Radiation Monitoring Report

Stanford in the Vale Landfill Site

January 2015

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Approval Sheet

Customer:	Oxfordshire County Council
Site:	Stanford in the Vale Landfill Site
Project title:	Radiation Monitoring Report
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Issue	Status	Date	Prepared By	Signature	Date
1	Final	21/01/2015	A Morbey	*A Morbey*	20/01/2015
			Approved By	**Signature**	**Date**
			D Higgins	*D Higgins*	21/01/2015

Foreword

enitial has used its best endeavours, experience and expertise to provide a meaningful, accurate and relevant representation of the works carried out. The works were based on a defined programme and scope of works and terms and conditions agreed with the Client.

The findings discussed in this document relating to information provided by the Client relate only to those to which we have had access. In undertaking monitoring of properties in the ownership of third parties, enitial has followed written protocols and deployed trained, competent staff. All monitoring equipment utilized is fit for the purpose to which it has been applied and enitial can warrant that the data acquired is representative of the conditions pertaining at the time of the surveys. It is acknowledged however that certain aspects may be superseded or rendered irrelevant by information in documentation to which we have not accessed. Similarly, the conditions monitored and reported herein cannot be assumed to be prevailing at the property and no warranty is given or implied to that effect.

enitial cannot accept responsibility to any parties whatsoever, following the issue of this report, for any matters arising which may be considered outside the agreed scope of works.

This report is issued solely to the Client. enitial does not accept any responsibility to any third parties to whom this report may be circulated, in part or in full, and any such parties rely on the contents at their own risk.

Contents

Appendices

1. Introduction

On 14th January 2015, enitial were commissioned by Oxfordshire County Council (OCC) to undertake radiation monitoring of water samples taken from monitoring points at Stanford in the Vale landfill site.

A Thermoscientific mini 900E ratemeter (series 900 c/w E probe), radiation monitor was used to scan the liquids. This is a portable unit that is suitable for radiation contamination monitoring, and detects gamma and x-rays. This model E uses a thin end window G-M tube, and is suitable for estimating the lower contamination limits from ^{14}C, ^{35}S, ^{45}Ca and ^{131}I, as well as the more penetrating β emitters but not ^{3}H. The tube is sensitive to α particles and can estimate contamination levels down to 2×10^{-4} µCi cm^2.

The following method was used: a water sample was obtained using a disposal bailer (groundwater) or waterra tubing (leachate) (a new, clean bailer was used for each groundwater sample). The liquid sample to be scanned for radiation was poured into a shallow, plastic container with a broad surface area, and placed on the ground away from any stone or metal which could distort the reading. The probe of the rate meter was slowly passed just above the surface of the liquid and the reading recorded. The shallow container was rinsed between sample points with deionised water to prevent cross-contamination.

Groundwater samples were taken from boreholes BH7 and BH22 located beyond the south west boundary of the landfill site, and a leachate sample was taken from in-waste well LCC1. It was not possible to obtain groundwater samples from boreholes BH10, 13, 20 and 21 because either the borehole was dry or there was insufficient volume of liquid to obtain a sample.

Monitoring was undertaken in accordance with the method statements provided in Appendix C. Please note these are generic method statements and not all sections are directly relevant to this work.

