Mallinckrodt Medical Imaging Ireland

T/A

Guerbet

ANNUAL ENVIRONMENTAL REPORT 2015

Licensee: Mallinckrodt Medical Imaging Ireland
Damastown Industrial Estate
Mulhuddart
D15 YE36, Dublin 15

Licence No: P0050-02

Prepared by: Mercedes Kavanagh
EHS Engineer

Approved by: Brendan O'Reilly
EHS / Engineering Manager

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1. INTRODUCTION

This is the Annual Environmental Report of Mallinckrodt Medical Imaging Ireland (trading as Guerbet) as per Condition 2.9.2 of the Integrated Pollution Control License No P0050-02.

As specified in the EPA AER guidance document all summary information is presented for the previous calendar year, 2015. A submission of summary environmental information in electronic format (PRTR) is included in Appendix 1, as per EPA guidance document.

In 2013, the Company received an update to its IPPC license to make it compliant with the industrial emissions directive. The site now has an Industrial Emissions License (IEL).

In November 2015 Mallinckrodt Medical Imaging Ireland changed its trading name to Guerbet. The EPA was formally informed in correspondence reference, *P005002.15.MK.06*, in December 2015.

2. COMPANY BACKGROUND

Mallinckrodt Medical Imaging Ireland is located in Damastown Industrial Estate, Mulhuddart, D15 YE36, Dublin 15. The plant is a continuous manufacturing pharmaceutical facility which produces Ioversol, a bulk API for Optiray, an X-ray Contrast imaging Agent.

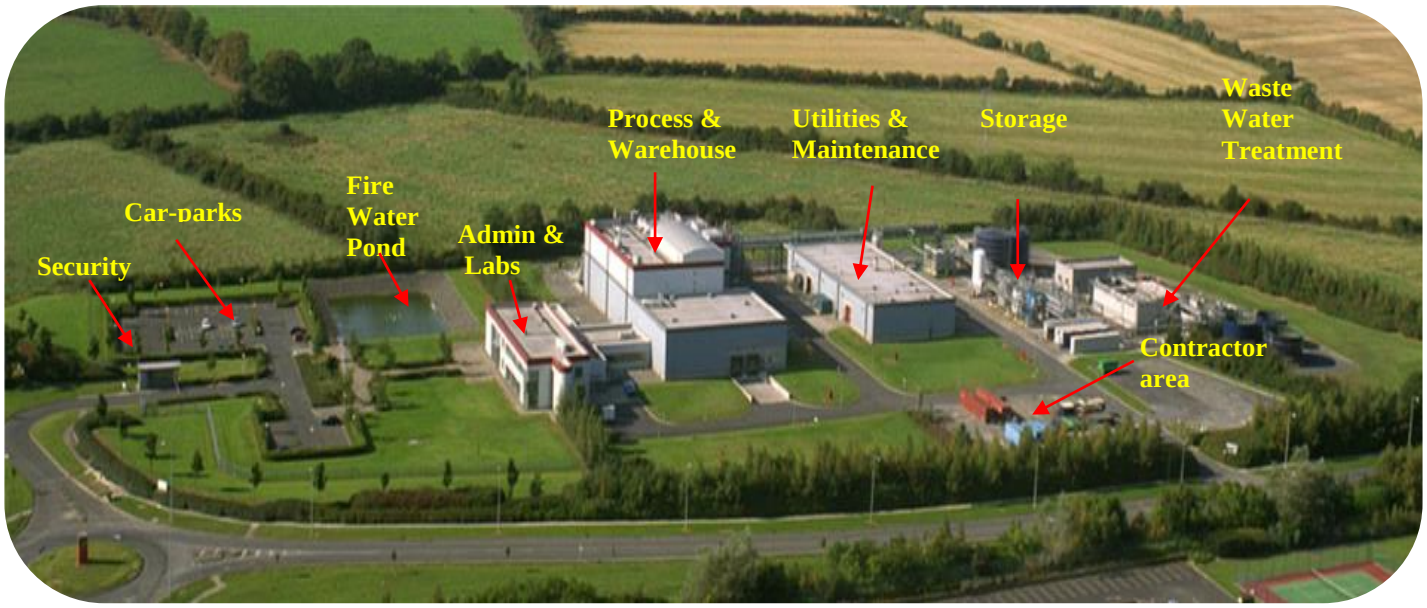
The plant was built on a green-field site and production began in 1993. The original development was subject to a capacity expansion project 5 years later in 1998 converting the chemical processing to a new 'Alternative Synthesis' process. The site was further expanded in 2008 increasing production of Ioversol by 30%.

There are approximately 98 employees across management, production, engineering, quality, finance and administration with production operating on a four shift rota 24 hours/day for approximately 355 days per year.

Historically the company has had a number of different trading names. In July 2007, Tyco Healthcare split from Tyco International evolving to the new corporation Covidien. The site then began trading as Covidien Pharmaceuticals Dublin as reported to the EPA in January 2010. On the 28th of June 2013 Covidien separated its Pharmaceutical and Medical Device business. Mallinckrodt Pharmaceuticals became a standalone publically traded company headquartered in Ireland.

In November 2015 Mallinckrodt Medical Imaging Ireland was purchased by Guerbet, a pharmaceutical group with specialization in medical imaging.

Mallinckrodt Medical Imaging Ireland has remained the legal entity for this site.



The site covers a total area of 120,000m^2, 60,000m^2 of which have been developed by the company. The remaining land is reserved. The developed area contains:

- Administration (with canteen),
- Boiler room,
- Carparks,
- Cooling Tower,
- Drum Store,
- Fire Water Retention Pond,
- Laboratories,
- Maintenance Building,
- Process Building,
- Security,
- Tank Farm,
- Warehouse,
- Waste Water Treatment Plant,
- Water Storage.

The site has been licensed by the Environmental Protection Agency (EPA) since 1995, and is accredited to ISO14001:2004 Environmental Management System Standard since 2008. The scope of this management system is the manufacture and testing of Ioversol, analytical testing of Optiray and related services.

The site Environmental, Health and Safety policy can be found overleaf. It was updated in January 2015 and communicated to all staff operating from the site. It is also posted around the site.

Environmental, Health and Safety Policy

Mallinckrodt Medical Imaging Ireland is committed to protecting the health and safety of our employees, and protecting the environment. We will provide safe working conditions for all site stakeholders and we are committed to conserving natural resources, reducing the environmental burden of waste generation and emissions to the air, water and land. Through continuous improvement methodologies we develop safe, environmentally compatible products and processes. We will strive to reduce and recycle where practicable and will ensure that any wastes remaining are disposed of in a safe and environmentally sound manner.

We will be a responsible member of the community in which we live and work. We will continue to expand our knowledge and understanding of the effects of our operations on safety, health and the environment. We are committed to continuous improvement in our operations and to sharing the knowledge we gain with our employees, customers and suppliers and local community.

We will establish and maintain appropriate controls including the establishment of annual objectives and targets and regular periodic review, to ensure that our policy is being followed and to develop a culture of continuous improvement. We will comply with all applicable EHS legislation, and will operate management systems which effectively manage all EHS aspects of our operations.

Mallinckrodt Medical Imaging Ireland is licensed by the Environmental Protection Agency under the terms of the Integrated Pollution Prevention and Control license P0050-02. We have been designated as an Upper Tier SEVESO II site under the Control of Major Accident Hazards legislation and we are therefore conscious of the potential for our operations to impact health and safety of the wider community in which we operate.

