installation for each cell
 - ii. The landfill cap type, thickness and date of installation for each cell
 - iii. Landfill cap maintenance procedures
 - iv. Waste density
 - v. The date of installation of the landfill gas collection system, the design of the landfill gas collection system, and its maintenance
 - vi. The landfill site geometry (i.e. surface area and depth of landfill cells)

Items B(i), (ii) and (iii) arise from the calculations required to convert reported volumes of landfill gas combusted in flares to the mass of methane combusted. Item B(iv) enables a cross-check on methane combustion in engines to be carried out. Items A(i) to (v) are required to enable national methane flaring quantities to be estimated from individual site data. Items C and D are included to enable the UNFCCC review recommendations for comprehensive monitoring or sampling methods to be applied.

2.2) Approach to data collection

In order to secure available data from the regulator and industry stakeholders identified in the ITT, the following approach was adopted:

- Set up dedicated project email address; set up dedicated online workspace (Microsoft Sharepoint).
- Develop data collection pro-forma highlighting data requirements and supporting information such as how the data was obtained and evidence for data quality. Key aspects will include: equipment calibration procedures; accredited quality systems; calculation methodologies. Train project team on use of pro-forma.
- Initial phone call by senior member of Ricardo-AEA project team to make contact with key individual(s), explain the reason for the enquiry, and outline the nature of the information request.
- Confirmation of information request by email by data acquisition & analysis team.
- Follow-up phone calls/emails by data acquisition team as required to secure a response. Escalation to senior member of project team if no response forthcoming.
- Data completeness and quality checking using the procedures applied for UK GHG inventory compilation.
- Follow-up phone calls/emails to clarify data if needed, following the completeness and quality check.

2.3) Environment Agency records

Following correspondence and discussions with the Environment Agency, Ricardo-AEA was provided with the Geoscience Operations Team (GOT) database. The GOT database provided details on 1,318 landfill sites in England and Wales classified as being either “Closed” or “Closing.” “Closed” sites were those which closed in 2001 or earlier, prior to the implementation of the Landfill Directive. “Closing” sites were those which stopped receiving waste following the implementation of the Landfill Directive. However, many of these sites were not formally closed.

The Environment Agency is currently engaged on a programme of work to ensure that all such sites are properly and safely closed.

The database included the Environment Agency Waste Management Licence (EA WML) number, and details on the category, size and management practices at the site.

In order to refine the database the following filters were applied to the list:

- Site description: the following types of site were included:
 - A1 – Co-disposal landfill site
 - A2 – Other landfill site taking special waste
 - A4 - Household, commercial and industrial waste landfill
 - A5 – Landfill taking non-biodegradable wastes (Although such wastes would not be expected to produce significant quantities of methane, this category of site was included for completeness – for example, in case biodegradable waste had previously been accepted at the sites.)
 - A6 – Landfill taking other wastes
 - L04 – Non-hazardous landfill

Thus the following types of site were excluded:

- A11 – Household, commercial and industrial transfer station
- A22 – Composting facility
- A7 – Industrial waste landfill (factory curtilage)
- L01 – Hazardous merchant landfill
- L05 – Inert landfill
- Landfill gas management system:
 - Flare
 - Flare and GUP
 - GUP with standby flare
 - Unknown

The filtered list included 354 “Closed” landfill sites and 107 “Closing” landfill sites. The list of “Closed” landfill sites was used to undertake a thorough data search of documents stored on the Environment Agency’s public register. The public register draws on internal Environment Agency databases, principally the EDRM system used for storage of records relating to environmental permitting. The public register enables access to all documents stored on EDRM which are marked for public access. The public register was accessed during several visits to Environment Agency offices.

The Environment Agency is working closely with operators of “Closing” landfill sites, and undertook to liaise with operators regarding the provision of data on landfill gas flaring volumes for these sites, where available. This information will be provided separately by the Environment Agency.

The Environment Agency also provided references for a number of sites which are currently operational, but which have not had recent permit reviews. Consequently, these sites do not have a permit condition requiring annual reporting of volumes of landfill gas combusted in flares and engines, and hence these sites are not included in the landfill gas combustion datasets for 2009 – 2012 provided by the Environment Agency. These sites were referred to as “Permit review” sites. 57 such sites were identified by the Agency. A number of these landfill sites do not accept biodegradable wastes, but were included in the study for completeness – for example, in case biodegradable waste had previously been accepted at the sites.

During the search Ricardo-AEA reviewed all documents stored under the EA WML number for each site, including annual reports, gas management plans and environmental permit documents. Any reference made to the quantity of landfill gas flared or to the installation or operation of a flare and/or gas utilisation plant (GUP) was recorded, including the capacity, running hours of the flare and the methane content of the flared gas.

2.4) Consultation with operators and gas contractors for landfill sites in Scotland

SEPA provided a database of the volumes of landfill gas flared at sites in Scotland during 2013⁴. This database provided information on volumes of landfill gas combusted in flares and engines at 50 landfill sites in Scotland. This list was believed by SEPA to represent all sites with landfill gas flares in Scotland.

Ricardo-AEA identified the landfill operators and gas contractors in Scotland known to have been operating at some point between 1990 and 2012, based on the SEPA 2013 landfill gas flaring database and the HMRC list of registered landfill operators for Scotland. Ricardo-AEA used this list to undertake a consultation process to obtain data on gas production rates and collection and combustion arrangements. Operators of all sites on the SEPA 2013 list were contacted. Additionally, these operators were asked about the existence of landfill gas flaring at other sites for which they were responsible, in order to provide an independent check on SEPA’s view that the 50 sites represented all sites with landfill gas flares in Scotland. This extended the number of sites under consideration from 50 to 113.

Following an initial phone call by a senior member of Ricardo-AEA’s project team, each operator/contractor was forwarded a data request form, detailing the required information for each site, and asked to return the completed form to the project email address by a set date. The requested data included:

- Information on the gas management system:
 - The mass or volume of methane, or mass or volume of landfill gas flared.
 - The mass or volume of methane, or mass or volume of landfill gas combusted in an engine.
 - The percentage methane content of the landfill gas, where the mass or volume of gas flared was available.
 - The temperature of the gas, where the mass or volume of gas flared was available.
 - The methods used to measure, calculate or estimate mass or volumes of the gas.
- Information to determine the site profile:
 - Date at which the landfill started and (if appropriate) stopped receiving waste.
 - The total amount of waste landfilled each year since the site was opened.

⁴ SEPA (2014), Communication from J McFeat to Ricardo-AEA, April 2014

- Percentage composition of accepted waste by household, commercial/industrial, inert, hazardous and other.
- Leachate management arrangements, including recycling through landfill cap, onsite treatment, offsite treatment, no treatment, discharge to sewer, spray irrigation and other.
- Method of landfill gas collection, including ring main, manifolds feeding wells, herringbone transmission lines, control at gas wells, control at manifolds and other.
- Methods of lining/capping, including unlined & uncapped, a WML compliant liner & cap, Landfill Directive compliant liner & cap and other.
- Any operational records, such as EA/SEPA Compliance Assessment Report (CAR) scores and current/historic civil or criminal actions relating to landfill gas odour or landfill gas emissions.

The information request was followed up with further contact by telephone and email, including a written request from SEPA to provide information to feed into this process, emphasising its importance for the UK greenhouse gas inventory.

2.5) Data collation and analysis

The data acquisition & analysis team developed a standardised format for reporting and collating the data, including conversion to common units. This format has allowed rapid data analysis and QC checks, and facilitating the subsequent estimation of emissions. Data quality was coded into the dataset, enabling the project team to select subsets of data received which meet specific quality criteria. A national summary dataset was produced, together with a detailed site-specific dataset which lists key parameters for all the sites identified in the study. The data summary contains the items listed in Section A in the Project Specification section of the ITT. The site-specific dataset contains the items listed in Sections B, C and D in the Project Specification.

A project record was also maintained, which contains the original data as provided by process operators.

2.6) Data confidence levels

A range of approaches was adopted to enable landfill gas estimates to be developed with different ranges of confidence.

High confidence level

Raw emissions data collected from records held on the Environment Agency's Public Register have a high level of confidence. This data is typically provided as either:

- Data on the total quantity of landfill gas flared per site in any given year; or
- Data on the capacity and total operating hours per flare in any given year, which has been used to derive the total quantity of landfill gas flared in that year. This applies to limited operating hours (5% or less of the year) at a single site in 2011 only. This site has substantial installed landfill gas engine capacity. It is possible that the flares may not have been operating at capacity during the limited hours that they operated in 2011: however, in view of the limited extent of operating hours, it is likely that flaring was carried out to provide additional combustion capacity when one or more engines were off-line. Under such abnormal operating conditions, flares may be expected to operate close to capacity.

Medium confidence level

Data collected from records held on the EA Public Register that could not be classified as 'raw emissions data', but provided useful background information on the operation of a flare or GUP can be considered to have a medium level of confidence. This includes data or information on the following:

- Flare capacity, excluding the total flare operating hours;
- Total flare operating hours, excluding flare capacity;
- Amendments to flare capacity;
- Annual flare operating hours;
- Construction date of the flare;
- Construction date of the GUP;
- Percentage methane in landfill gas;
- Commencement of waste tipping; and
- Site closure date.