F**indings**

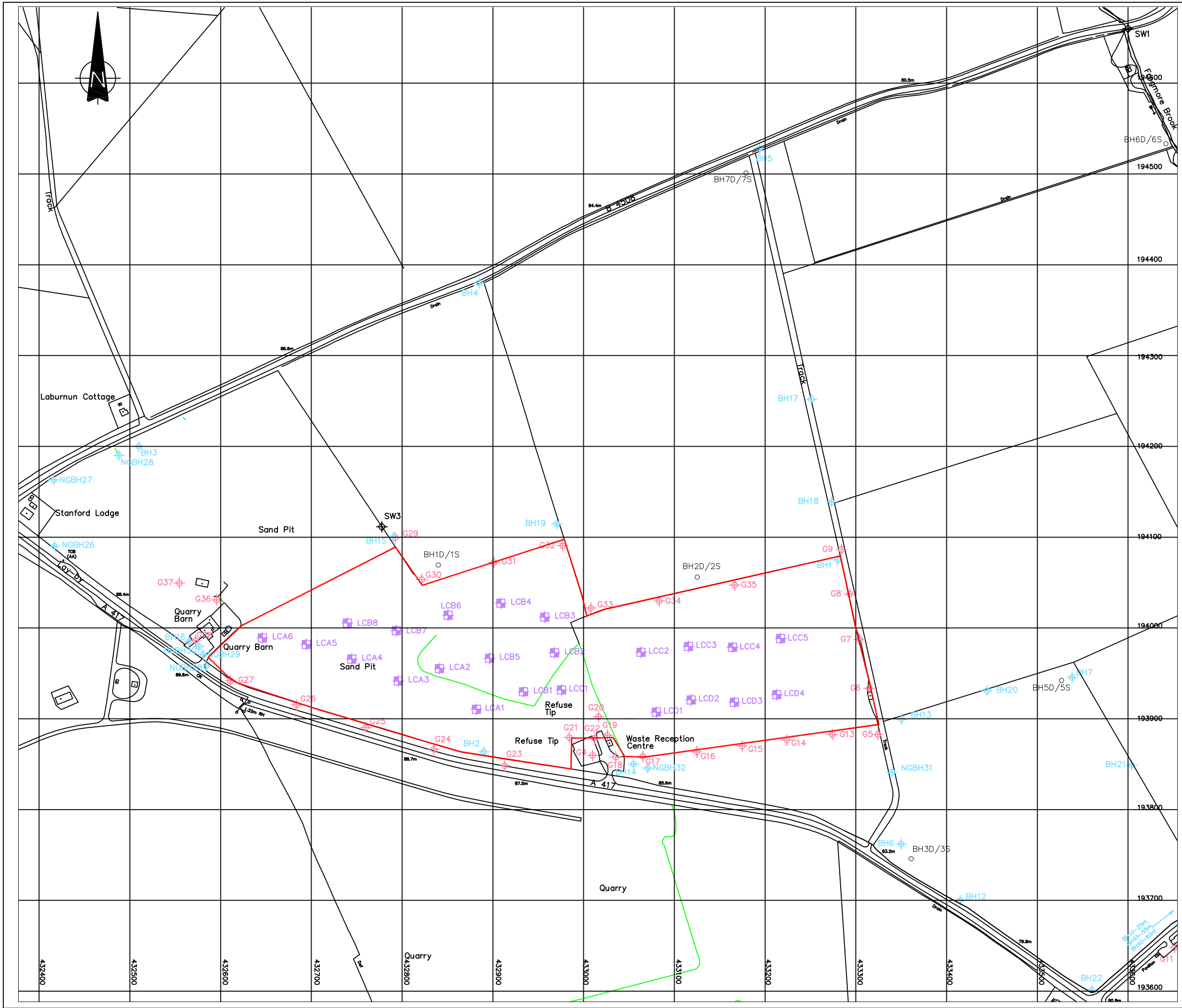
The results of the radiation monitoring survey undertaken on 14th January 2015 are provided in Appendix B. A site plan which shows the location of the monitoring points is presented in Appendix A.

Zero readings were recorded in both groundwater samples and the leachate sample.

2. Recommendations

No further action is recommended.

Appendix A



NOTES

1) ADAPTED FROM WSA DRAWING NUMBER: 0240/922 600 215.

KEY

LCC2	LEACHATE CHAMBER
BH26	GROUNDWATER BOREHOLE
NGBH27	NEW GROUNDWATER BOREHOLE
G30	GAS BOREHOLE
	WASTE BOUNDAFY

OXFORDSHIRE COUNTY COUNCIL

STANFORD

ENVIRONMENTAL MONITORING PLAN

DRAWN BY: EW	DATE: 25.06.2008
CHECKED BY: SV	SCALE @ A3: 1:4000
APPROVED BY: SV	ISSUING OFFICE: ALFRETON

DRAWING NUMBER	ISSUE	REVISION
1764.AR.02	Fn	-

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CAD FILE REF: 1764.AR.02.DWG

Appendix B

Monitoring record

Date	14/01/2015
Site	Stanford in the Vale
Personnel	A Morbey
Weather	Sunny intervals
Ground conditions	water pooling in places
Temperature (deg c)	5
Atm. pressure (mbar)	996

Start Time	**Finish Time**
11:00	13:00

Instrument	**Instrument Serial Number**	**Date tested/checked**	**Date re-test/ calibration due**
Thermoscientific mini 900E rate meter. Series 900 c/w E probe. Thermo G-M tube	_09035/S13741	22/12/2014	21/12/2015

Monitoring Location	"Radiation" reading counts per second
BH7	0
BH22	0
LCC1	0

Appendix C

Method Statement – Radiation Monitoring

1. Introduction

This method statement has been prepared to cover the activity of radiation monitoring of liquid samples. It should be read in conjunction with the method statements and risk assessments for groundwater, leachate and surface water monitoring and sampling.

enitial's Method Statements have evolved over recent years and are based on industry best practice, together with legislation and guidance from various sources. Feedback gathered from our customers and the Environment Agency via waste management licence and permit audits has also been incorporated.

The Dangerous Substances and Explosive Atmosphere Regulations (DSEAR) 2002 require operators to have systems in place to reduce or mitigate the risk of an explosive atmosphere forming and where it does to eliminate or reduce the risk of personal injury or harm to an acceptable level. The ESA Industry Codes of Practice (ICoPs) have been reviewed during the writing of this method statement and relevant information has been incorporated where appropriate.

Before work can take place the DSEAR site zoning plan must be consulted. Be aware of any changes from the norm that may alter the zoning rating of the working area e.g. contractors on site, changes in the gas well system or if the work being undertaken alters the zoning.

2. Description

Radiation monitoring is undertaken when required as a site specific task to determine contamination of water bodies. A handheld portable radiation monitor is used to check for contamination.

3. Sampling Container

A shallow, plastic container with a broad surface area is required to hold the liquid to be scanned for radiation.