Taking responsibility for our own health and safety, and protection of the environment is an essential part of our job at Mallinckrodt Medical Imaging Ireland. We will ensure that our employees are trained in, and aware of their responsibilities in this regard. We ask each of our employees to conscientiously observe this commitment and to reflect it in the pursuit of their day to day activities.

Signed:

Niall Donnelly
Plant Manager

16/01/15

3. SUMMARY INFORMATION

3.1 Monitoring Data

3.1.1 Emissions to Atmosphere

All emissions to air in quarterly monitoring were within the terms of the license.

A summary table of the air emissions is included in Appendix 1 and has been submitted in electronic form to the Agency.

The full list of parameters of our license as they relate to air monitoring from the discharge points are included below and in Appendix 2. There were two non-compliances received in relation to air in 2015 both of which related to incidents on site and are discussed in further details in section 4.1

Emission Point	Parameter	IPPC/IEL Mass ELV (kg/year)	Mass Emission (kg)		
			2013	2014	2015
AB-02 & AB-06	Total Dust	6622	16.52	20.283	98.325
ABAS-02	TA Luft Organics Class 1	876	5.995	0.869	0.166
ABAS-02	TA Luft Organics Class 2	17520	18.593	2.264	0.716
AB-03	TA Luft Class 3 Vapour Inorganics	2628	0.032	0.224	0.116
ABAS-01	TA Luft Class 3 Carcinogens	219	8.481	8.572	17.293
AB-04 & AB-05	NOx	19272	7210	4445.17	10200.52
AB-04 & AB-05	CO	9636	148.55	41.04	133.46

3.1.2 Emission to Sewer

The summary information required for this AER has been submitted electronically to the Agency. A copy of this PRTR submission is included in Appendix 1. The full list of parameters of our license as they relate to monitoring of waste water from the discharge point to sewer is included below and in Appendix 2. All parameters are within the Mass Emission Limit for the site.

As per condition 6.5 of the IPPC/IEL license, Microtox and Respirometry were approved as the appropriate testing regimes for toxicity testing of discharges to sewer. All results were within IPPC/IEL limits specified.

A summary of compliance is provided below;

Parameter	Frequency	IPPC/IEL Mass ELV (kg/year)	Mass Emission 2013	2014	2015
Flow (m^3)	Continuous	803000	285599	316704	319947
BOD	Monthly	481800	9946	19185	18243
COD	Monthly	963600	125272	235641	150539
Suspended solids	Monthly	481800	33168	59937	47174
Sulphates as SO4	Monthly	240900	12594	21989	13899
Copper as Cu	Monthly	4015	3.4	4	4
Fats, Oils, Grease	Monthly	16060	2002	1680	1232
Phosphates as P	Monthly	16060	1765	2071	1503
Iodinated Compounds	Monthly	240900	34236	39679	42155
Chlorides	Monthly	3,613,500	312,637	1,340,005	693,291
Ammonia as N	Monthly	80300	7377	5923	10478
Nitrates as N	Monthly	20075	936	423	357
Kjeldahl Nitrogen	Monthly	160600	10669	13371	18667
Total Nitrogen	Monthly	240900	11833	12411	19812

Parameter	Frequency	IPPC/IEL ELV	Emission 2014	Emission 2015
Temperature	Continuous	42^{o} max	29.5	29^{o} max
pH	Continuous	6 – 10	7.69-9.111	7.4-9.0
Toxicity	Quarterly	10 TU	<2.2TU	<2.2TU
Organic Solvents	Biannually	Solvent Screen Process	No elevated results	No elevated results

3.1.3 Emissions to Surface Water

All emissions to Surface water were monitored in accordance with our IPPC/IEL License. Inline pH and TOC analysers are in place on the surface water discharge to the River Tolka and are fed back to the DCS plant control system. These are configured to activate an alarm in the event of an exceedance of pH or TOC and automatically divert any surface water to the Firewater Retention Pond.

All diversions in 2015 were fully investigated, and were normally as a result of TOC pump issues due to environmental conditions or ingress of detritus to the TOC monitoring system.

There were 3 Category 1 events relating to surface water reported to the agency in 2015. Two of these occasions relate to inaccurate or faulty readings on the analyser.

3.1.4 Waste

Overall the waste recycling and recovery rate on site increased from 40% in 2014 to over 75% in 2015. This was largely due to an effort to reduce waste to landfill and send material such as carbon for recovery as opposed to landfill as a final waste destination.

A summary table of the waste generated is included in Appendix 1 as part of PRTR reporting, and has been submitted electronically to the Agency.

3.1.5 Resource Consumption

Data for energy usage and water consumption is included in the Environmental Data Submission included in Appendix 2. Based on 596.294 tonnes of product produced, these are the metrics for resource consumption.

Parameter	Unit	2012	2013	2014	2015
Light Fuel Oil	m^3/year	0.951	0.841	1.00	1.65
Natural Gas	m^3/year	3,970,361	3,391,014	3,513,556	3,894,686
	m^3/Kg Product	6.783	6.850	6.321	6.531
Electricity	MWhr	12293.9	10798.2	10560.5	10774.7
	MWhr/kg Product	0.021	0.022	0.019	0.018
Municipal water use	m^3/year	357,507	332,673	308,091	362,185
	m3/kg Product	0.611	0.672	0.554	0.607

Natural Gas is in line with Greenhouse Gas Permit allowance and permit. An annual return in line with our GHG permit has been submitted to the Agency in March 2016.

4. ENVIRONMENTAL INCIDENTS AND COMPLAINTS

4.1 Incidents

Please see below the summary of reportable environmental incidents in 2015 as defined under EPA guidance on reporting of incidents.

As part of the site IPPC/IEL License there is a requirement to inform the Agency of any release to atmosphere from any potential emission point; any emission which does not comply with the requirements of the license; any malfunction or breakdown of control equipment or monitoring equipment which is likely to lead to loss of control of the abatement system; and any incident with the potential for environmental contamination of surface water or groundwater, or posing an environmental threat to air or land, or requiring an emergency response by the Local Authority.

Incidents were reported to the EPA as required over the course of the year. All incidents reported to the EPA were categorised as Category 1 Environmental incidents in 2015.

Incident Date	Issue	Corrective Action	Preventive Actions
30.11.2014 – Incident Occurred 13.01.2015 - Reported to the EPA	Suspended Solids monthly result of 748ppm against the license limit of 600ppm (>1.2 times the IPPCL limit).for November 2014	Performed an incident investigation into elevated results. Internal testing of a split sample was well within license limit including historical results. The external lab miss labelled sample and compared limit to the wrong spec.	Develop procedure with the external lab to obtain results within 3 weeks of sampling. Periodic split sample testing to verify results.
21.01.2015	It was identified that the analyser (AT-2057-90) on the Ethylene abator was reading out of trend values. It was noted that the sensor needed replacing, however on replacing readings on the local transmitter were not matching readings on the DCS. Following investigation it was noted that the instrument range was set at 0-50ppm instead of required 0-200ppm. Loss of continuous monitoring during investigation	No impact on the environment. Although continuous monitoring of EtO emissions were lost for a number of days it is unlikely that the incident had an environmental impact as the sites abator and scrubber system trends show that they were operating as normal for the full duration of the instrument malfunction	To prevent moisture build up measuring system installed in an enclosure – Pm added for visual inspection of the systems tubing for moisture during quarterly calibrations Full RCA details available on site
12.02.2015	The surface water TOC analyser (AI-952-02) went into fault and began to show a reduced negative recorded value.	No impact on the environment. The surface water drains are diverted to the fire water retention pond and have been for the duration of the maintenance activity on the analyser. External contractor called in for emergency maintenance Trends for TOC and PH were monitored for the duration of event and reported as normal and within licensed parameters	
22.03.2015	Utilities sump overflow – sump used to collect various flushes of the water system mostly brine and low strength waste.	No impact on the environment. The diverter valve was closed at the time of the event. Trends for SW TOC and PH were reviewed and showed No adverse impact. Sample taken for sump to determine PH of material results showed Ph of 7.95	Pump replaced
19.06.2015	The surface water TOC analyser (AI-952-02) was not operating, loss of continuous monitoring.	No impact on the environment. The fault automatically triggered the SW to be diverted to the fire water retention pond on site	Analyser maintenance carried out