Low confidence level

Where it has not been possible to identify either raw emissions data or other supporting data in records held on the EA Public Register an estimation of emissions across the timeline has been generated by applying a set of assumptions based on the date of issue of the Waste

Management Licence (WML) by the EA. These estimations are considered to have a low confidence level.

No data

Where the review of documents held on the EA Public Register provided neither 'raw emissions data' or other supporting data, and it has not been possible to confirm the issue date of the WML, an emissions timeseries has not been estimated.

2.7) Assumptions

The following are the assumptions applied to data extracted from records stored on the Public Register categorised as having either a medium or low level of confidence, in order to develop time series estimates:

- It has been assumed that methane will only be generated in quantities suitable for flaring 3 years after the issuing of the WML.
Basis: to reflect project team experience of the landfill industry
- Where the closure date of the landfill site has not been identified and the site is known to have a flare only, it has been assumed the flare will be operational for a period of 20 years, commencing 3 years after the issuing of the WML.
Basis: to reflect project team experience of typical flare operational lifetimes and landfill gas production lifetimes, linked to assumptions of turndown after 10 years, as set out below.
- Where the closure date of the landfill site has not been identified and the site is known to have a flare and GUP, it has been assumed the flare will be operational for a period of 18 years, commencing 3 years after the issuing of the WML.
Basis: to reflect project team experience of typical flare operational lifetimes and

landfill gas production lifetimes, linked to assumptions of turndown after 10 years, as set out below.

- Where a site is known to have a flare only, it has been assumed the flare will be operational 95% of the time (8322 hours per year) for the first 10 years, operating at 100% capacity (maximum flowrate). During the following year the flare will operate at 90% turndown (or, equivalently, operate for 90% of the time, or a combination), with levels of operation reducing linearly to 0% over the following 9 years.
Basis: project team experience of flare availability and typical decrease in gas production following site closure.
- Where a site is known to have a flare and GUP, it has been assumed the flare will be operational 8% of the time (700 hours per year) at 100% capacity for the first 10 years. During the following 10 years it was assumed the flare throughput will decrease linearly to 0% (combined effect of reducing operating hours and turndown).
Basis: Operators normally aim to maintain flaring below 10% of the time, to avoid additional regulatory requirements. Many sites have excess installed GUP capacity, which facilitates lower flaring. Project team experience of flare availability and typical decrease in gas production following site closure.
- Where the installation date of either a flare or GUP has been confirmed it has been assumed flaring has occurred at a constant rate for 10 years following this date.
Basis: to reflect project team experience of typical flare operational lifetimes and landfill gas production lifetimes,
- If the capacity of the flare is known to exceed 525 m³/hour the estimated emission for that site has been based on a flowrate of 525 m³/hour
Basis: this was designed to represent use of the flare as back-up for a single 1MW engine.
- If the capacity of the flare is known to be below 525 m³/hour the estimated emission for that site has been based on the flowrate listed in the source document.
- If the capacity of the flare is unknown the estimated emission for that site has been based on a flowrate of 525 m³/hour.
Basis: this was designed to represent use of the flare as back-up for a single 1MW engine.
- Where the percentage methane has not been confirmed an assumed methane content of 44% has been applied to the flared gas
Basis: level used in calculating methane combustion in landfill gas flaring in UK GHG Inventory¹.

Because of the reliance on generic project team experience, these assumptions are used to develop time series estimates which are of moderate or low confidence only.

3) Results

3.1) Environment Agency “Review” sites

Definition

Environment Agency “Review” sites comprise those older sites which are currently operational but which do not have the latest permit conditions requiring the annual reporting of the quantities of combusted landfill gas.

List of sites reviewed

Ricardo-AEA identified 57 landfill sites categorised as “Review” for assessment during the review of documents held on the Public Register. The operator and facility details for these sites are provided in Appendix 1. As noted above, this list may include some sites which did not accept biodegradable waste, but which were included in the study for completeness – for example, in case biodegradable waste had previously been accepted at the sites. The list may include some sites which are no longer operational, but which may continue to produce landfill gas.

Data summary

Of the 57 sites researched the following 3 were found to have records to suggest the operation of a landfill gas flare.

- **Walleys Quarry** – An Air Quality Impact Assessment provided by Walder Associates in 2008 confirmed “*The GUP will be located in the south eastern corner of the landfill and will contain 2x 1MW gas engines and 1 flare with a 1,500 m³/hr capacity.*” From this information, it was estimated that the flare is likely to have operated on a standby basis. This was estimated to be a landfill gas flowrate of 525 m³/hour (the approximately volume of gas combusted in a 1MW engine) for 8% of the time (701 hours per year, a typical engine downtime figure), with a methane content of 44% (the methane content of landfill gas at older sites), between 2009 and 2013. This estimate is of medium confidence
- **Whitemoss Landfill** – An Environmental Statement provided by MJCA in 2013 confirmed that “*The flare has the ability to burn 300m³ of landfill gas per hour but at present the site generates only around 50m³ of landfill gas per hour and the quantity is decreasing.*” In addition a Flare Emissions Monitoring Report produced by Redwing Environmental Ltd confirmed that the flare was in use in 2009. On the basis of this information, it was assumed that the flare operated at a flowrate of 50m³/hour for 95% of the time (8322 hours per year), with a methane content of 44%, between 2009 and 2013. This estimate is of medium confidence.
- **Shelford Landfill Site** – In Viridor’s Annual Environmental Monitoring Report produced in 2013 it was confirmed that “*Landfill gas is managed at the site through an active collection system, comprising a number of extraction wells linked via a polyethylene pipe work system to a Gas Utilisation Plant (GUP). Extracted gas is subsequently utilised within the site’s power generation compound which consists of seven gas engines and three flares.*” In its Annual Operational Report (2014), Viridor confirmed that a total of 6,607,448 normalised cubic metres of landfill gas was combusted in 2013. This gas was assumed to have a methane content of 44%.

In its 2011 Annual Environmental Monitoring Report, Viridor confirmed that “*the total high temperature flaring capacity on site is 5,500Nm³/hr (1 x 2,500 Nm³/hr unit, 1 x 2,000 Nm³/hr unit, and 1 x 1,000Nm³/hr unit)*” and that “*the flare run hours for the period [2011] were 439 hours for Flare 1 and 153 hours for Flare 2*”. Following receipt

of further clarification from the Environment Agency, it was assumed that in 2011 flares operated at a flowrate of 1000 Nm³/hour for 439 hours, and 2000 Nm³/hr for 153 hours, with a methane content of 44%. An average of these two annual combustion figures was used to estimate emissions in 2012. The estimates for 2011 and 2013 are of high confidence. The estimate for 2012 is of medium confidence.

The data for these sites is summarised in Table 1. For the 54 remaining sites records suggested that flares were not in use, or no data are provided to enable gas flaring quantities to be estimated. It has therefore been assumed that no flaring took place at these sites. In cases where sites accepted non-biodegradable waste, this reflects the expected situation.

Table 1: Estimated methane combusted in flares at Environment Agency “Review” landfills in England and Wales (1990 – 2013)

Facility name	Annual CH ₄ combusted in flares (tonnes)								
	1990	2000	2005	2008	2009	2010	2011	2012	2013
Walleys Quarry	0	0	0	0	116	116	116	116	116
Whitemoss Landfill	0	0	0	0	131	131	131	131	131
Shelford Landfill Site	0	0	0	0	0	0	234	1155	2077
Total (high confidence only)	0	0	0	0	0	0	234	0	2077
Total (high and medium confidence)	0	0	0	0	246	246	471	1402	2324

3.2) Environment Agency “Closed” sites

Definition

Environment Agency “Closed” sites are those which accepted biodegradable waste, where the tipping of waste ceased prior to 2001.

List of sites reviewed

Appendix 1 provides a complete list of the closed landfill sites in England and Wales for which documents have been reviewed on the Public Register, as discussed in Section 2.3. The table also provides each sites’ Waste Management Licence issued by the Environment Agency, the year in which this was issued and confirmation of the presence of a ‘Flare’, a ‘Flare & GUP’ or a ‘GUP with standby flare’ as per the GOT database.