3.1 Prevention Of Cross Contamination

The Procedure for prevention of cross contamination shall be followed at all times, this can be achieved by rinsing the sampling container with deionised water between sampling points. Also the sampling procedures detailed in the groundwater, surface water and leachate monitoring and sampling method statements should be followed.

If at any time you know or suspect that contamination has occurred, discard the sample and repeat the sampling. If re-sampling is not possible note this in your field notes.

4. Pre-Monitoring Procedures

4.1 Pre-site visit Preparation

- Check to ensure that all the correct personal protective equipment (PPE) is available and is worn at the appropriate time. The PPE must be in good order.
- Check the location of the site and the precise location of the monitoring points.
- Take any necessary keys and equipment to enter the site safely and locate the monitoring facilities.
- Check for any site/company specific documentation that may be required for work to begin, such as site inductions and permit to work documents. If this in not in place, contact the client prior to the site monitoring/sampling visit in order to bring this information up to date, if necessary.
- Ensure the radiation monitoring equipment is in working order and calibrated. Report any issues to the equipment facilitator.
- Make sure that the results of any Risk or CoSHH assessments applicable to the work have been taken into account.
- Familiarise yourself with any site specific risk assessments.
- If the instrument is faulty or showing erroneous readings, it should be removed from daily use until either repaired or recalibrated.
- Collect the shallow, plastic sampling container and deionised water.

4.2 On-site Pre-Start Checks

- Put on the appropriate personal protective equipment, wearing disposable gloves at all times whilst monitoring/sampling.
- Landfill gas is potentially toxic due to the potential presence of a number of substances including carbon monoxide and hydrogen sulphide, consequently a multi gas alarm should be worn (as close to the wearer's mouth as possible). Refer to enitial's landfill gas and personal gas alarms document for further information.
- Sign in at the site office or weighbridge/ log in to the lone worker system in line with enitial's Lone Worker Policy.
- Check the DSEAR site zoning plan to ensure all equipment (including battery powered tools) is suitable for the designated zone. Also note that non-ATEX approved items should not be used in any DSEAR zoned area of a site e.g. cameras, MP3 players etc. (for further information see ESA ICoP 5, Section 5.7).
- Check for additional hazards that may be present – on an open site this involves communication with site staff to establish any hazardous waste tipping for example asbestos tipping (refer to enitial's pre-monitoring communication memo for details).
- Check the location of the site and the precise location of the monitoring points to ensure safe access.
- Take any necessary keys and equipment to enter the site safely and locate and access the monitoring facilities.

- Ensure that all equipment is carried around the site without causing damage to it.
- Care should be taken when sampling as the water/liquid may be contaminated.
- Make sure that a mobile phone is readily available, however a phone should ideally not be used within any DSEAR zone except in an emergency – move outside the zone e.g. further than 2.2m away from a gas well in all other situations. ESA ICoP5 (August 2007) states that mobile phones may be used in zone 2 but not in zone 1 or 0.
- Use the radiation monitor outside the radius of a zoned area.
- Plan work to minimise excessive carrying of equipment – liaising with colleagues if work is spread over a month, use of a colleague to help if on site or working near-by or allowing enough time to make more than one journey to minimise the weight being carried.
- Vehicles must remain on the designated roadways whilst being driven on site. Vehicles may only deviate from this when permission is given from the site supervisor/manager.

5.0 Radiation Monitoring

5.1 Equipment List

Any necessary keys,
Monitoring point location map (if required),
Sampling equipment, which will be dependant on water/liquid being tested. Please refer to groundwater, leachate and surface water monitoring and sampling method statements for details,
Shallow, plastic container with broad surface area,
Deionised water,
Radiation monitor, such as a Thermoscientific mini 900E ratemeter (series 900 c/w E probe,
PDA, Logbook or template sheet and pencil/pen,

5.2 Radiation Monitoring

Obtain a sample of the liquid to be tested using the appropriate equipment as detailed in the groundwater, leachate and surface water sampling method statements. For example, if sampling groundwater, use a new, clean, disposal bailer for each sampling point or a clean, dedicated length of Waterra tubing. The liquid sample to be scanned for radiation should be poured into the shallow, plastic container with a broad surface area, and placed on the ground away from any stone or metal which could distort the reading. Pass the probe of the rate meter slowly just above the surface of the liquid and record the reading in counts per second. Rinse the shallow container with deionised water between sampling points to prevent cross-contamination.

6. Reporting procedures

- If required, leave a copy of the results with the Site Manager before leaving site.
- Let the Site Manager know you have finished and sign out if required.
- Comply with the enitial Lone Worker Policy at time of departure from site.
- All field data is entered onto the database/Excel for reference.
- Results obtained are verified for accuracy by a competent person before being sent to the client.

7. Site Exit

Before signing out of the lone worker system or weighbridge/site office as applicable, the operative must ensure that the site is left in a tidy condition. All materials used during the working day (where not specifically meant to be left on site) must be removed prior to leaving. This will include picking up any litter/debris/packing materials arising from the technicians work or associated activities. All H&S related issues noted on site must be reported to the site operator/representative and passed on to the relevant person responsible for H&S within enitial.