Incident Date	Issue	Corrective Action	Preventive Actions
16.07.2015	Total Site Wide power outage, all monitoring equipment lost for the duration of 4 hours	Overflow of waste tank during the return of power as lack of visibility of tank levels on DCS	External issue to the industrial estate
31.08.2015	A leak of Chloro Acetyl Chloride (CAC) was identified coming from a pipeline between tank from process. Uncontrolled release to atmosphere	No impact on the environment. Mist from flange on pipe Site evacuated and Emergency response team on site inspected and isolated. Area made safe and incident reported	Replacement of CAC Transfer line with a fully welded Hastalloy line. Action Completed
21.09.2015	A leak of Chloro Acetyl Chloride (CAC) was identified coming the production building. Uncontrolled release to atmosphere	No impact on the environment. Odour detected and Mist observed coming from pipe Site evacuated and Emergency response team on site inspected and isolated. Area made safe and incident reported	Replacement of CAC Transfer line with a fully welded Hastalloy line. Action Completed
28.10.2015	Breach in Emission Limit Value for EtO on site Non routine activity overloaded abator Non-compliance received from the EPA	Localized Impact Category 1 Scrubber SC-2051 restarted	Communication of event to production and supervisors regarding importance of not pressurising scrubber system when the EtO strip is in progress. Update of DCS to ensure scrubber recirculation pump stays running when high levels of EtO are detected to minimise environmental impact. Update of DCS to ensure acknowledgement of licence limit exceedance prior to cycle resume Full RCA details available on site.
14.08.2015 – Incident Occurred 11.11.2015 – Reported to the EPA	Breach in Emission Limit Value for volumetric flow rate for dryer D301 Vent AB-06. Maximum rate per hour exceeded for quarter 3 monitoring report Non-compliance received from the EPA	No impact on the environment.	Reduction made to Main air and air broom flows following RCA on site. Spot check carried out in December 2015 by independent consultant to ensure levels below ELV as set down in the licence.
30.11.2015	The surface water TOC analyser (AT-952-01) went into alarm showing reading of 100mg/l above the trigger levels as per license conditions	No impact on the environment. All surface water to the fire water retention pond once trigger level reached. Adverse weather conditions on site and maintenance on drain cleaning being carried out on the day which may have flushed debris towards the analyser.	Note placed in Maximo to ensure that prior to all drain cleaning on site that all surface water is diverted to the fire water retention pond

4.2 Complaints

No environmental complaints were received in 2015.

5. MANAGEMENT OF THE ACTIVITY

5.1 Guerbet Dublin Environmental Management System

Mallinckrodt Medical Imaging Ireland, T/A Guerbet Dublin, is certified to the Environmental Management System Standard ISO14001:2004, and is audited externally normally twice yearly to ensure ongoing conformance with this standard. The Plant Manager has overall responsibility for environmental management at the site with designated responsibilities for performance and compliance support assigned to the EHS-Engineering Manager. The EHS/Engineering Department comprises of three EHS employees- EHS/Engineering Manager, EHS Engineer and Environment and Energy Engineer.

The key elements of the environmental management system comprises of identifying environmental aspects associated with site activities, the determination of suitable operational controls (engineering and administrative); the identification of pertinent legal requirements; definition and implementation of objectives and targets; ongoing monitoring of performance and compliance; and management review of performance on a periodic basis. Emergency planning and good internal stakeholder structures are also features of the system. These elements are structured to meet the requirements of both ISO14001 and Guerbet Corporate requirements to provide for continual improvement in environmental performance.

5.2 Environmental Management Programme Report and Proposal

As per condition 2.2.1 of the license a schedule of Environmental Objectives and Targets is required. Normally this has been provided in a five year plan to the Agency as part of the annual environmental report. We have included the five year EMP for 2011– 2015 with the overall performance in Appendix 3 of this report.

In line with ISO 14001 this year we have provided the years plan for 2016 in Appendix 3 of the report. All objectives and targets on this plan are based on the significant environmental aspects of the site and related compliance requirements.

The company can prepare a five year plan if this is required by the Agency however we believe that the yearly plan at present is more effective in ensuring Environmental Objectives and Targets are addressed at our site.

5.3 Pollution Emission Register Report and Proposal

As per IPPC/IEL Condition 2.4, the substances for the 2015 Pollution Emission Register are:

- Total Nitrogen (CAS No. 7727-37-9)
- 2-Chloroethanol (CAS No. 107-07-3)

Total Nitrogen and 2-Chloroethanol have been reported in previous year's annual environmental reports. A copy of the PER for 2015 is contained within Appendix 4 of this report.

5.4 Other Significant Environmental Activities

5.4.1 EPA Inspections and Sampling

There was one site EPA visit carried out in 2015 in relation to the ELRA and CRAMP for the site. A report of inspection was issued and the ELRA and CMP for the site has since been agreed

The EPA sampled the waste water treatment effluent throughout the year. A split sample was taken by Guerbet each time. There were no noncompliance's associated with the monthly samples taken during 2015

5.4.2 External Environmental Management System Audits

ISO14001:2004 surveillance audits were carried out in February, August and December of 2015. A recertification audit is due to take place in 2016.

6. LICENSE SPECIFIC REPORTS

There are a number of license specific reports to be provided as part of the site IPPC/IEL license on a periodic basis. A summary of the status of these are as follows:

Report Type	License Requirement	Reports Submitted in AER 2015
Sump Integrity	Every 3 years	Included in this AER
Environmental Noise Monitoring	Every 3 years	Included in this AER - Completed February 2016
Groundwater Monitoring Report	Every 2 years	Included in this AER – Completed February 2016
Bund Integrity	Every 3 years	Included in this AER
Underground pipeline integrity	Every 3 years	Included in this AER – Completed December 2015

6.1 Noise Monitoring

An environmental noise assessment was carried out in February 2016. During the assessment, it has been observed that the noise levels appears to be in excess of the day, evening and night time noise limits as outlined in IEL P0050-02 however such levels are not attributable to the Guerbet facility and are largely attributable to passing traffic and other extraneous noise sources.

The independent noise monitoring report is included in Appendix 5 and confirms that the Guerbet facility is in compliance with the day, evening and night noise levels as set down in P0050-02.

6.2 Groundwater Monitoring

Groundwater monitoring was conducted in February 2016 and results have been included in Appendix 8 of this report.