Data summary

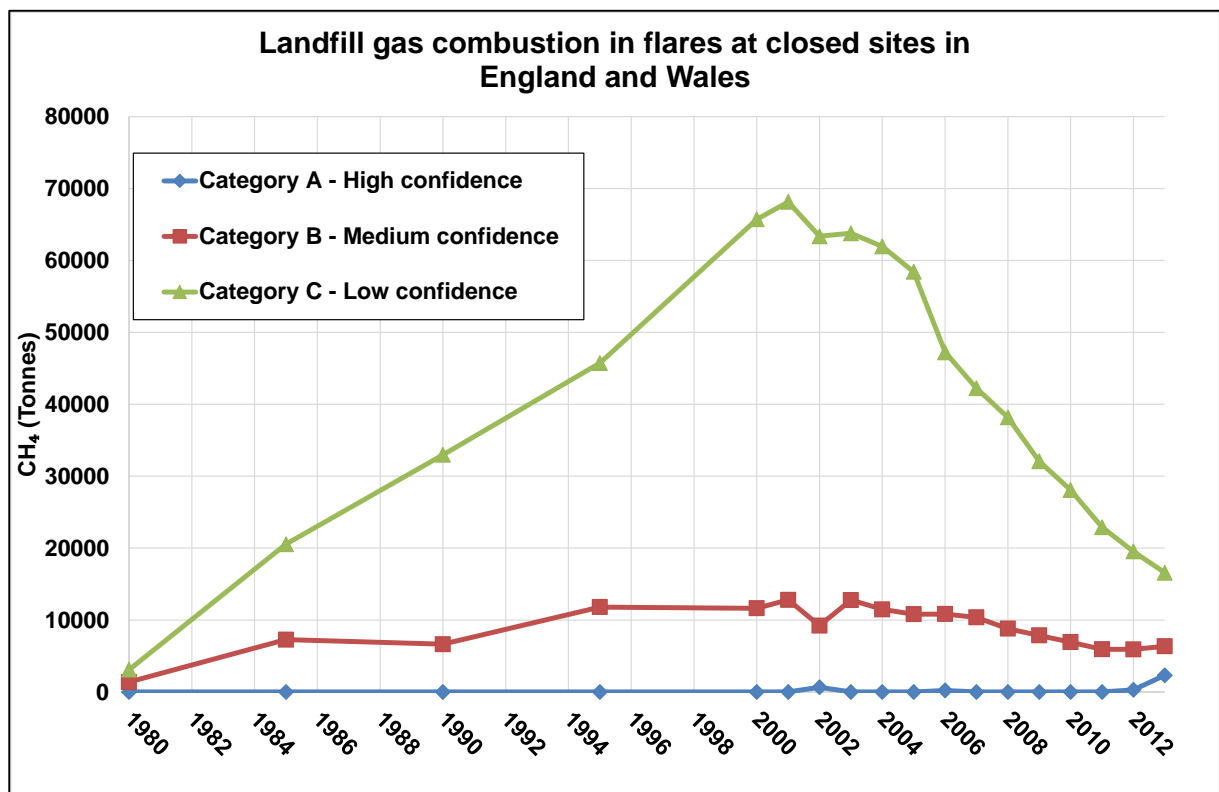
A summary of the methane emission calculations for “Closed” sites in England and Wales are provided in Table 2 and presented in Figure 1. Emissions have been grouped into the following categories based on the data source:

- **Category A:** High confidence: based on sum of raw emissions data only.
- **Category B:** Medium confidence: based on sum of raw emissions data and assumed values based on supporting data.
- **Category C:** Low confidence: based on sum of raw emissions data, assumed values based on supporting data, and assumed values based on licence issue date.

Table 2: Estimated methane combustion at “Closed” landfills in England and Wales (1990 – 2013) (T)

Category	1990	2000	2001	2002	2003	2004	2005	2006
Category C - Low confidence	32976	65717	68150	63374	63786	61947	58419	47229
Category B - Medium confidence	6634	11633	12797	9225	12770	11475	10802	10834
Category A - High confidence	0	0	0	639	0	0	0	208
Category	2007	2008	2009	2010	2011	2012	2013	
Category C - Low confidence	42225	38179	32081	28075	22914	19541	16571	
Category B - Medium confidence	10369	8801	7859	6929	5926	5919	6349	
Category A - High confidence	0	0	0	0	0	288	2311	

Figure 1: Estimated methane combustion at “Closed” landfills in England and Wales (1980 – 2013)



A complete dataset of the methane emission calculations for “Closed” sites in England and Wales is provided in Appendix 2.

3.3) Environment Agency “Closing” sites

Definition

“Closing” sites are those which ceased accepting waste following the implementation of the Landfill Directive, and which are now the focus of an Environment Agency work programme to ensure safe closure of the sites.

List of sites reviewed

This information will be provided separately by the Environment Agency.

Data summary

This information will be provided separately by the Environment Agency.

3.4) Landfill sites in Scotland

Definition

The sites considered in this study were the 50 sites identified by SEPA as having operational flares during 2013,⁴ together with other sites operated by the same operators and/or landfill gas contractors.

List of sites reviewed

The sites reviewed are set out in Appendix 3.

Data summary

The landfill gas flaring data identified for Scottish sites is provided in Table 3. This information is all taken from site-specific data provided by operators, and is considered to be “high confidence.” The database for 2013 provided by SEPA indicates that approximately 18,800 T methane was reported as combusted in landfill gas flares at sites in Scotland. In view of this, it is likely that the data in Table 3 below represents a relatively small proportion of the total quantity of landfill gas flared at Scottish landfill sites.

Table 3: Methane combusted in flares at landfill sites in Scotland (T methane)

Permit or Licence Number	Site Name	2005	2006	2007	2008	2009	2010	2011	2012	2013
PPC/A/1000106	Brandon Howe Landfill								301	160
PPC/A/1000060	Crows Nest Landfill Site, Banchory									776
PPC/A/1004300	West Carron Landfill									22
PPC/E/0020083	Lochhead Landfill Site, Dunfermline			9	57	59	21	45	45	31
PPC/E/0020085	Lower Melville Wood LF, Cupar							60	50	130
PPC/E/0020001	Levenseat Landfill		313	375	Slight	Slight	Slight	Slight	Slight	
WML/N/0020095	Moray Council, Kirkhill LF, Calcots Rd, Elgin						127	134	134	127
PPC/W/0020014	Shewalton Landfill, Area 2			45	13	14	6	43	33	16
WML/W/0020069	Dalmacoulter Landfill Site, Airdrie				8	6	6	8	179	66
PPC/A/1000113	Auchinlea Landfill Site, Bellside, Cleland			392	311	272	162	392	141	191
PPC/A/1000112	Easter Langlee No 2 Landfill Site, Galashiels							17	60	87

Permit or Licence Number	Site Name	2005	2006	2007	2008	2009	2010	2011	2012	2013
PPC/A/1000154	Galdenoch Waste Disposal Site						128	109	598	554
PPC/A/1000155	Aucheninnes Waste Disposal Site						294	98	412	595
PPC/E/0020056	Binn Farm Landfill		5663	1636	437	371	757	1248	353	782
WML/W/0000222	Craignaught Landfill			7	6	16	48	42	7	76
WML/E/0000084	Melville Sand Pit, Lasswade							16	59	21
WML/N/0050036	Longman Landfill Site, Inverness					157	152	122	109	100
PPC/A/1004251	Granish Landfill Site Cell 3, Aviemore					85	148	122	118	118
	Total	0	5976	2463	832	980	1849	2455	2599	3854

Additional information on methane combustion in flares at landfill sites in Scotland in 2013 is provided in the SEPA database.⁴

4) Conclusions and Recommendations

4.1) The UK GHG Inventory

In order to comply with the requirements of the review panel, it is recommended that the UK Greenhouse Gas inventory should use “High Confidence” data set out in chapter 3 above only, combined with the Environment Agency and SEPA site-specific operator records of landfill gas flaring.

The “High Confidence” data obtained during the course of this project are summarised in Table 4. For context, it should be noted that these quantities are small in comparison to the overall methane budget. The discontinuities in these time series arise from the availability of data for individual sites, rather than reflecting actual year on year variation in the amount of methane flared.

Table 4: High confidence landfill gas flaring data

	1990	1995	2000	2001	2002	2003	2004	2005
Methane flared at Environment Agency “Review” sites (tonnes)	0	0	0	0	0	0	0	0
Methane flared at Environment Agency “Closed” sites (tonnes)	0	0	0	0	639	0	0	0
Methane flared at SEPA sites (tonnes)	0	0	0	0	0	0	0	0
Total methane flared (tonnes)	0	0	0	0	639	0	0	0

	2006	2007	2008	2009	2010	2011	2012	2013
Methane flared at Environment Agency “Review” sites (tonnes)	0	0	0	0	0	441	0	2077
Methane flared at Environment Agency “Closed” sites (tonnes)	208	0	0	0	0	0	288	2311
Methane flared at SEPA sites (tonnes)	5976	2463	832	980	1849	2455	2599	3854
Total methane flared (tonnes)	6195	2463	832	980	1849	2896	2886	8241

This record should be updated on receipt of finalised data for “Closing” sites from the Environment Agency. When compiling the UK GHG Inventory, the Environment Agency landfill gas flaring datasets for 2009 to 2013, and the SEPA landfill gas flaring dataset for 2013 should also be taken into account.