Method Statement - Groundwater Monitoring and Sampling (Bailing)

1. Introduction

This method statement has been prepared to cover the activity of groundwater level monitoring, bailing boreholes and subsequent sampling on site. It should be read in conjunction with the risk assessment for groundwater monitoring and sampling.

enitial's Method Statements have evolved over recent years and are based on industry best practice, together with legislation and guidance from various sources. Feedback gathered from our customers and the Environment Agency via waste management licence and permit audits has also been incorporated.

The Dangerous Substances and Explosive Atmosphere Regulations (DSEAR) 2002 require operators to have systems in place to reduce or mitigate the risk of an explosive atmosphere forming and where it does to eliminate or reduce the risk of personal injury or harm to an acceptable level. The ESA Industry Codes of Practice (ICoPs) have been reviewed during the writing of this method statement and relevant information has been incorporated where appropriate.

Before work can take place the DSEAR site zoning plan must be consulted. Be aware of any changes from the norm that may alter the zoning rating of the working area e.g. contractors on site, changes in the gas well system or if the work being undertaken alters the zoning.

2. Description

Sampling of groundwater from monitoring facilities is undertaken as required under the Environment Permit to determine any contamination of the water table in the vicinity. These samples are then tested for a range of parameters on site using portable instrumentation. Laboratory analysis is then conducted to verify these readings and to test for a wider range of determinants. Bailing of samples is used where required on a site specific basis.

3. Sampling Bottles

3.1 Preregistered Sampling Bottles

If sampling bottles are available prior to the sampling visit, check the associated paper work, such as the chain of custody and/or the job file, to ensure the correct bottles have been supplied, and are accurately and securely labelled. If bottles are delivered direct to site this should be carried out prior to commencing work. Any errors should be immediately notified to the project manager or analyst. Ensure you have a copy of any instructions provided by the laboratory for filling the bottles.

3.2 Non Registered Sampling Bottles

Ensure that the correct type and quantity of bottles are taken for the appropriate analytical suite. Where there is any doubt seek confirmation from the project manager. The use of incorrect bottles may result in invalid samples being taken. This information will be available within the relevant job file.

3.3 Bottle Filling

Ensure you are aware of the correct procedure to fill each type of bottle and whether additional sample preservation such as the addition of fixatives is required. Ensure you have a copy of any instructions provided by the laboratory for filling the bottles or see enitial's procedure for bottle filling.

3.4 Prevention Of Cross Contamination

The Procedure for prevention of cross contamination shall be followed at all times.

If at any time you know or suspect that contamination has occurred, discard the sample and repeat the sampling. If re-sampling is not possible note this in your field notes.

4. Pre-Monitoring Procedures

4.1 Pre-site visit Preparation

- Check to ensure that all the correct personal protective equipment (PPE) is available and is worn at the appropriate time. The PPE must be in good order.
- Check the location of the site and the precise location of the groundwater points.
- Take any necessary keys and equipment to enter the site safely and locate the monitoring facilities.
- Check for any site/company specific documentation that may be required for work to begin, such as site inductions and permit to work documents. If this in not in place, contact the client prior to the site monitoring/sampling visit in order to bring this information up to date, if necessary.
- Ensure all analytical instrumentation for the in-situ determination of temperature, pH and electrical conductivity are in working order and calibrate with appropriate solutions, where necessary. Report any issues to the equipment facilitator.
- Make sure that the results of any Risk or CoSHH assessments applicable to the work have been taken into account.
- Familiarise yourself with any site specific risk assessments.
- Any instrument that is faulty or showing erroneous readings should be removed from daily use until either repaired or recalibrated.
- Collect the appropriate number of sample bottles (sterilized with lids) including spares.
- If glass bottles are to be used, ensure they are transported to site in appropriate packaging to avoid breakage.

4.2 On-site Pre-Start Checks

- Put on the appropriate personal protective equipment, wearing disposable gloves at all times whilst monitoring/sampling.
- Landfill gas is potentially toxic due to the potential presence of a number of substances including carbon monoxide and hydrogen sulphide, consequently a multi gas alarm should be worn (as close

to the wearer's mouth as possible). Refer to enitial's landfill gas and personal gas alarms document for further information.

- Sign in at the site office or weighbridge/ log in to the lone worker system in line with enitial's Lone Worker Policy.
- Check the DSEAR site zoning plan to ensure all equipment (including battery powered tools) is suitable for the designated zone. Also note that non-ATEX approved items should not be used in any DSEAR zoned area of a site e.g. cameras, MP3 players etc. (for further information see ESA ICoP 5, Section 5.7).
- Check for additional hazards that may be present – on an open site this involves communication with site staff to establish any hazardous waste tipping for example asbestos tipping (refer to enitial's pre-monitoring communication memo for details).
- Check the location of the site and the precise location of the groundwater points to ensure safe access to boreholes.
- Take any necessary keys and equipment to enter the site safely and locate and access the monitoring facilities.
- Ensure that all equipment is carried around the site without causing damage to it. Glass bottles should be stored safely to avoid breakage (bubble wrap, divided box).
- Care should be taken when sampling as groundwater may be contaminated.
- Make sure that a mobile phone is readily available, however a phone should ideally not be used within any DSEAR zone except in an emergency – move outside the zone e.g. further than 2.2m away from a gas well in all other situations. ESA ICoP5 (August 2007) states that mobile phones may be used in zone 2 but not in zone 1 or 0.
- Plan work to minimise excessive carrying of equipment and/or sampling bottles – liaising with colleagues if work is spread over a month, use of a colleague to help if on site or working near-by or allowing enough time to make more than one journey to minimise the weight being carried.
- Vehicles must remain on the designated roadways whilst being driven on site. Vehicles may only deviate from this when permission is given from the site supervisor/manager.