6.3 Bund and Sump Inspection Report and CCTV survey

Some Bund inspections and testing was carried out in 2015. Sump testing, inspection and repair work was also carried out in 2015 in line with IPPC/IEL requirements as required.

Bund and Sump Matrices are included in Appendix 9 of this report and give a summary of current status of all bunds and sumps on site.

A CCTV survey on underground pipelines was complete on all surface and foul drains in December 2015. It is planned to complete process drains during shutdown of September 2016. Please find a summary of findings in Appendix 9. These have been entered into our maintenance plan for 2016.

6.4 Report on List I and II Substance Reductions

This report was completed in 2004 and is available for inspection on site. The principal conclusion was that a ca. 7.5 % reduction in the amount of 2-Chloroethanol was planned to be achieved from mid 2002 onwards. The actual achieved was ca. 10.5 % in 2003. The process is now fully optimized in terms of the use of 2-Chloroethanol.

6.5 Review of Closure Management Plan (CMP) and Environmental Liabilities Risk Assessment (ELRA)

In 2015 the **C**losure, **R**estoration and **A**ftercare **M**anagement Plant (**CRAMP**) was submitted to the Agency for review via Eden. The CRAMP is now called the **C**losure **M**anagement **P**lan (**CMP**) for this site. Following submission of further information and clarifications the CMP has was agreed with the EPA in Dec 2015. A copy of this agreement is contained within Appendix 6 of this report

An ELRA for the site has also been agreed with the EPA since February 2016 and agreement is included in Appendix 7 of this report. The implementation of financial provisions for the CMP and the ELRA is currently in progress and Guerbet hope to have this in place in quarter 2 of 2016.

6.6 Energy Efficiency Audit

In 2015 all consumption of gas, electricity and water usage was tracked on site and a significant metering project took place in 2015.

In 2016 a new energy plan for the site will be created and a resource has been dedicated to the implementation of a new energy management system on site. Key projects have been identified such as compressor replacement, lighting and cooling tower replacements where energy savings will be implemented as part of these projects.

7. CONCLUSIONS

In ensuring ongoing compliance of the site to the IPPC/IEL License the site continued to demonstrate strong environmental performance in 2015.

The site has continued to successfully deliver on the agreed environmental programme with excellent success especially in the areas of resource and waste recycling and recovery. Increased management of environmental monitoring criteria at plant level, and an increased focus on compliance criteria in the company has resulted in increased ownership and awareness of environmental requirements and performance across the plant.

The site wishes to continue to operate to a very high standard of environmental performance, and is committed to maintaining good stakeholder relations with the Agency, public and surrounding community in providing the highest level of environmental protection.

Appendix 1 Data submission PRTR

Environmental Protection Agency

Guidance to completing the PRTR workbook

PRTR Returns Workbook

Version 1.1.19

REFERENCE YEAR	2015

1. FACILITY IDENTIFICATION

Parent Company Name	Mallinckrodt Medical Imaging Ireland
Facility Name	Mallinckrodt Medical Imaging - Ireland
PRTR Identification Number	P0050
Licence Number	P0050-02

Classes of Activity

No.	class_name
-	Refer to PRTR class activities below

Address 1	Damastown
Address 2	Mulhuddart
Address 3	Dublin 15
Address 4	
	Dublin
Country	Ireland
Coordinates of Location	-6.424872792 53.41381314
River Basin District	IEEA
NACE Code	2120
Main Economic Activity	Manufacture of pharmaceutical preparations
AER Returns Contact Name	Mercedes Kavanagh
AER Returns Contact Email Address	Mercedes.Kavanagh@mallinckrodt.com
AER Returns Contact Position	Environment and Energy Engineer
AER Returns Contact Telephone Number	018207940
AER Returns Contact Mobile Phone Number	0872261567
AER Returns Contact Fax Number	n/a
Production Volume	596.294
Production Volume Units	Kilograms
Number of Installations	0
Number of Operating Hours in Year	0
Number of Employees	98
User Feedback/Comments	CO2 emissions were calculated using the EPA emission factor for 2015 and as submitted in GHG report. Wastewater emissions are calculated using monthly samples data times flow measurements, therefore a slight difference in monthly values can show significant changes from year to year. Air Emissions were calculated using results from quarterly reports carried out by Glenside Environmental during 2015. All waste information was input from waste summary reports supplied by the five waste providers used on site.
Web Address	

2. PRTR CLASS ACTIVITIES

Activity Number	Activity Name
50.1	General
4(e)	Installations using a chemical or biological process for the production on an industrial scale of basic pharmaceutical products

3. SOLVENTS REGULATIONS (S.I. No. 543 of 2002)

SECTION A : SECTOR SPECIFIC PRTR POLLUTANTS

RELEASES TO AIR					Please enter all quantities in this section in KGs						
POLLUTANT		METHOD							QUANTITY		
			Method Used		AB-04/AB-05 Boilers	ABAS-01	AB-03	ABAS-02			
No. Annex II	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	Emission Point 2	Emission Point 3	Emission Point 4	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
03	Carbon dioxide (CO2)	C	ETS		7812954.0	0.0	0.0	0.0	7812954.0	0.0	0.0
08	Nitrogen oxides (NOx/NO2)	M	CRM		10200.52	0.0	0.0	0.0	10200.52	0.0	0.0
07	Non-methane volatile organic compounds (NMVOC)	M	EN 13649:2001		0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	Sulphur oxides (SOx/SO2)	M	CRM		22.16	0.0	0.0	0.0	22.16	0.0	0.0

* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button

SECTION B : REMAINING PRTR POLLUTANTS

RELEASES TO AIR					Please enter all quantities in this section in KGs				
POLLUTANT		METHOD					QUANTITY		
			Method Used		AB-04/AB-05 Boilers	ABAS-01			
No. Annex II	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	Emission Point 2	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
02	Carbon monoxide (CO)	M	CRM		133.46	0.0	133.46	0.0	0.0
66	Ethylene oxide	M	EN 13649:2001		0.0	17.29	17.29	0.0	0.0

* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button

SECTION C : REMAINING POLLUTANT EMISSIONS (As required in your Licence)

RELEASES TO AIR					Please enter all quantities in this section in KGs								
POLLUTANT		METHOD									QUANTITY		
			Method Used		AB-02	AB-06	AB-03	ABAS-02	ABAS-01				
Pollutant No.	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	Emission Point 2	Emission Point 3	Emission Point 4	Emission Point 5	Emission Point 6	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
210	Dust	M	CRM		88.695	9.631	0.0	0.0	0.0	0.0	98.326	0.0	0.0
344	TA luft carcinogenic substance class 3	M	EN 13649:2001		0.0	0.0	0.0	0.0	17.293	0.0	17.293	0.0	0.0
230	TA Luft organic substances class 1	M	EN 13649:2001		0.0	0.0	0.0	0.166	0.0	0.0	0.166	0.0	0.0
231	TA Luft organic substances class 2	M	EN 13649:2001		0.0	0.0	0.0	0.716	0.0	0.0	0.716	0.0	0.0
319	Inorganic acids	M	EN 1911-1 to 3:2003		0.0	0.0	0.116	0.0	0.0	0.0	0.116	0.0	0.0

* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button

Additional Data Requested from Landfill operators

For the purposes of the National Inventory on Greenhouse Gases, landfill operators are requested to provide summary data on landfill gas (Methane) flared or utilised on their facilities to accompany the figures for total methane generated. Operators should only report their Net methane (CH4) emission to the environment under T(total) KG/yr for Section A: Sector specific PRTR pollutants above. Please complete the table below:

Landfill: Mallinckrodt Medical Imaging - Ireland

Please enter summary data on the quantities of methane flared and / or utilised	T (Total) kg/Year	M/C/E	Method Used		Facility Total Capacity m3 per hour	
			Method Code	Designation or Description		
Total estimated methane generation (as per site model)	0.0				N/A	
Methane flared	0.0				0.0	(Total Flaring Capacity)
Methane utilised in engine/s	0.0				0.0	(Total Utilising Capacity)
Net methane emission (as reported in Section A above)	0.0				N/A	

4.2 RELEASES TO WATERS

Link to previous years emissions data

SECTION A : SECTOR SPECIFIC PRTR POLLUTANTS

Data on ambient monitoring of storm/surface water or groundwater, conducted as part of your licence requirements, should NOT be submitted under AER / F

RELEASES TO WATERS					Please enter all quantities in this section in KGs		
POLLUTANT					QUANTITY		
			Method Used				
No. Annex II	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year
					0.0	0.0	0.0

* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button

SECTION B : REMAINING PRTR POLLUTANTS

RELEASES TO WATERS					Please enter all quantities in this section in KGs		
POLLUTANT					QUANTITY		
			Method Used				
No. Annex II	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year
					0.0	0.0	0.0

* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button

SECTION C : REMAINING POLLUTANT EMISSIONS (as required in your Licence)

RELEASES TO WATERS					Please enter all quantities in this section in KGs		
POLLUTANT					QUANTITY		
			Method Used				
Pollutant No.	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year
					0.0	0.0	0.0

* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button

SECTION A : PRTR POLLUTANTS

OFFSITE TRANSFER OF POLLUTANTS DESTINED FOR WASTE-WATER TREATMENT OR SEWER					Please enter all quantities in this section in KGs			
POLLUTANT		METHOD			QUANTITY			
			Method Used		WWT-01			
No. Annex II	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
06	Ammonia (NH3)	M	CRM	G/67 Based on APHA 2012, 22nd Edition, 4500- NH3 and bluebook Ammonia in waters 1081	10478.49	10478.49	0.0	0.0
79	Chlorides (as Cl)	M	CRM	G/67 Based on APHA 2012, 22nd Edition, 4500-NCL E	693291.03	693291.03	0.0	0.0
12	Total nitrogen	M	CRM	G/93 Based on ENV 12260 1996	19812.18	19812.18	0.0	0.0
76	Total organic carbon (TOC) (as total C or COD/3)	C	OTH	Standard Calculations for COD	50179.74	50179.74	0.0	0.0
20	Copper and compounds (as Cu)	M	CRM	Method 200JB	4.04	4.04	0.0	0.0

* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button

SECTION B : REMAINING POLLUTANT EMISSIONS (as required in your Licence)

OFFSITE TRANSFER OF POLLUTANTS DESTINED FOR WASTE-WATER TREATMENT OR SEWER					Please enter all quantities in this section in KGs			
POLLUTANT		METHOD			QUANTITY			
			Method Used		WWT-01			
Pollutant No.	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
238	Ammonia (as N)	M	CRM	G/67 Based on APHA 2012, 22nd Edition, 4500- NH3 and bluebook Ammonia in waters 1081	10478.49	10478.49	0.0	0.0
303	BOD	M	CRM	G/04 Based on APHA 2012, 22nd Edition, Method 5120B TCMP Nitrification inhibition	18242.81	18242.81	0.0	0.0
306	COD	M	CRM	G/03 Based on APHA 2012, 22nd Edition Method 5220D	150539.21	150539.21	0.0	0.0
240	Suspended Solids	M	CRM	G/19 Based on APHA 2012, 22nd Edition, Method 2540D	47173.7	47173.7	0.0	0.0
314	Fats, Oils and Greases	M	CRM	G/32 Based on APHA 2012, 22nd Edition, Method 5520B	1232.33	1232.33	0.0	0.0
387	Ortho-phosphate (as P)	M	CRM	G/67 Based on APHA 2012, 22nd Edition, 4500-P.E. Ascorbic Acid Method	1502.84	1502.84	0.0	0.0
362	Kjeldahl Nitrogen	C	OTH	In house method based on calculation (TN-TON)	18666.52	18666.52	0.0	0.0
327	Nitrate (as N)	M	CRM	G/67 Based on APHA 2012, 22nd Edition, 4500-N02B colorimetric method	356.62	356.62	0.0	0.0

* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button

5. ONSITE TREATMENT & OFFSITE TRANSFERS OF WASTE

Please enter all quantities on this sheet in Tonnes

0

Transfer Destination	European Waste Code	Hazardous	Quantity (Tonnes per Year)	Description of Waste	Waste Treatment Operation	Method Used		Location of Treatment	Haz Waste : Name and Licence/Permit No of Next Destination Facility Non Haz Waste: Name and Licence/Permit No of Recover/Disposer	Haz Waste : Address of Next Destination Facility Non Haz Waste: Address of Recover/Disposer	Name and License / Permit No. and Address of Final Recoverer / Disposer (HAZARDOUS WASTE ONLY)	Actual Address of Final Destination i.e. Final Recovery / Disposal Site (HAZARDOUS WASTE ONLY)
						M/C/E	Method Used					
To Other Countries	07 05 03	Yes	2.31	organic halogenated solvents, washing liquids and mother liquors	D10	M	Weighed	Abroad	Indaver ,WL36-2	Tolka Quay Road ,Dublin Port,Dublin,Dublin 1,Ireland	Indaver Antwerpen AV,WLAV1/9800000/485/MV /BD,Indaver Antwerpen AV,Poldervlietwegs,Haven ,550 Antwerp,Belgium	Poldervlietwegs,Haven,550, Antwerp,Belgium
To Other Countries	07 05 03	Yes	0.45	organic halogenated solvents, washing liquids and mother liquors	D10	M	Weighed	Abroad	Indaver ,WL36-2	Tolka Quay Road ,Dublin Port,Dublin,Dublin 1,Ireland	AVG Hamburg-Germany,IB2234/AVG-GENB-2,Abfall-Verwertungs-Gesellschaft mbH ,Borsigstrasse 2 ,Hamburg,22113,Germany	Abfall-Verwertungs-Gesellschaft mbH ,Borsigstrasse 2 ,Hamburg,22113,Germany
To Other Countries	07 05 04	Yes	1.705	other organic solvents, washing liquids and mother liquors	D10	M	Weighed	Abroad	Indaver ,WL36-2	Tolka Quay Road ,Dublin Port,Dublin,Dublin 1,Ireland	Indaver Antwerpen AV,WLAV1/9800000/485/MV /BD,Indaver Antwerpen AV,Poldervlietwegs,Haven ,550 Antwerp,Belgium	Poldervlietwegs,Haven,550, Antwerp,Belgium
To Other Countries	07 05 04	Yes	1.465	other organic solvents, washing liquids and mother liquors	D10	M	Weighed	Abroad	Indaver ,WL36-2	Tolka Quay Road ,Dublin Port,Dublin,Dublin 1,Ireland	AVG Hamburg-Germany,IB2234/AVG-GENB-2,Abfall-Verwertungs-Gesellschaft mbH ,Borsigstrasse 2 ,Hamburg,22113,Germany	Abfall-Verwertungs-Gesellschaft mbH ,Borsigstrasse 2 ,Hamburg,22113,Germany
To Other Countries	07 05 13	Yes	7.468	solid wastes containing dangerous substances	D10	M	Weighed	Abroad	Indaver ,WL36-2	Tolka Quay Road ,Dublin Port,Dublin,Dublin 1,Ireland	Indaver Antwerpen AV,WLAV1/9800000/485/MV /BD,Indaver Antwerpen AV,Poldervlietwegs,Haven ,550 Antwerp,Belgium	Poldervlietwegs,Haven,550, Antwerp,Belgium
Within the Country	20 01 40	No	5.54	metals	R4	M	Weighed	Offsite in Ireland	Hammond Lane,WP/173/2008	Pigeon Hse rd ,Ringsend 4 ,Co. Dublin,.,Ireland		
To Other Countries	15 01 10	Yes	5.0	packaging containing residues of or contaminated by dangerous substances	R3	E	Weighed	Abroad	Sita Environmental LTD,W0192-03	Greenogue Industrial Estate,Rathcoole,Dublin,.,Irel and	JFC Plastics Limited ,.,Warcs, U.K.,.,.,United Kingdom	Warcs,U.K.,.,.,United Kingdom
To Other Countries	15 01 10	Yes	17.45	packaging containing residues of or contaminated by dangerous substances	R4	E	Weighed	Abroad	Sita Environmental LTD,W0192-03	Greenogue Industrial Estate,Rathcoole,Dublin,.,Irel and	Megisa,.,EL Ferroll Spain,.,.,.,Spain	.,.,.,.,Spain
Within the Country	19 09 04	No	33.26	spent activated carbon	D1	M	Weighed	Offsite in Ireland	AES (Drehid),W0201-03	Killinagh Lower & Killinagh Upper ,.,Carbury ,County Kildare.,Ireland		
Within the Country	20 01 01	No	5.99	paper and cardboard	R3	M	Weighed	Offsite in Ireland	Shred It,WP98102	53 Parkwest Road ,Parkwest Industrial Estate ,Dublin,Dublin 12,Ireland		
Within the Country	20 01 08	No	1.61	biodegradable kitchen and canteen waste	R3	M	Weighed	Offsite in Ireland	Thorntons Recycling MRF ,W0044-02	Killeen Road,Ballyfermot ,Dublin ,12,Ireland		
Within the Country	20 03 01	No	18.42	mixed municipal waste	R1	M	Weighed	Offsite in Ireland	Thorntons Recycling MRF ,W0044-02	Killeen Road,Ballyfermot ,Dublin ,12,Ireland		
Within the Country	19 09 04	No	71.61	spent activated carbon	R12	M	Weighed	Offsite in Ireland	AVR Environmental Solutions Ltd Eras Eco	Foxhole,Youghal,Cork,Cork,I reland		
Within the Country	20 01 01	No	46.27	paper and cardboard	R3	M	Weighed	Offsite in Ireland	Thorntons Recycling Mixed Dry Recyclables (MDR) Materials Recovery Facility (MRF),WFP-DC-10-0021-02	Henry Road,Park West Business Park ,Dublin ,12,Ireland		
Within the Country	13 02 08	Yes	0.2	other engine, gear and lubricating oils	R1	M	Weighed	Offsite in Ireland	Indaver ,WL36-2	Tolka Quay Road ,Dublin Port,Dublin,Dublin 1,Ireland	Indaver Antwerpen AV,WLAV1/9800000/485/MV /BD,Indaver Antwerpen AV,Poldervlietwegs,Haven ,550 Antwerp,Belgium	Poldervlietwegs,Haven,550, Antwerp,Belgium
Within the Country	16 02 13	Yes	7.0	discarded equipment containing hazardous components (16) other than those mentioned in 16 02 09 to 16 02 12	R4	M	Weighed	Offsite in Ireland	KMK Metal Recycling Ltd ,W0113-04	Cappincur Industrial Estate,Daingean Road ,Tullamore ,Co Offaly ,Iceland	KMK Metal Recycling Ltd ,W0113-02,Cappincur ,Daingean Road ,Tullamore ,Co Offaly ,Ireland	Cappincur ,Daingean Road ,Tullamore ,Co Offaly ,Ireland
Within the Country	14 06 03	Yes	0.561	other solvents and solvent mixtures	D10	M	Weighed	Offsite in Ireland	Indaver ,WL36-2	Tolka Quay Road ,Dublin Port,Dublin,Dublin 1,Ireland	AVG Hamburg-Germany,IB2234/AVG-GENB-2,Abfall-Verwertungs-Gesellschaft mbH ,Borsigstrasse 2 ,Hamburg,22113,Germany	Abfall-Verwertungs-Gesellschaft mbH ,Borsigstrasse 2 ,Hamburg,22113,Germany
Within the Country	16 05 08	Yes	0.032	discarded organic chemicals consisting of or containing dangerous substances	D15	M	Weighed	Offsite in Ireland	Indaver ,WL36-2	Tolka Quay Road ,Dublin Port,Dublin,Dublin 1,Ireland	Indaver Antwerpen AV,WLAV1/9800000/485/MV /BD,Indaver Antwerpen AV,Poldervlietwegs,Haven ,550 Antwerp,Belgium	Poldervlietwegs,Haven,550, Antwerp,Belgium

* Select a row by double-clicking the Description of Waste then click the delete button

Link to previous years waste data
Link to previous years waste summary data & percentage change
Link to Waste Guidance

APPENDIX 2 IEL EMISSION SUMMARY

Summary of IED Emissions 2015 P0050-02

Energy Usage

Energy Consumption	Sulphur Content	Unit	2012	2013	2014	2015
Heavy Fuel Oil		M^3/yr	0	0	0	0
Light Fuel Oil	0.05%	M^3/yr	0.951	0.841	0.85	1.651
Natural Gas	0.0007	M^3/yr	3970361	3391014	3513555.91	3894686
Electricity		MWhr	12293.9	10795.2	10560.45	10774.72
Coal		Kg/yr	0	0	0	0

Water	Unit		2012	2013	2014	2015
On-site groundwater use	m^3/yr		0	0	0	0
On-site surface water us	m^3/yr		0	0	0	0
Municipal water use	m^3/yr		357507	332673	316704	362185

Process Emissions to Waters

Indicate Yes if emissions are to: Freshwate / No — or Sewer

Parameter	Unit	Max. Licensed Emission per year	2012	2013	2014	2015
Volume	M^3/yr	803000	345806.13	285599.4	316703.86	319946.89
Suspended Solids	Kg/yr	481800	25745.07	33168	59937.30	47173.68
BOD	Kg/yr	481800	8063.77	9946.18	19784.76	18242.81
COD	Kg/yr	963600	157514.62	125272.8	235641.02	150539.21
Total Dissolved Solids	Kg/yr	Not Applica				
Total Nitrogen	Kg/yr	240900	12584.9	11833.8	12411.17	19812.18
Total Phosphorous	Kg/yr	16060	2257.44	1764.54	2070.89	1502.84
Toxicity	Max. TU	10	<2.2	<2.2	<2.2	<2.2
Hg	Kg/yr	Not Applica				
Cd	Kg/yr	Not Applica				
Pb	Kg/yr	Not Applica				
Cr	Kg/yr	Not Applica				
As	Kg/yr	Not Applica				
Zn	Kg/yr	Not Applica				
Cu	Kg/yr	4015	3.26757	3.44	3.88	4.04
Ni	Kg/yr	Not Applica				
Sulphates	Kg/yr	240900	14225.54	12594.22	21988.75	13898.60
Fats ,Oils ,Grease	Kg/yr	16060	3465.66	2002.19	1680.28	1232.33
Iodinated Compounds	Kg/yr	240900	45986.57	34256.51	39678.79	42155.01
Chlorides	Kg/yr	3613500	815630.1	612637.57	1340005.00	693291.03
Ammonia	Kg/yr	80300	10461.97	7377.28	5922.66	10478.49
Nitrates	Kg/yr	20075	1014.99	935.67	423.28	356.62
Kjeldahl Nitrogen	Kg/yr	160600	17352.93	10668.89	13371.03	18666.52
% Compliance	%		100	100	100.00	100.00
Number of samples						14