The UNFCCC Review Panel suggested an alternative approach based on classification of sites. Our review clearly indicates that there is no realistic prospect of developing an estimate of landfill gas combustion in flares using this approach. This is because of the lack of data to support a classification of landfill sites following the approach suggested by the Review Panel. The data required may potentially include:

- The landfill liner type, thickness and date of installation for each cell
- The landfill cap type, thickness and date of installation for each cell
- Landfill cap maintenance procedures
- Waste density

- The date of installation of the landfill gas collection system, the design of the landfill gas collection system, and its maintenance
- The landfill site geometry (i.e. surface area and depth of landfill cells)

It would also be necessary to have a robust estimate of current and historical landfill gas flaring at sites in different classes based on these aspects: this study indicates that historical data on landfill gas flaring by class of site is unlikely to be available. It is recommended that this approach should not be pursued further.

4.2) Other applications

For other applications, it may be appropriate to use the “Medium confidence” or “Low confidence” data set out in Chapter 3 above.

4.3) Method development

It is recommended that consideration could be given to the default approaches set out in the 2006 Guidelines. The 2006 guidelines state:

“The default value for CH₄ recovery is zero. CH₄ recovery should be reported only when references documenting the amount of CH₄ recovery are available. Reporting based on metering of all gas recovered for energy and flaring, or reporting of gas recovery based on the monitoring of produced amount of electricity from the gas (considering the availability of load factors, heating value and corresponding heat rate, and other factors impacting the amount of gas used to produce the monitored amount of electricity) is consistent with good practice.

Estimating the amount of CH₄ recovered using more indirect methods should be done with great care, using substantiated assumptions. Indirect methods might be based on the number of SWDS in a country with CH₄ collection or the total capacity of utilisation equipment or flaring capacity sold.

When CH₄ recovery is estimated on the basis of the number of SWDS with landfill gas recovery a default estimate of recovery efficiency would be 20 percent ...

When the amount of CH₄ recovered is based on the total capacity of utilisation equipment or flares sold, an effort should be made in order to identify what part of this equipment is still operational. A conservative estimate of amount of CH₄ generated could be based on an inventory of the minimum capacities of the operational utilisation equipment and flares. Another conservative approach is to estimate total recovery as 35 percent of the installed capacities. ... If a country uses this method for flaring, care must be taken to ensure that the flare is not a back-up flare for a gas-to-energy project. Flares should be matched to SWDS wherever possible to ensure that double counting does not occur.”

These approaches could potentially give a more robust estimate of actual methane capture at UK landfill sites for earlier years in view of the minimal availability of country-specific data on landfill methane flaring for the years prior to 2008. However, robust data would be needed on landfill gas engine and flare capacities, which may not be available for the relevant years. Additionally, robust data are available on methane combustion in landfill gas engines for earlier

years and this information is already used in the landfill methane inventory. This would reduce the potential benefit of adopting the default approaches in the 2006 guidelines.

Appendices

Appendix 1: “Review” and “Closed” landfill sites assessed in this project

Appendix 2: Environment Agency “Closed” sites full dataset

Appendix 3: Landfill sites in Scotland included in review

Appendix 1: “Review” and “Closed” landfill sites assessed in this project

Table A1.1 Environment Agency “Review” sites assessed during the review of documents held on the Public Register

Operator name	Facility name
Amec Capital Projects Limited	Rye Loaf Hill Landfill
Lafarge Tarmac Cement and Lime Limited	Cauldon Cement Works
Hills Waste Solutions Limited	Parkgate Farm Waste Management Facility
INEOS ChlorVinyls Limited	Randle Landfill Site
Keadby Generations Ltd	Fiddlers Ferry Ash Lagoons
Lafarge Aggregates Ltd	Walleys Quarry
Singleton Birch Limited	Campwood Landfill Site
Whitaker; Phillip; Rawson; Armitage; Greaves	Tarn Moor Memorial Woodland
Hills Waste Solutions Limited	Purton Landfill Site
North Lincolnshire Council	Conesby Quarry Phase III
Castle Cement Limited	Grange Top Quarry Landfill
Brock PLC	Eardswick Hall Landfill Site
Pinden Limited	Pinden Quarry
Cemex UK Cement Ltd	South Ferriby Works Landfill
Impetus Waste Management Ltd	ICI No 3 Teesport
Impetus Waste Management Ltd	ICI No 2 Teesport
Severn Trent Water Ltd	Minworth Landfill
Booth Ventures Limited	Harwood Quarry Landfill Site
BAE Systems Properties Limited	BAE Systems Landfill
Drax Power Limited	Barlow Mound Ash Disposal Site

Operator name	Facility name
Outokumpu Stainless Ltd	Tinsley Park Works Landfill Site
BPB United Kingdom Limited	Kirkby Thore Works Landfill Site
Cemex UK Cement Ltd	Southam Landfill
Whitemoss Landfill Ltd	Whitemoss Landfill
RWE nPower Plc	Radley Ash Disposal Site
Commercial Recycling Ltd	Southwood Landfill Site
Tilfen Land Limited	Tripcock Point
Lynemouth Power Limited	Alcan Ash Lagoons 1-4
Churchill Enviro Ltd	Fletcher Bank Landfill Site
RWE nPower Plc	Tilbury Ash Disposal Site
Thompsons Of Prudhoe Limited	Springwell Quarry
Rugeley Power Limited	Rugeley Power Station
Magnox Limited	Oldbury-on-Severn Power Station
Castle Cement Limited	Ribblesdale Works
Booth Ventures Limited	Britannia Quarry
Demex Limited	Thornhill Quarry Landfill Site
Bradley Park Waste Management Ltd	Bradley Park Landfill
Darrington Quarries Ltd	Darrington North Landfill
E.ON UK plc	Ironbridge "A" Power Station Landfill
Elementis UK Ltd	Coatham Stob Quarry (Area 6)
Mick George Limited	Witcham Meadlands Landfill
William Lee Ltd	William Lee Landfill Site
Hills Waste Solution Limited	Parkgate Farm Hazardous waste landfill
Westcombe Waste Ltd	Whiscombe Hill Landfill

Operator name	Facility name
Lafarge Cement UK Limited	South Pit Phase 3 Landfill
Sahaviriya Steel Industries UK Limited	CLE 3/8 Landfill Site
Keadby Generation Ltd	Brotherton Ings Ash Disposal
Augean South Limited	East Northants Resource Management Facility
Eggborough Power Ltd	Gale Common Ash Disposal Site
Alab Environmental Services Ltd	Nettleton Bottom Quarry
Cory Environmental (Central) Ltd	Kinderton Landfill Site
British Salt Ltd	Hilltop Farm Brinefields
Viridor Waste Management Ltd	Shelford Landfill Site
Ineos Enterprises Limited	Holford Brinefield Landfill Site
L I Winn and Son Ltd	Herniss Farm
Aylesford Newsprint Services Ltd	Margetts Pit SNRHW Landfill
Himley Environmental Limited	Oak Farm Quarry Landfill

Table A1.2 Details of the closed landfill sites in England and Wales assessed during the review of data stored on the Public Register

Site name	EA Waste Management Licence No.	Licence issued	EA record of landfill gas management
Ayletts Farm Quarry, Rainham	80104	1978	Flare
Bamber Quarry Landfill	19374	1981	Flare
Beenham Stage 4	86034	1982	Flare & GUP
Beighton Landfill Site	61619	1996	Flare & GUP
Betton Abbots Landfill	47054	1994	Flare & GUP
Bickley Ball	21604	1979	Flare
Biffa Dosthill Landfill Site	42000	1997	Flare
Biffa - Marchington Landfill Site	42355	1993	Flare & GUP
Birchwood House Farm	19837	1998	Flare
Bolam Quarry	67008	1977	Flare & GUP
Bothenhampton Landfil	23529	1993	Flare
Bowmans Harbour	42367	Unknown	Flare
Bramshill Landfill, Eversley	83052	1996	Flare
Brenkley Quarry Landfill Site	67482	1991	Flare & GUP
Brixworth Landfill	70580	1992	Flare & GUP
Burnhills - Phase 1	67443	1984	Flare
Burnhills Quarry Landfill Site	67466	1992	Flare & GUP
Carlin Howe Farm	60132	1995	Flare
Carlton Forest Quarry	43196	1986	Flare & GUP
Chadderton Landfill Site	53651	1995	Flare & GUP
Chapmans Well Waste Disposal Site	67192	1992	Flare & GUP
Chavey Down, Bracknell	83011	1980	Flare & GUP

Site name	EA Waste Management Licence No.	Licence issued	EA record of landfill gas management
City Of Stoke On Trent - Newford Valley	41520	1985	Flare
Clayton Hall Sand Quarry L F S	54010	1977	Flare & GUP
Coalmoor Landfill Site	47013	1991	Flare
Cockfield Waste Disposal Site	67127	1985	Flare
Colnbrook By-pass, Hillingdon	80024	1985	Flare
Combebow Landfill Site	20751	1977	Flare
Corby Inert Landfill Site	73044	1987	Flare
Cotestones L F S	54100	1993	Flare
Cowpen Bewley Landfill	60091	1977	Flare & GUP
Crawcrook Quarry	67548	1993	Flare
Derbyshire C C - Birchwood Quarry	41818	1994	Flare
Docking Landfill	70441	1992	Flare
Douglas Road Landfill Site	61620	1996	Flare
Duckworth Clough Landfill Site	53745	1994	Flare
Enderby Warren	43366	1981	Flare & GUP
Eye Quarry - Northern Extension	73011	1982	Flare
Flint Grit Pond	70328	1993	Flare & GUP
Frankham Waste Disposal Site	67387	1993	Flare
Gamblethorpe Landfill	65168	1996	Flare & GUP
Glapwell Landfill Site	61928	2006	GUP with standby flare
Griff No 2 Landfill Site	41602	1986	Flare
Harecrag Waste Disposal Site	67388	1993	Flare