5.0 Groundwater sampling

5.1 Equipment List

Any necessary keys,
Monitoring point location map (if required),
Water bailer,
Water bailer reel with appropriate cord length,
Appropriate sample bottles,
Sample bottle container such as a rucksack,
PDA, Logbook or template sheet and pencil/pen,
Waterproof marker (if not using pre-registered bottles).

5.2 Bailing boreholes – pre sample measurements

- Refer to the Procedure for Dip to Level/Base (a summary of which can bee seen below).
- Use separate dip meters for groundwater and leachate wells.
- Remove borehole lid or remove dipping point plug as necessary
- Lower the dip meter into the borehole and record the level at which water is encountered. This is usually to the top of the borehole or the top of the well casing; ensure the correct location is determined to provide continuity of results.
- This reading should then be converted into a level relative to the borehole survey datum. This can be done using the following formula:

Surveyed datum (mAOD) – Dip reading (m) = Water level (mAOD)

This calculation ideally should not be made in the field but in the office to avoid mistakes.

If a base level is required:

- Lower the dip meter until it reaches the base of the borehole and record the base level.
- The difference between the two readings is the column of water, record in metres.

5.3 Sampling using a bailer

- Rinse the bailer thoroughly before proceeding with the sampling.
- Lower the clean, disposable bailer into the well using a suitable length of plastic coated line and allow it to fill. The bailer may need weighting in large diameter wells. Use a separate line for groundwaters and leachates.
- Discard the first 5 litres where appropriate (5 full bailers), this rinses both the bailer and removes standing water in the well. If there is insufficient water then one litre may be removed. Please note that only on rare occasions would bailing be used to remove 3 well volumes from a borehole (see groundwater purging method statement for details)
- Refill the bailer and record on site measurements from this sample (see Section 4.3 below).
- Fill and empty the sample bottle in order to rinse out and prime then (unless otherwise stated by the laboratory. Fill the sample bottle(s) completely with the next sample(s), ensuring that there is no air gap when the top is screwed on.
- Label the bottle(s) correctly with company, site, location and date.
- Add fixative to the sample(s), if necessary.
- Replace the well lid if necessary.
- Close the borehole lid.

5.4 Groundwater in-situ testing

The following parameters are tested for on site: temperature (°C), electrical conductivity (µs/cm) and pH. These readings are taken to determine whether any change in chemistry has occurred in the groundwater since the last sampling visit.

- Rinse all of the instruments prior to any measurements being taken.
- Rinse a beaker with the sample water from the bailer thoroughly before undertaking the analysis.
- Use one instrument at a time, taking temperature readings first to give the most accurate reading. If a temperature dip meter is available, it may be used to gain a reading directly from the borehole.
- For pH and electrical conductivity, record stable readings.
- Note any colouration in the sample and level of sediment.
- Ensure all equipment is transported safely without causing damage to the next monitoring point.

5.5 Sample storage and transport

- When all sampling has been undertaken, check that the correct number of bottles has been filled. Sample bottles should be placed in the container supplied/agreed by the laboratory for transportation. Where this is a cool box and ice pack exchange and freezing procedures exist for the site, the box should be packed and sufficient ice packs included.
- When transporting the samples across the site ensure they are kept upright. Glass bottles should be safely protected to avoid breakage.
- Make out a chain of custody form for all samples to ensure that all bottles are correctly labelled and the correct analysis is being undertaken.
- There should not be more than 24 hours between sample collection and delivery to the appropriate laboratory.

6. Reporting procedures

- Leave a copy of the in-situ analysis with the Site Manager if required.
- Let the Site Manager know you have finished and sign out if required.
- Comply with the enitial Lone Worker Policy at time of departure from site.
- All field and laboratory data is entered onto the database/Excel for reference.
- Results obtained are verified for accuracy by a competent person before being sent to the client.

7. Composite Sampling

- On occasion, and depending on the sampling suite specified, there may be a need to fill a number of sample bottles from one point source.
- If more than one bottle is to be filled from a single sampling point using a bailer or other vessel, a composite sample should be obtained in each bottle. This may not always be possible due to the limitations of the monitoring environment.
- All bottles for that sample point should be opened and pre-rinsed (unless they contain fixative) and placed securely near the

sampling point. Care should be taken to ensure that the lids do not get contaminated or mixed up.