Emissions to air

Parameter	Unit	Max. Licensed	2012	2013	2014	2015
General Dust	Kg/yr	6622.6	64.23	16.65	18.58	98.33
Particulates	Kg/yr	481.8				
Sox	Kg/yr	3372.6		148.55	52.39	22.16
Nox	Kg/yr	19272		7210.76	4451.64	10200.52
CO	Kg/yr	9636		0.00	43.16	133.46
TA Luft Class I	Kg/yr	876	327.02	5.96	8.41	0.17
TA Luft Class II	Kg/yr	17520	10.72	18.59	0.59	0.72
TA Luft Class III (Car & Inorg)	Kg/yr	2628	9.46	8.51	5.15	17.41
Total Organic (as C)	Kg/yr	Not Applicable				
Non-Methane VOC	Kg/yr	Not Applicable				
Ammonia	Kg/yr	Not Applicable				
Total Heavy Metals	Kg/yr	Not Applicable				
Benzene	Kg/yr	Not Applicable				
PAHs	Kg/yr	Not Applicable				
Dichloromethane	Kg/yr	Not Applicable				
PCDDs/PCDFs	Kg/yr	Not Applicable				
% Compliance	%		100.00	100.00	100.00	100.00
Number of samples			28.00	28.00	28.00	28.00

APPENDIX 3 EMP FOR 2011 – 2015 (COMPLETED) & PLAN FOR 2016

EMP for 2011– 2015

Aspect no.	Aspect	No.	Objective		2016	2017	2018	2019	2020
1 & 29	Emissions to air	1	Phase out ozone depleting compounds on site	Target	50%	100%	100%	*100%*	
				Actual	50%	75%	75%	*100%*	
		2	Meet CO_2 emission allowances by:	Target	100%	100 %	100 %		
				Actual	100%	100%	100%		
25, 26 & 28	General & Recyclable waste	4	To increase the recycling and recovery of all waste rate to:	Target	77%	78%	79%	*80%*	85%
				Actual	36%	38%	36%	40%	76.5%
5, 49 & 66	Use of Natural Resources	5	To decrease the civic water usage on-site from 2009 figures based on kgs of Ioversol produced by:	Target	6%	7%	8%	9%	10%
				Actual	37%	11.7%	2.1%	19.8%	25.3%
		6	Develop a projects policy that takes environmental aspects in particular energy into account	Target		100%			
				Actual		100%			
23, 43, 47, 51, 57, 60, 61, 64, 67, 80	Use of energy	7	Reduce the Electricity usage on-site based on kgs of Ioversol produced from 2009 figures year on year by:	Target	1%	2%	3%	4%	5%
				Actual	4%	13.2%	10.4%	21.5%	25.3%
		8	Reduce the gas consumption on site based on kgs of Ioversol produced from 2009 figures year on year by	Target	1%	2%	3%	4%	5%
				Actual	7%	7%	8.5%	11.3%	12.2%
17 & 18	Management systems	9	Improve internal incident investigation procedure for environmental incidents	Target	75%	100%			
				Actual	30%	100%			
32 &	***Emissions to Water***	10	Increase the % recovery rate of DMAC to the following rates	Target	65%	65.5	66	67	67.5

33, 27	- surface water, ground water, sewer			Actual	71.5%	65.5%	72%	69%	
		11	Increase the % recovery rate of Methanol to the following rates	Target	97%	97.2	97.3	97.4	97.5
				Actual	93%	95%	96%	97%	

Note:

********The "actual" status is based is a direct comparison with the "target" as opposed to the actual being a percentage of the Target*

Environmental Management Programme 2016

Complete				ON HOLD					
Ref No	***Aspect No***	***Date Set***	***Type***	***Objective / Classification***	***Target Details***	***Method***	***Timeframe***	***Responsible***	***Status***
EP01		Dec-15	Environ	Energy - Reduction in Use	Development of an Energy Management Programme in line with ISO50001 with the goal of future accreditation 2017/2018	1 - Development of Energy Opprotunities Register 2 - Meet with key contact in SEAI for support 3 - Development of Energy Forum 4 - Development of Energy Monitoring System 5 - Energy Audit Update 6 - Review existing SOP's to ensure Energy is addressed for procurement and change control	Dec-16	**MK**	**WIP - C**ommenceed, Contact meeting set up with new relationship manager Steven Roycroft for Feb 2016, Meetings with Airtricity and Bord Gais April 2016 re rebate scheme
EP02		Dec-15	Environ	Energy - Reduction in Use	Energy Awareness Programme to be developed to include training, posters, energy week in conjunction with Energy Management Programme for the Site	1 - Questionaire to staff on Energy Awareness 2 - Energy Awareness Week e.g. Watt Challenge 3 - Energy Awareness Campaign including posters, leaflets 4 - Energy Awareness Training for all Staff	Dec-16	**MK**	**Not Started -** June Energy Awareness Week
EP03		Dec-15	Environ	Water - Reduction in Use	Water Awareness Programme to be developed to include Training control room staff that water can be minimised during sanitisations, Evaporator seal water use/ alternatives, 2nd pass RO commissioning,Cooling tower overflows etc	1 - Water Awareness Programme to include Training 2 - Investigate alternative uses for Evaporator seal & make recommendation 3 - Investigate water uses in 2nd Pass RO commissioning & make recommendations 4 - Investigate cooling towers overflows & make recommendations 5 - Investigate all water uses on site to determine if changes can be made on type of water	Dec-16	**MK**	**Not Started -** July Water Awareness Week