Site name	EA Waste Management Licence No.	Licence issued	EA record of landfill gas management
Harnhill Quarry Landfill Site	27257	1979	Flare & GUP
Heathfield South	21729	1990	Flare & GUP
Henthorn Road Landfill Site	54102	1993	Flare
Himley Wood Landfill	46148	1996	Flare & GUP
Hines Pit	23630	1981	Flare
Holbury 2	19875	1987	Flare
Holwood Quarry Landfill Site	20531	1993	Flare
Hook Lane Landfill Site	19937	1996	Flare
Howden Clough Landfill Site	65118	1989	Flare & GUP
Howley Park Landfill	61400	1993	Flare
Ibstock Brick - Redhurst Quarry	42220	1992	Flare
Kibblesworth Quarry Landfill Site	67534	1993	Flare
Kirkless Landfill Site	54231	1993	Flare & GUP
Lillyhall Landfill Stage 2	57099	1983	GUP with standby flare
Longford I I, Poyle	83081	1989	Flare
Lount Landfill Site	43248	1993	GUP with standby flare
Lower Spen Valley	61058	1996	Flare
Marley Landfill Facility	10009	1982	Flare
Marley Tile Stage 3	86035	1982	Flare & GUP
Medebridge Road Landfill	70281	1990	Flare & GUP
Mexborough Landfill	60870	1993	Flare
Mickleby Landfill Site	60180	1996	Flare
Midgeland Farm	54049	Unknown	Flare

Site name	EA Waste Management Licence No.	Licence issued	EA record of landfill gas management
Norlands Lane, Thorpe	83063	1977	Flare & GUP
Nuttingswood - High Heavens	86067	Unknown	Flare
Odcombe Waste Disposal Site	27114	1981	Flare
Old Rodmell Cement Works	19621	1981	Flare
Onyx Leigh Environmental Limited	61929	1991	Flare
Otterham Landfill	19412	1982	Flare
Pakefield Landfill	70722	1987	Flare
Parbold & West Quarry	54018	1981	Flare
Pickeridge Farm Quarry, Fulmer	80000	1988	Flare
Pluckley Brickworks	19538	1985	Flare & GUP
Poole Brickworks Landfill	27115	1978	Flare & GUP
Poundbottom Landfill - Licence B	19994	1992	Flare
Rakehead Lane Landfill Site	53552	Unknown	Flare
Ridge Landfill Site	19814	1993	Flare
Runfold South Landfill & Quarry	83115	1978	Flare & GUP
Rushton Landfill	70608	1978	Flare & GUP
S W S Landfill	60076	1990	Flare
Sandy Cross, Seale, Farnham	83040	Unknown	Flare & GUP (permitted)
Scorton Landfill Site	68724	1993	Flare & GUP
Seale Lodge Sandpit, Seale, Farnham	83041	1989	Flare & GUP (permitted)
Sidegate Lane Landfill	70670	1992	Flare & GUP
Sisters Waste Disposal Site	67391	1993	Flare
Smallmead Farm	86029	1980	Flare & GUP

Site name	EA Waste Management Licence No.	Licence issued	EA record of landfill gas management
Somerley Landfill	23505	1993	Flare & GUP
Soothill Brickworks	61204	1984	Flare
South Walney Landfill	57213	1993	Flare & GUP
Southleigh Landfill Site	19870	1995	Flare & GUP
St Bedes Brickworks	67155	1990	Flare & GUP
Staffordshire C C Bemersley Landfill Site	41020	1980	Flare
Staffordshire C C - Fowlchurch Landfill Site	42351	1993	Flare
Staines Road Farm, Shepperton	83104	Unknown	Flare
Stangate Landfill	19508	1981	Flare
Stoke Hill	21683	1979	Flare
Stourhill Quarry Landfill	46032	Unknown	Flare
Sutton Barton Landfill & Civic Amenity Site	21675	1981	Flare
Sutton Wick	86227	1986	Flare & GUP (permitted)
Sutton Wick 2	86137	1986	Flare
Sutton Wick 2 Extension	86142	1990	Flare
Tanhouse Farm, Colnbrook	83085	1989	Flare
Tenement Lane Landfill Site	53505	1998	Flare
Thornton Fields Farm	60098	1986	Flare
Tiscott Wood Landfill Site	20549	1992	Flare
Trumps Farm Landfill Virginia Water	83065	1994	GUP with standby flare
Ulnes Walton L F S, Phase 1	54098	1993	Flare

Site name	EA Waste Management Licence No.	Licence issued	EA record of landfill gas management
Ulmes Walton L F S, Phase 2	54280	1997	Flare & GUP
Mountsorrel Quarry	43281	Unknown	Flare
Vigo Utopia Landfill Site	42628	1996	Flare & GUP
W R G Bretby No 1 Landfill Site	42656	1989	Flare & GUP
Ware Quarry	80208	1979	Flare & GUP
Warmwell Quarry (Camas)	23615	1991	Flare
Warmwell Quarry North	23674	1997	Flare & GUP
Welford Quarry Landfill	48092	1990	Flare & GUP
West & Parbold Quarries Landfill Site	54017	1981	Flare
West Lodge	60161	Unknown	Flare
West Tanfield Landfill	66008	1993	Flare
West Tanfield Quarries	68657	1987	Flare
Westbury Landfill	27129	1987	Flare & GUP
Whistley Court	83152	1988	Flare
Whites Pit (northern Area)	23629	1985	Flare & GUP
Windmill Quarry Landfill Site	19679	1986	Flare & GUP
Wooton Quarry	70647	1992	GUP with standby flare

Appendix 2: Environment Agency “Closed” sites full dataset

Key

	Assumed values based on licence issue date only Low confidence		Values based on raw data. High confidence
	Assumed values based on background data. Medium confidence		Estimation not possible.

Site name	Time-series (Tonnes methane flared per year)																		
	1980	1985	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	
Ayletts Farm Quarry, Rainham	0	0	0	0	0	0	0	0	1373	1373	1373	1373	1373	1373	1373	1373	1373	1373	
Bamber Quarry Landfill	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Beenham Stage 4	0	116	116	101	29	14	0	0	0	0	0	0	0	0	0	0	0	0	
Beighton Landfill	0	0	0	0	116	116	116	116	116	116	116	116	116	101	87	72	58	43	
Betton Abbots Landfill	0	0	0	0	116	116	116	116	116	116	116	101	87	72	58	43	29	14	
Bickley Ball	0	1308	1308	1308	619	551	482	413	344	275	206	138	69	0	0	0	0	0	
Biffa Dosthill Landfill	0	0	0	0	1373	1373	1373	1373	1373	1373	1373	1373	1373	1373	650	578	506	434	
Biffa - Marchington Landfill	0	0	0	0	116	116	116	116	116	116	101	87	72	58	43	29	14	0	
Birchwood House Farm	0	0	0	0	0	1373	1373	1373	1373	1373	1373	1373	1373	1373	1373	650	578	506	
Bolam Quarry	116	116	101	29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Bothenhampton Landfill	0	0	0	0	1373	1373	1373	1373	1373	1373	650	578	506	434	361	289	217	145	
Bowmans Harbour	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Bramshill Landfill, Eversley	0	0	0	0	1373	1373	1373	1373	1373	1373	1373	1373	1373	1373	650	578	506	434	
Brenkley Quarry Landfill	0	0	0	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	
Brixworth Landfill	0	0	0	1373	116	116	116	116	116	116	116	101	87	72	58	43	29	14	
Burnhills - Phase 1	0	0	1373	1373	434	361	289	217	145	72	0	0	0	0	0	0	0	0	
Burnhills Quarry Landfill	0	0	0	116	116	116	116	116	116	101	87	72	58	43	29	14	0	0	
Carlin Howe Farm	0	0	0	0	1373	1373	1373	1373	1373	1373	1373	1373	650	578	506	434	361	289	
Carlton Forest Quarry	0	0	116	116	1156	1012	867	723	578	434	289	145	0	0	0	0	0	0	
Chadderton Landfill	0	0	0	0	116	116	116	116	116	116	116	116	101	87	72	58	43	29	
Chapmans Well Waste	0	0	0	116	116	116	116	116	116	101	87	72	58	43	29	14	0	0	
Chavey Down, Bracknell	0	116	116	116	87	72	58	43	29	14	0	0	0	0	0	0	0	0	
City Of Stoke On Trent - Newford Valley	0	0	1373	1373	506	434	361	289	217	145	72	0	0	0	0	0	0	0	