- Each sample obtained from the sampling point (for example every bailer full of liquid drawn) should be split between all of the bottles. This procedure should be repeated until all of the bottles are appropriately filled.
- Note: Glass bottles should be filled directly with the sample as it is obtained not decanted from a plastic bottle already filled from the sample point.

8. Site Exit

Before signing out of the lone worker system or weighbridge/site office as applicable, the operative must ensure that the site is left in a tidy condition. All materials used during the working day (where not specifically meant to be left on site) must be removed prior to leaving. This will include picking up any litter/debris/packing materials arising from the technicians work or associated activities. All H&S related issues noted on site must be reported to the site operator/representative and passed on to the relevant person responsible for H&S within enitial.

Method Statement - Leachate Level Monitoring and Sampling

1. Introduction

This method statement has been prepared to cover the activity of leachate level monitoring and sampling. It should be read in conjunction with the risk assessment for leachate level monitoring and sampling.

The sampling and level monitoring of waters from within the landfill is undertaken on a routine basis. This is to determine the state of degradation of the waste and also to determine the potential of the leachate as a possible pollutant to the surrounding environment. These samples are then tested for a range of parameters on site, using portable instrumentation. Laboratory analysis is then conducted to verify these readings and usually to test for a wider range of determinants.

enitial's Method Statements have evolved over recent years and are based on industry best practice, together with legislation and guidance from various sources. Feedback gathered from our customers and the Environment Agency via waste management licence and permit audits has also been incorporated.

The Dangerous Substances and Explosive Atmosphere Regulations (DSEAR) 2002 require operators to have systems in place to reduce or mitigate the risk of an explosive atmosphere forming and where it does to eliminate or reduce the risk of personal injury or harm to an acceptable level. The ESA Industry Codes of Practice (ICoPs) have been reviewed during the writing of this method statement and relevant information has been incorporated where appropriate.

Before work can take place, the DSEAR site zoning plan must be consulted. Be aware of any operational changes that may alter the zoning rating of the working area e.g. contractors on site, changes in the gas well system or if the work being undertaken alters the zoning.

2. Description

Leachate level monitoring is routinely undertaken on a weekly/monthly basis in compliance with the relevant monitoring schedules/Environment Permits. Any samples obtained are couriered to a pre-arranged laboratory and the results obtained are verified for accuracy by a competent person before being sent to the client.

3. Sampling Bottles

3.1 Preregistered Sampling Bottles

If sampling bottles are available prior to the sampling visit, check the associated paper work, such as the chain of custody and/or the job file, to ensure the correct bottles have been supplied, and are accurately and securely labelled. If

bottles are delivered direct to site this should be carried out prior to commencing work. Any errors should be immediately notified to the project manager or analyst. Ensure you have a copy of any instructions provided by the laboratory for filling the bottles.

3.2 Non Registered Sampling Bottles

Ensure that the correct type and quantity of bottles are taken for the appropriate analytical suite. Where there is any doubt seek confirmation from the project manager. The use of incorrect bottles may result in invalid samples being taken. This information will be available within the relevant job file.

3.3 Bottle Filling

Ensure you are aware of the correct procedure to fill each type of bottle and whether additional sample preservation such as the addition of fixatives is required. Ensure you have a copy of any instructions provided by the laboratory for filling the bottles or see enitial's procedure for bottle filling.

3.4 Prevention Of Cross Contamination

The Procedure for prevention of cross contamination shall be followed at all times.
If at any time you know or suspect that contamination has occurred, discard the sample and repeat the sampling. If re-sampling is not possible note this in your field notes.

4. Pre-Monitoring Procedures

4.1 Pre-site Visit Preparation

- Check to ensure that all the correct personal protective equipment (PPE) is available and is worn at the appropriate time. The PPE must be in good order.
- Check the location of the site and the precise location of the leachate wells.
- Ensure that your vehicle is in good and safe working condition and suitably clean and organised to minimise the risk of sample contamination in accordance with the Procedure for prevention of cross contamination. Fuel cans must not be stored next to monitoring/sampling equipment
- Obtain any necessary keys/equipment to enter site safely and to gain safe entry to all of the monitoring facilities.
- Check that dedicated leachate dip meters, bailers and field testing kits are in good working order.
- Make sure that the results of any risk or CoSHH assessments applicable to this activity have been taken into account.
- Check for any site/company specific documentation that may be required for work to begin, such as site inductions and permit to work documents. If this in not in place, contact the client prior to the site monitoring/sampling visit in order to bring this information up to date, if necessary

- It may be necessary to contact the site prior to the visit to assess the likelihood of access to the sampling points.
- Ensure all analytical instrumentation for in-situ determination of temperature, pH, and electrical conductivity are in working order and calibrate with the appropriate solutions, where necessary. Report any issues to the equipment facilitator.
- Any instrument that is faulty or showing erroneous readings should be removed from daily use until either repaired or recalibrated.
- Collect an appropriate number of sample bottles (sterilised with lids), remembering to take spares.
- Ensure the correct type of bottle is taken for the appropriate suite of analysis (plastic and/or glass).