Site name	Time-series (Tonnes methane flared per year)																	
	1980	1985	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Clayton Hall Sand Quarry Landfill	116	116	101	29	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coalmoor Landfill	0	0	0	1373	1373	1373	1373	1373	650	578	506	434	361	289	217	145	72	0
Cockfield Waste Disposal	0	0	1373	1373	506	434	361	289	217	145	72	0	0	0	0	0	0	0
Colnbrook By-pass, Hillingdon	0	1373	1373	1373	434	361	289	217	145	72	0	0	0	0	0	0	0	0
Combebow Landfill	1373	1373	1373	1373	1373	1373	1373	1373	650	578	506	434	361	289	217	145	72	0
Corby Inert Landfill	0	0	0	0	0	1373	1373	1373	1373	1373	1373	1373	1373	1373	1373	650	578	506
Cotestones L F S	0	0	0	0	287	287	287	287	287	287	287	287	287	287	287	287	288	287
Cowpen Bewley Landfill	116	116	101	29	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crawcrook Quarry	0	0	0	0	1373	1373	1373	1373	1373	1373	650	578	506	434	361	289	217	145
Derbyshire C C - Birchwood	0	0	0	0	208	208	208	208	208	208	208	99	88	77	66	55	44	33
Docking Landfill	0	0	0	1373	1373	1373	1373	1373	1373	650	578	506	434	361	289	217	145	72
Douglas Road Landfill	0	0	0	0	1373	1373	1373	1373	1373	1373	1373	1373	1373	650	578	506	434	361
Duckworth Clough Landfill	0	0	0	0	1373	1373	1373	1373	1373	1373	1373	650	578	506	434	361	289	217
Enderby Warren	0	116	116	1156	434	289	145	0	0	0	0	0	0	0	0	0	0	0
Eye Quarry - Northern Extension	0	0	0	434	72	0	0	0	0	0	0	0	0	0	0	0	0	0
Flint Grit Pond	0	0	0	0	116	116	116	116	116	116	101	87	72	58	43	29	14	0
Frankham Waste Disposal	0	0	0	0	0	0	0	1635	1635	1635	1635	1635	1635	1635	1635	1635	1635	774
Gamblethorpe Landfill	0	0	0	0	116	116	116	116	116	116	116	116	116	101	87	72	58	43
Glapwell Landfill	0	0	0	0	0	0	0	0	0	0	116	116	116	116	116	116	116	116
Griff No 2 Landfill	0	0	0	0	1373	1373	1373	1373	1373	1373	1373	1373	650	578	506	434	361	289
Harecrag Waste Disposal	0	0	0	0	1373	1373	1373	1373	1373	1373	650	578	506	434	361	289	217	145
Harnhill Quarry Landfill	0	116	116	58	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Heathfield South	0	0	0	116	116	116	116	101	87	72	58	43	29	14	0	0	0	0
Henthorn Road Landfill	0	0	0	0	1373	1373	1373	1373	1373	1373	650	578	506	434	361	289	217	145
Himley Wood Landfill	0	0	0	0	116	116	116	116	116	116	116	116	116	101	87	72	58	43
Hines Pit	0	1373	1373	578	217	145	72	0	0	0	0	0	0	0	0	0	0	0
Holbury 2	0	0	1373	1373	650	578	506	434	361	289	217	145	72	0	0	0	0	0
Holwood Quarry Landfill	0	0	0	0	1373	1373	1373	1373	1373	1373	650	578	506	434	361	289	217	145
Hook Lane Landfill	0	0	0	0	1373	1373	1373	1373	1373	1373	1373	1373	1373	650	578	506	434	361
Howden Clough Landfill	0	0	0	116	116	116	101	87	72	58	43	29	14	0	0	0	0	0
Howley Park Landfill	0	0	0	0	1373	1373	1373	1373	1373	1373	650	578	506	434	361	289	217	145

Site name	Time-series (Tonnes methane flared per year)																	
	1980	1985	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Ibstock Brick - Redhurst Quarry	0	0	0	1373	1373	1373	1373	1373	1373	650	578	506	434	361	289	217	145	72
Kibblesworth Quarry Landfill	0	0	0	0	1373	1373	1373	1373	1373	1373	650	578	506	434	361	289	217	145
Kirkless Landfill	0	0	0	0	116	116	116	116	116	116	101	87	72	58	43	29	14	0
Lillyhall Landfill Stage 2	0	0	116	116	43	29	14	0	0	0	0	0	0	0	0	0	0	0
Longford II, Poyle	0	0	0	0	1373	1373	1373	1373	1373	1373	1373	1373	1373	650	578	506	434	361
Lount Landfill	0	0	0	0	116	116	116	116	116	116	101	87	72	58	43	29	14	0
Lower Spen Valley	0	0	0	0	1373	1373	1373	1373	1373	1373	1373	1373	1373	650	578	506	434	361
Marley Landfill Facility	0	1373	1373	650	289	217	145	72	0	0	0	0	0	0	0	0	0	0
Marley Tile Stage 3	0	116	116	101	29	14	0	0	0	0	0	0	0	0	0	0	0	0
Medebridge Road Landfill	0	0	0	116	116	116	116	101	87	72	58	43	29	14	0	0	0	0
Mexborough Landfill	0	0	0	0	1373	1373	1373	1373	1373	1373	650	578	506	434	361	289	217	145
Mickleby Landfill	0	0	0	0	1373	1373	1373	1373	1373	1373	1373	1373	1373	650	578	506	434	361
Midgeland Farm	0	0	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94
Norlands Lane, Thorpe	1373	1373	650	289	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nuttingswood - High Heavens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Odcombe Waste Disposal	0	1373	1373	1373	1373	1373	116	116	116	116	116	116	116	116	116	116	101	87
Old Rodmell Cement Works	0	1373	1373	578	217	145	72	0	0	0	0	0	0	0	0	0	0	0
Onyx Leigh Environmental Limited	0	0	0	1373	1373	1373	1373	1373	1373	1373	1373	1373	1373	1373	1373	1373	1373	1373
Otterham Landfill	0	1373	1373	650	289	217	145	72	0	0	0	0	0	0	0	0	0	0
Pakefield Landfill	0	0	1373	1373	650	578	506	434	361	289	217	145	72	0	0	0	0	0
Parbold & West Quarry	0	1373	1373	578	217	145	72	0	0	0	0	0	0	0	0	0	0	0
Pickeridge Farm Quarry, Fulmer	0	0	0	1373	1373	650	578	506	434	361	289	217	145	72	0	0	0	0
Pluckley Brickworks	0	0	116	116	72	58	43	29	14	0	0	0	0	0	0	0	0	0
Poole Brickworks Landfill	0	0	1308	1373	2027	2027	116	116	116	116	116	116	116	116	116	116	101	87
Poundbottom Landfill - Licence B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rakehead Lane Landfill	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ridge Landfill	0	0	0	0	1373	1373	1373	1373	1373	1373	650	578	506	434	361	289	217	145
Runfold South Landfill &	0	1373	1373	1373	1373	1373	1373	1373	1373	1373	1373	116	116	116	116	116	116	116
Rushton Landfill	0	116	116	43	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S W S Landfill	0	0	0	883	883	883	639	1555	1555	1555	1555	1288	1288	1288	1288	1288	1288	1288

Site name	Time-series (Tonnes methane flared per year)																	
	1980	1985	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Sandy Cross, Seale, Farnham	0	0	0	116	116	101	87	72	58	43	29	14	0	0	0	0	0	0
Scorton Landfill	0	0	0	0	116	116	116	116	116	116	101	87	72	58	43	29	14	0
Seale Lodge Sandpit, Seale, Farnham Gu10	0	0	0	116	116	116	101	87	72	58	43	29	14	0	0	0	0	0
Sidegate Lane Landfill	0	0	0	1373	116	116	116	116	116	116	116	101	87	72	58	43	29	14
Sisters Waste Disposal	0	0	0	0	1373	1373	1373	1373	1373	1373	650	578	506	434	361	289	217	145
Smallmead Farm	0	116	116	72	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Somerley Landfill	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Soothill Brickworks	0	0	1373	1373	434	361	289	217	145	72	0	0	0	0	0	0	0	0
South Walney Landfill	0	0	0	0	116	116	116	116	116	116	101	87	72	58	43	29	14	0
Southleigh Landfill	0	0	0	0	116	116	116	116	116	116	116	101	87	72	58	43	29	14
St Bedes Brickworks	0	0	0	116	116	116	116	101	87	72	58	43	29	14	0	0	0	0
Staffordshire C C Bemersley Landfill	0	0	0	0	0	785	785	785	785	785	785	785	785	785	785	372	330	289
Staffordshire C C - Fowlchurch Landfill	0	0	0	0	1373	1373	1373	1373	1373	1373	650	578	506	434	361	289	217	145
Staines Road Farm, Shepperton	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stangate Landfill	0	1373	1373	1373	1373	1373	1373	1373	1373	1373	1373	1373	1373	1373	1373	1373	1373	2217
Stoke Hill	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stourhill Quarry Landfill	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sutton Barton Landfill & Civic	0	1373	1373	1373	578	506	434	361	289	217	145	72	0	0	0	0	0	0
Sutton Wick	0	0	116	116	87	72	58	43	29	14	0	0	0	0	0	0	0	0
Sutton Wick 2	0	0	0	0	361	289	217	145	72	0	0	0	0	0	0	0	0	0
Sutton Wick 2 Extension	0	0	0	1373	1373	1373	1373	650	578	506	434	361	289	217	145	72	0	0
Tanhouse Farm, Colnbrook	0	0	0	0	0	0	0	654	654	654	654	654	654	654	654	654	654	310
Tenement Lane Landfill	0	0	0	0	0	1373	1373	1373	1373	1373	1373	1373	1373	1373	1373	650	578	506
Thornton Fields Farm	0	0	1373	1373	578	506	434	361	289	217	145	72	0	0	0	0	0	0
Tiscott Wood Landfill	0	0	0	654	654	654	654	654	654	310	275	241	206	172	138	103	69	34
Trumps Farm Landfill	0	0	0	0	116	116	116	116	116	116	116	116	101	87	72	58	43	29
Ulnes Walton L F S, Phase 1	0	0	0	0	1373	1373	1373	1373	1373	1373	650	578	506	434	361	289	217	145
Ulnes Walton L F S, Phase 2	0	0	0	0	116	116	116	116	116	116	116	116	116	116	101	87	72	58
Mountsorrel Quarry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vigo Utopia Landfill	0	0	0	0	0	48	48	48	48	48	48	48	48	48	48	42	36	30

Site name	Time-series (Tonnes methane flared per year)																	
	1980	1985	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
W R G Bretby No 1 Landfill	0	0	0	116	116	116	1301	1156	1012	867	723	578	434	289	145	0	0	0
Ware Quarry	0	231	231	116	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Warmwell Quarry (Camas)	0	0	0	650	289	217	145	72	0	0	0	0	0	0	0	0	0	0
Warmwell Quarry North	0	0	0	0	116	116	116	116	116	116	116	116	116	116	101	87	72	58
Welford Quarry Landfill	0	0	0	116	116	116	116	101	87	72	58	43	29	14	0	0	0	0
West & Parbold Quarries	0	1373	1373	1373	1373	1373	1373	1373	1373	1373	1373	1373	1373	1373	1373	1373	650	578
West Lodge	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
West Tanfield Landfill	0	0	0	0	1373	1373	1373	1373	1373	1373	650	578	506	434	361	289	217	145
West Tanfield Quarries	0	0	1373	1373	650	578	506	434	361	289	217	145	72	0	0	0	0	0
Westbury Landfill	0	0	116	116	101	87	72	58	43	29	14	0	0	0	0	0	0	0
Whistley Court	0	0	0	1373	1373	1373	650	578	506	434	361	289	217	145	72	0	0	0
Whites Pit (northern Area)	0	0	116	116	36	29	22	14	7	0	0	0	0	0	0	0	0	0
Windmill Quarry Landfill	0	0	116	116	87	72	58	43	29	14	0	0	0	0	0	0	0	0
Wooton Quarry	0	0	0	116	116	116	116	116	116	101	87	72	58	43	29	14	0	0
Total – Low confidence	3093	20546	32976	45722	65806	68239	63464	63875	62036	58508	47318	42267	38217	32114	28104	22937	19559	16585
Total – Medium confidence	1373	7263	6634	11797	11633	12797	9225	12770	11475	10802	10923	10369	8801	7859	6929	5926	5918	6349
Total – High confidence	0	0	0	0	0	0	639	0	0	0	208	0	0	0	0	0	288	2311

Appendix 3: Landfill sites in Scotland included in review

Permit or Licence Number	Site Name and Address		Status	SiteActivity	2013 Flare Data
WML/N/0020016	Aberdeen City Council	Ness Farm Landfill, Aberdeen	Closed		N
WML/N/0020091	Aberdeenshire Council	Govals Quarry Landfill Site, Lumsden	Closed		N
PPC/A/1000106	Aberdeenshire Council	Brandon Howe Landfill	Closed		Y
PPC/A/1000060	Aberdeenshire Council	Crows Nest Landfill Site, Banchory	Closed	Non-hazardous	Y
WML/N/0020036	Aberdeenshire Council	Millmoss Landfill Site, Turrif	Closed		N
WML/N/0020065	Aberdeenshire Council	Burnside Quarry Landfill	Closed		N
WML/W/0020043	Argyll & Bute Council	Moleigh LFS & CASite, Ariogan, Oban	Closed		Y
PPC/E/0020086	Avondale Environmental Ltd	Avondale Hazardous Landfill Site, Polmont	Authorised	Hazardous	N
PPC/E/0020059	Avondale Environmental Ltd	Avondale Landfill, Polmont	Authorised	Non-Hazardous	Y
WML/W/0000251	Barr Environmental Ltd	Clayshant Landfill, Sandhead, Stranraer	Closed		N
PPC/W/0020026	Barr Environmental Ltd	Auchencarroch Landfill, Alexandria	Authorised	Non-Hazardous	Y
PPC/W/0020019	Barr Environmental Ltd	Garlaff Landfill Sites, Skares Road, Cumnock	Authorised	Non-Hazardous	Y
WML/W/0000240	Barr Environmental Ltd	Hollybush Farm Landfill Site	Closed		N
PPC/A/1004300	Central Demolition (Recycling) Ltd	West Carron Landfill	Authorised	Non-Hazardous	Y
WML/E/0020023	Clackmannanshire Council	Black Devon Landfill Site, Alloa	Closed		Y
WML/W/0020013	Dumfries & Galloway Council	Locharmoss Waste Disposal Site, Dumfries	Closed		Y
WML/W/0020024	Dumfries & Galloway Council	Blacks Plantation Landfill, Whithorn	Closed		N
WML/W/0020016	Dumfries & Galloway Council	Sanquhar Landfill Site	Closed		N
WML/W/0020018	Dumfries & Galloway Council	Gatelawbridge Landfill Site, Thornhill	Closed		N
WML/W/0020008	Dumfries & Galloway Council	Corsehill Landfill Site, Annan	Closed		N
WML/W/0000262	Dumfries & Galloway Council	Lochwhinyeon (sludge lagoon), Twynholm	Closed		N
PPC/E/0020083	Fife Council	Lochhead Landfill Site, Dunfermline	CurrentlyAuthorised	Non-Hazardous	Y
PPC/E/0020085	Fife Council	Lower Melville Wood LF, Cupar	CurrentlyAuthorised	Non-Hazardous	Y
WML/E/0000265	Fife Council	Fife Council, Lochty Park LF, Glenrothes	Closed		N
WML/W/0020035	Glasgow City Council	Summerston Landfill	Closed		Y
WML/W/0000049	Glasgow City Council	Wilderness Quarry, Bishopbriggs	Closed		N
WML/W/0000101	Glasgow City Council	Cathkin Quarry, East Kilbride	Closed		Y

Permit or Licence Number	Site Name and Address		Status	SiteActivity	2013 Flare Data
PPC/W/0020063	Glasgow City Council	South Cathkin Landfill Site	Authorised	Non-Hazardous	N
WML/E/0000047	Levenseat Ltd	Muldron Quarry, near Fauldhouse, West Lothian	Closed		N
PPC/E/0020001	Levenseat Ltd	Levenseat Landfill	Authorised	Non-Hazardous	Y
PPC/A/1008897	Levenseat Ltd	Torphin Quarry, Harburn, West Calder	Authorised	Inert	Y
WML/E/0000058	Levenseat Ltd	Torphin Quarry, by Harburn, West Lothian	Authorised		N
PPC/N/0050031	Locheil Logistics Ltd	Duisky Landfill Site, Kinlocheil, FortWilliam	Authorised	Non-Hazardous	Y
WML/E/0020047	Midlothian Council	Drummond Moor (No1) Landfill Site, Penicuik	Closed		Y
WML/N/0020095	Moray Council	Moray Council, Kirkhill LF, Calcots Rd, Elgin	Closed		N
PPC/N/0020028	Moray Council	Nether Dallachy Landfill Site	Authorised	Non-Hazardous	Y
WML/N/0050038	Moray Council	Newtyle Landfill Site, Forres	Closed		N
WML/W/0020057	North Ayrshire Council	Brodick Landfill Site, Isle of Arran	Closed		N
WML/W/0020058	North Ayrshire Council	Nethermains Landfill, (Phase III), Irvine	Closed		N
PPC/W/0020014	North Ayrshire Council	Shewalton Landfill, Area 2	Authorised	Non-Hazardous	Y
WML/W/0020059	North Ayrshire Council	Shewalton LS, Irvine	Closed		N
WML/W/0020069	North Lanarkshire Council	Dalmacoultter Landfill Site, Airdrie	Closed		Y
PPC/A/1000113	North Lanarkshire Council	Auchinlea Landfill Site, Bellside, Cleland	Authorised	Non-Hazardous	Y
WML/W/0000172	Patersons Of Greenhead Ltd	Greenhead Moss LF Phase2, Waterloo	Closed		N
PPC/W/0020046	Patersons of Greenoakhill Ltd	Greenoakhill Landfill, Mount Vernon, Glasgow	Authorised	Non-Hazardous	Y
WML/E/0000139	Scottish Borders Council	Caddonlee Farm Railway Cutting Landfill,	Closed		N
PPC/A/1000112	Scottish Borders Council	Easter Langlee No 2 Landfill Site, Galashiels	Authorised	Non-Hazardous	Y
WML/E/0000141	Scottish Borders Council	Corsbie Dean, Berwickshire	Closed		N
WML/E/0020100	Scottish Borders Council	Dunionhill Landfill Site, Jedburgh	Closed		Y
WML/E/0020101	Scottish Borders Council	Preston Cleugh Landfill Site, Preston	Closed		Y
PPC/A/1004252	Scottish Water	Broadside Landfill	Authorised	Non-Hazardous	N
WML/E/0000299	Scottish Water	Craggans Landfill, Crieff	Closed		N
WML/E/0000306	Scottish Water	Water, Killiecrankie WTW, Pitlochry	Closed		N