4.2 On-Site Pre-Sampling Checks

- Put on the appropriate personal protective equipment, wearing disposable gloves at all times whilst sampling/monitoring.
- Landfill gas is potentially toxic due to the potential presence of a number of substances including carbon monoxide and hydrogen sulphide, consequently a multi gas alarm should be worn (as close to the wearer's mouth as possible). Refer to enitial's landfill gas and personal gas alarms document for further information.
- Anti-static clothing (particularly footwear, which is enitial standard issue) should be worn when undertaking the monitoring.
- Check the DSEAR site zoning plan to ensure all equipment (including battery powered tools) is suitable for the designated zone. Also note that non-ATEX approved items should not be used in any DSEAR zoned area of a site e.g. cameras, MP3 players etc. (for further information see ESA ICoP 5, Section 5.7).
- Inform your supervisor or site management of where you are going and what you are doing. REMOVE THIS SENTENCE!
- Sign in at the site office or weighbridge/log in to the lone worker system in line with enitial's Lone Worker Policy.
- Check for additional hazards that may be present – on an open site this involves communication with site staff to establish any hazardous waste tipping for example asbestos tipping (refer to enitial's pre-monitoring communication memo for details).
- Take any necessary keys and equipment to enter the site safely and locate the monitoring facilities.
- Familiarise with any site-specific risk assessments including the closed site risk assessment if applicable.
- Make sure that a mobile phone is readily available, however a phone should ideally not be used within any DSEAR zone except in an emergency – move outside the zone e.g. further than 2.2m away from a gas well in all other situations. ESA ICoP5 (August 2007) states that mobile may be used in zone 2 but not in zone 1 or 0.
- Adhere to the safety codes and take caution when crossing haul roads, operational areas and when sampling in operational areas.
- Ensure you have made yourself seen to any mobile plant drivers when monitoring/sampling in operational areas.

- Ensure that all equipment is carried around the site without causing damage to it. Glass bottles should be protected to avoid breakage.
- Check the field record sheet(s) from previous sampling exercises and site observation records for any relevant information that may relate to safe working.
- Plan work to minimise excessive carrying of equipment and/or sampling bottles – liaising with colleagues if work is spread over a month, use of a colleague to help if on site or working near-by or allowing enough time to make more than one journey to minimise the weight being carried.
- Vehicles must remain on the designated roadways whilst being driven on site. Vehicles may only deviate from this when permission is given from the site supervisor/manager.

4.3 Equipment List

Any necessary keys,
Monitoring point location map (if required),
Water bailer,
Water bailer reel with appropriate length cord,
Appropriate sample bottles,
Sample bottle container such as a rucksack,
PDA, Logbook or template sheet and pencil/pen,
Waterproof marker (if not using pre-registered bottles).

5. Leachate Level Monitoring & Sampling

Avoid standing directly over wells for extended periods.

5.1 Pre-sample measurements

- Use only a dedicated leachate dip meter to monitor leachate levels. This is to avoid introducing any potential contaminants to groundwater when conducting groundwater level monitoring and sampling. If working in a zoned area, only dip meters with an ATEX rating appropriate to the zone being worked in should be used e.g. Geotechnical 'ATEX' dipmeter for use in zone 1 & 2 (see ESA ICoP 5, August 2007, Section 5.7).
- If monitoring or sampling from a well that is attached to the site's gas extraction system; before removing caps/lids, locate the isolation valve on the pipe work coming from the well and record the position the valve is set at, then close valve – record this information on client's data if required. This prevents air being drawn into the system that could extinguish the site's landfill gas flares/engines. It also prevents any air ingress to the gas system, so preventing reclassification to DSEAR zone 1 and any potentially explosive atmosphere being generated (see ESA ICoP 2, November 2005, Section 5.10). If there is no isolation valve present at the well seek guidance from the relevant client contact or liaison manager for the site.
- Working at arm's length from the leachate well (to keep a suitable distance away), remove the well lid slowly and at an angle away from your body (or remove the dipping point plug as necessary). If a pump is installed, only dip

via a separate dipping point to ensure the dip tape does not become caught.

- Lower the dip meter into the well carefully, keeping the tape away from the sides of the well to minimise wear to the dip tape and record the level at which liquid is encountered. This is usually to the top of the well; ensure the right location is determined.
- This reading can then be converted into a level relative to the survey datum, if required. This calculation ideally should not be made in the field, but in the office to avoid mistakes. Note that as the well is raised this will change, so obtain the most current reading. This can be done using the following formula:

  Well Top Surveyed Level (mAOD) – Dip Reading (m) = Leachate level (mAOD)

- Leachate field head readings may also be recorded and this is calculated thus:

  Base Dip (m) – Dip reading (m) = Leachate Head (m)

If a base level is required:

- Lower the dip meter until it reaches the base of the borehole and record the base level. Wind up the dip meter carefully and avoid touching the sides of the well chamber as far as possible to minimise damage to the tape.
- The difference between the base and the leachate dip reading is the column of water, record in metres.
- Replace the well lid/dip port caps once the dip is complete so that the installation is made gas-tight (where necessary).
- Reopen the gas extraction valve (**very slowly**) to the position recorded before any lids/caps were removed. Record that this position has been returned to on the client's data where required.
- Given the nature of leachate wells, it is likely that at some stage a dip meter may become stuck while attempting to undertake a level measurement. In this instance, seek assistance from site personnel to retrieve the dipmeter. This could involve removing pump pipework and pump from the well. If it is not possible to retrieve the dip meter, seek an alternative dedicated leachate dip meter to complete the scheduled monitoring. Do not use a groundwater dip meter under any circumstances
- If there is no replacement dip meter, contact your line supervisor or line manager so that another visit can be scheduled to complete the monitoring exercise.

5.2 Sampling

If a well is regularly pumped using a dedicated pump, a sample may be gained directly from the discharge pipe. In this case:

- Isolate the leachate line (there should be a valve that shuts the line off, preventing leachate reaching the tank and stopping back flow during sampling).

- Open the sampling tap and obtain a sample.
- Close the sample tap and reopen the leachate line.

If this is not possible, a bailer may be used:

- If monitoring or sampling from a well that is attached to the site's gas extraction system; before removing caps/lids, locate the isolation valve on the pipe work coming from the well and record the position that the valve is set at, then close valve. Note this position in your data if required by the client.
- Using a dedicated leachate bailer reel, lower a clean, disposable bailer into the well and allow it to fill. The bailer may need weighting in large diameter wells. Note: equipment used to sample leachate must not be used to sample groundwater.
- If splashed by the liquid, rinse off immediately.
- Discard the first two litres where appropriate (two full bailers), this rinses both the bailer and removes standing water in the well.
- If there is insufficient water then one litre may be removed.
- Refill the bailer and record any on site measurements required from this sample.
- Fill and empty the sample bottle(s) in order to rinse out and prime (unless otherwise stated).
- Fill the sample bottle(s) completely with the next sample(s), ensuring that there is no air gap when the top is screwed on.
- Replace the well lid/dip port caps so that the installation is gas-tight.
- Re-open the gas extraction valve very slowly to the position recorded before any lids/caps were removed. Note this in your data if the client requires it.
- Label the bottle(s) correctly with company, site, location and date.
- Add fixative to the sample, if necessary.
- Replace the well lid if necessary.

5.3 Leachate in-situ testing

The following parameters are tested for on site: temperature (°C), electrical conductivity (µs/cm) and pH. These readings are taken to determine whether any change in chemistry has occurred in the leachate since the last sampling visit.

- Rinse all the instruments prior to measurements being taken.
- If the well is within a DSEAR zoned area, undertake the field analysis at least 2.2m away from the borehole to comply with DSEAR regulations (see ESA ICoP 5, August 2007, Section 5.7).
- Rinse a beaker with the leachate from the bailer/pump thoroughly before undertaking the analysis.
- Use one instrument at a time, taking temperature readings first to give the most accurate reading. If a temperature dip meter or probe is available then this may be used to gain a reading directly from the body of the water.
- For pH and electrical conductivity record stable readings.
- Note any colouration in the sample and level of sediment.

- Ensure all equipment is transported safely, without causing damage, to the next monitoring point.

5.4 Sample storage and transport

- When transporting the samples across the site, ensure they are kept upright. Glass bottles should be protected to avoid breakage.
- When all sampling has been undertaken, check that the correct number of bottles has been filled. Sample bottles should be placed in the container supplied/agreed by the laboratory for transportation. Where this is a cool box and ice pack exchange and freezing procedures exist for the site, the box should be packed and sufficient ice packs included.
- Make out a chain of custody form for all samples to ensure that all bottles are correctly labelled and the correct analysis is being undertaken.
- There must not be more than 24 hours between sample collection and delivery to the appropriate laboratory.

6. Reporting procedures

- Leave a copy of the field data with the Site Manager and highlight any anomalous results.
- Sign out at the office/comply with the enitial Lone Worker Policy at the time of departure from site.
- All field and laboratory data is then entered onto the database/Excel for reference.
- Results obtained are verified for accuracy by a competent person before being sent to the client.

7. Composite sampling

- On occasion, and depending on the sampling suite specified, there may be a need to fill a number of sample bottles from one point source.
- If more than one bottle is to be filled from a single sampling point using a bailer or other vessel, a composite sample should be obtained in each bottle wherever possible. This may not always be possible due to the limitations of the monitoring environment.
- All bottles for that sample point should be opened and pre-rinsed (unless they contain fixative) and placed securely near the sampling point. Care should be taken to ensure that the lids do not get contaminated or mixed up.
- Each sample obtained from the sampling point (for example every bailer full of liquid drawn) should be split between all of the bottles. This procedure should be repeated until all of the bottles are appropriately filled.
- Note: Glass bottles should be filled directly with the sample as it is obtained, not decanted from a plastic bottle.

8. Site Exit

- Before signing out of the lone worker system or weighbridge/site office as applicable, the operative must ensure that the site is left in a tidy condition. All materials used during the working day (where not specifically meant to be left on site) must be removed prior to leaving. This will include picking up any litter/debris/packing materials arising from the technicians work or associated activities. All H&S related issues noted on site must be reported to the site operator/representative and passed on to the relevant person responsible for H&S within enitial.