Permit or Licence Number	Site Name and Address		Status	SiteActivity	2013 Flare Data
WML/E/0000085	Scottish Water	Upperside Quarry, near Temple, Midlothian	Closed		Y
WML/N/0020061	Scottish Water	Lumsden, Aberdeenshire	Closed		N
WML/W/0000283	Scottish Water	Laurieston Forest, Sludge Disposal Site	Closed		N
WML/N/0020097	Scottish Water Contracting	Elfhill Landfill Site, Easterton, Elgin	Closed		N
WML/E/0000236	Scottish Water Contracting	Lochcraigs Quarry LF, Lintrathen	Closed		N
WML/W/0020120	Scottish Water Contracting	WML Landfill, Carbarns WWTW	Closed		N
PPC/A/1004281	Shanks Argyll & Bute Ltd	Lingerton Landfill Site	Authorised	Non-Hazardous	Y
PPC/A/1004280	Shanks Argyll & Bute Ltd	Dalinelongart Landfill Site, Sandbank, Dunoon	Authorised	Non-Hazardous	N
WML/N/0020151	Shanks Northern Ltd	Tarbothill Farm Landfill Site	Closed		Y
PPC/A/1000154	Shanks Waste Management Ltd	Galdenoch Waste Disposal Site	Authorised	Non-Hazardous	Y
PPC/A/1000155	Shanks Waste Management Ltd	Aucheninnes Waste Disposal Site	Closed	Non-hazardous	Y
PPC/N/0020009	SITA North East Ltd	Hill of Tramaud Landfill Site, Bridge of Don	Closed	Non-hazardous	Y
PPC/E/0020056	SITA UK Ltd	Binn Farm Landfill	Authorised	Non-Hazardous	Y
PPC/W/0020008	Smith Skip Ltd	Knowes Farm IV Landfill Site	Authorised	Non-Hazardous	Y
WML/W/0000074	Smith Skip Ltd	Smith Skip Ltd, Knowes Farm, Beith	Closed		N
WML/E/0020076	Stirling Council	Lower Polmaise Landfill Site, Stirling	Closed	Non-hazardous	Y
PPC/N/0020010	Stoneyhill Waste Management Ltd	Stoneyhill Landfill Site	Authorised	Non-Hazardous	Y
PPC/A/1000116	Straid Farm Ltd	Straid Farm Landfill Site	Authorised	Non-Hazardous	Y
PPC/A/1000105	Tarbolton Landfill Ltd	Tarbolton Landfill, Mauchline	Authorised	Non-Hazardous	Y
WML/W/0000222	Tarmac Ltd	Craignaught Landfill	Restoration		Y
WML/E/0000084	Tarmac Ltd	MelvilleSand Pit, Lasswade	Closed		Y
WML/N/0050024	The Highland Council	Rassay LFS, Osaig, Creachan	Closed		N
WML/N/0050037	The Highland Council	RC&TS, Gairloch, WesterRoss	Closed		N
WML/N/0050027	The Highland Council	LFS Brackletter, bySpeanBridge	Closed		N
PPC/A/1000148	The Highland Council	Seater Landfill Site, Bower, by Wick	Authorised	Non-Hazardous	Y
WML/N/0050107	The Highland Council	SouthHead LFS, WickHarbour, Wick	Closed		N
WML/N/0050051	The Highland Council	CASite/LFS Portree, Dunvegan Rd, Portree	Closed		N
WML/N/0050026	The Highland Council	LFS Killchoan, Lighthouse Road	Closed		N
WML/N/0050047	The Highland Council	LFS, Torbreck Landfill, , Lochinver	Closed		N
WML/N/0050050	The Highland Council	RC&TS, Strathain, Ullapool, Ross-shire	Closed		N

Permit or Licence Number	Site Name and Address		Status	SiteActivity	2013 Flare Data
WML/N/0050057	The Highland Council	Rhiconich LFS, Sutherland	Closed		N
WML/N/0050058	The Highland Council	Tongue LFS, Tongue, Sutherland	Closed		N
WML/N/0050003	The Highland Council	toneyfield LFS, Newmore, Invergordon	Closed		N
WML/N/0050036	The Highland Council	Longman Landfill Site, Inverness	Closed		Y
WML/N/0050059	The Highland Council	Bettyhill LFS, Bettyhill, Sutherland	Closed		N
WML/N/0050060	The Highland Council	Melvich LFS, Melvich, Sutherland	Closed		N
WML/N/0050044	The Highland Council	LFS, Ardachu, Brora, Sutherland	Closed		N
WML/N/0050048	The Highland Council	LFS, Crofthaugh, Brora, Sutherland	Closed		N
PPC/A/1004251	The Highland Council	Granish Landfill Site Cell 3, Aviemore	Authorised	Non-Hazardous	Y
WML/N/0020098	The Highland Council	Granish L/F, Aviemore, Inverness	Closed		N
WML/E/0020114	Uk Waste Management Ltd	Wellbank Quarry LF, Dundee	Closed		Y
PPC/A/1004241	Viridor Waste Management Ltd	Rigmuir Landfill Site, East Kilbride	Authorised	Non-Hazardous	Y
PPC/E/0020058	Viridor Waste Management Ltd	Dunbar Landfill, Dunbar	Authorised	Non-Hazardous	Y
PPC/W/0020041	Waste Recycling Group (Scotland) Ltd	Greengairs Landfill, Greengairs, Airdrie	Authorised	Non-Hazardous	Y
WML/E/0000109	Waste Recycling Group (Scotland) Ltd	Kaimes Quarry Landfill Site, Kirknewton	Closed		Y
PPC/E/0020057	Waste Recycling Group (Scotland) Ltd	OatslieSandpit Landfill, Roslin, Cleugh Road	Closed	Non-hazardous	Y
PPC/E/0020007	Waste Recycling Group (Scotland) Ltd	DrummondMoor (No2) Landfill Site, Roslin	Authorised	Non-Hazardous	N
WML/E/0020192	Waste Recycling Group (Scotland) Ltd	DrummondMoor (No2) L/F, Rosewell, Midlothian	Closed		N
WML/W/0000064	WH Malcolm Ltd	Gartshore 9/11 SoilsTip, Twechar	Closed		N
WML/W/0000186	WH Malcolm Ltd	Shewalton Sand Quarry	Closed	Non-Hazardous	N
WML/W/0000223	WH Malcolm Ltd	Overgree Landfill Site, Burnhouse	Closed		N
PPC/A/1036720	WH Malcolm Ltd	Reilly Quarry, Houston	Authorised	Inert/Non-Hazardous	N
WML/W/0000078	WH Malcolm Ltd	Southbar Landfill Site, Bishopton	Closed		N
WML/W/0000052	WH Malcolm Ltd	Mavis Valley Landfill, , Bishopbriggs	Closed		N
WML/W/0000050	WH Malcolm Ltd	Inchbelly Landfill Site, Kirkintilloch	Restoration	Inert	N
WML/W/0000159	WH Malcolm Ltd	Medrox Quarry Landfill	Closed	INERT	N
PPC/A/1038061	WH Malcolm Ltd	Loanhead Quarry Beith	Authorised	Non-Hazardous	N
WML/W/0000221	WH Malcolm Ltd	Giffen Quarry Landfill Site, Beith	Closed		N
WML/W/0000277	WH Malcolm Ltd	Avenuehead Farm	Closed		N

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		LF, Muirhead			
PPC/N/0020001	WRG Waste Services Ltd	Wester Hatton Landfill, Aberdeen	Authorised	Non-Hazardous	Y

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Department of Energy & Climate Change
3 Whitehall Place
London SW1A 2AW
www.gov.uk/decc

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