Environmental Management Programme 2016

Complete				ON HOLD					
Ref No	***Aspect No***	***Date Set***	***Type***	***Objective / Classification***	***Target Details***	***Method***	***Timeframe***	***Responsible***	***Status***
EP04	25/26	Dec-15	Environ	Waste - Reduction in Use	Waste recycling programme review to take place to include waste awareness and training and Waste Electrical Electronic Equipment (WEEE) on site and consoliation of 5 waste service providers to site	1 - Review of waste management system on site 2- Consolidation of 5 waste service providers.Tender for waste providers hazardous and non-haardous 3 - WEEE review 4 - Waste Awareness Week 5 - Waste Training of Staff 6 - Review Current Supplier - Increase in Colour of raw materials leads to Increase in Carbon use			**WIP-** Waste awareness week organised fro Apil. Training commenced with Lab staff on what to place in correct bins and reduction of waste in March. Waste presentation currently being designed for circulation to all staff via on line training system
EP05	25/26	Dec-15	Environ	Waste - Formalise Internal movement	Waste flow charts to be developed for hazardous and non-harardous waste and standard works to be developed for Hazardous Wastes	1 - Develop flow charts for all waste movements 2 - Develop standard works for hazardous waste movements	Dec-16	**MK**	**Not Started**
EP06		Dec-15	Environ	Integrity - Underground Pipes	Complete the CCTV survey of all network drainage works and cary out remedial works as required	1 - Complete CCTV Survey 2- Review programme of works	Dec-16	**MK**	Completed - Report forwarded to Team 01.02.16. Repairs through Maintenance Dept not Projects as per BOR E-mail dated the 01.02.16
EP07		Dec-15	Environ/ H & S	Consumable Paper Use - Permit to Work System -	Investigate change of contractor management system to an on line system	1 - Quote from Company 2- Review to permit issuers 3- Cost project 4 - Review Benefits of Changing/ Disadvantages 5 - Implementataion	Dec-16	**OG/MK**	**WIP-** Demo received from Safepermit to schedule meeting with Supervisors and main permit issuers. MK sent e-mail to PP 10.02.16 looking for dates to schedule
EP08		Dec-15	Environ	ISO14001- Update to Standard	Review new standard ISO14001:2015 and ensure current EMS is in line with changes/new requirements before reassessment audit which is due in November 2016	1 - Review new standard to ensure current EMS is in line with new Standard 2 - Carry out a Gap analysis to assess changes 3 - Review existing documentation and make changes as required	Dec-16	**MK**	**WIP -** MK commenced audit plan Jan 2016 and adjusted new clauses of standard into the plan. Documentation to be updated through quality stream for changes to our system with the new standard

Environmental Management Programme 2016

Complete				ON HOLD					
Ref No	***Aspect No***	***Date Set***	***Type***	***Objective / Classification***	***Target Details***	***Method***	***Timeframe***	***Responsible***	***Status***
EP09	BAT Review	Dec-15	Environ/ H & S	BAT for Emissions of Organic Fine Chemicals	Actions resulting from review to be completed	1 - Solvent Managament Plan put in place 2 - Obtain quote from external consultant to carry out the work	Dec-16	**MK**	**WIP -** Order issued to PM to commence Plan for site E-mail sent 20.01.16
EP10	BAT Review	Dec-15	Environ	BAT for Emissions of Organic Fine Chemicals	Actions resulting from review to be completed	1 - NOX from Abator baseline measurements 2- Contact Glenside to carry out Monitoring	Dec-16	**MK**	Completed - report received 26.01.15
EP11	BAT Review	Dec-15	Environ/ H & S	BAT for general principles of Monitoring	Actions resulting from review to be completed	1 - Clarifty all testing carried out externally is carried out by INAB Labs or equivalent.	Dec-16	**OG/MK**	**Not Started**

APPENDIX 4 PER REPORT 2015

Mallinckrodt Medical Imaging Ireland
T/A Guerbet

POLLUTION EMISSION REGISTER 2015

Licensee: Mallinckrodt Medical Imaging Ireland
Damastown Industrial Estate
Mulhuddart
Dublin 15

Licence No: P0050-02

1 INTRODUCTION

This is the Pollution Emission Register of Mallinckrodt Medical Imaging Ireland (trading as Guerbet) as per Condition 2.4 of the Integrated Pollution Control Licence No. P0050-02.

The substances for the 2015 Pollution Emission Register are:

- Total Nitrogen (CAS No. 7727-37-9)
- 2-Chloroethanol (CAS No. 107-07-3)

2 MASS BALANCES

2.1 TOTAL NITROGEN

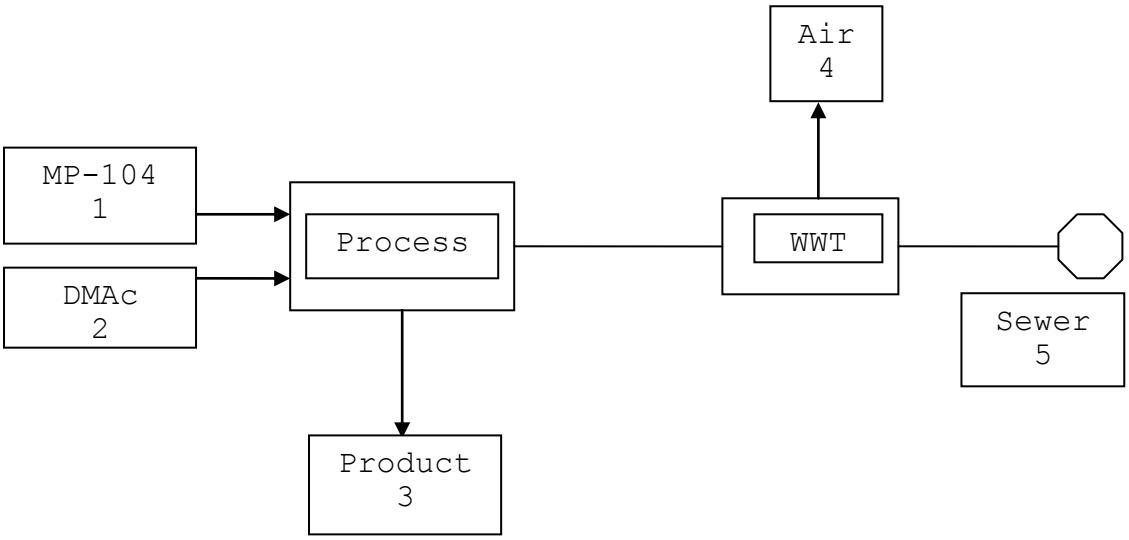
2.1.1 Process Description

N,N,Dimethylacetamide (DMAc) is charged to the process from a bulk tank in the tank farm. The DMAc molecule is ca. 16.1% nitrogen. The second source of nitrogen is the raw material for the process (MP-104). This comprises 6.0% nitrogen. The product, Ioversol, comprises 5.2% nitrogen. The nitrogen remaining in the waste water treatment effluent discharged to Sewer is measured as part of the IPPC license requirements. The emission to air, comprising largely nitrogen as a result of nitrification / denitrification in the waste water treatment plant is estimated by difference.

We maintain a high proportion of nitrifying bacteria in the waste water treatment plant. We monitor the ammonia levels closely as this parameter is a good indicator of the operation of the nitrification / denitrification process.

2.1.2 Final Mass Balance

A final mass balance for Total Nitrogen is shown below. This is based on the actual usage data for year 2015.



Stream No.	1	2	3	4	5
Description.	MP-104 In (as N)	DMAc in (as N)	Product Out (as N)	Emit to Air (as N)	Emit to Sewer (as N)
Kgs p.a. 2015	37320	45326	31067	31767	19812
% 2015			37.6%	38.4%	24.0%

The

Quantities in Streams 1 and 2 are based on actual purchases. Stream 3 is based on measurements. Stream 5 is based on measurements. Stream 4 is estimated by difference.

The emissions to air are predominately pure nitrogen from the nitrification / denitrification processes in waste water treatment.. The company have estimated from previous PER work on DMAc that only 6.7 kgs of this total quantity relates to fugitive losses of pure DMAc.

2.1.3 Fugitive Emissions

Estimates from previous mass balances for DMAc indicated that the total fugitive emissions associated with this material are ca. 42 kg/yr comprising ca, 6.7 kg of N. This represents ca. 0.01 % of the total nitrogen input. This shows the negligible extent of fugitive emissions of DMAc.

2.2 2-CHLOROETHANOL (CE)

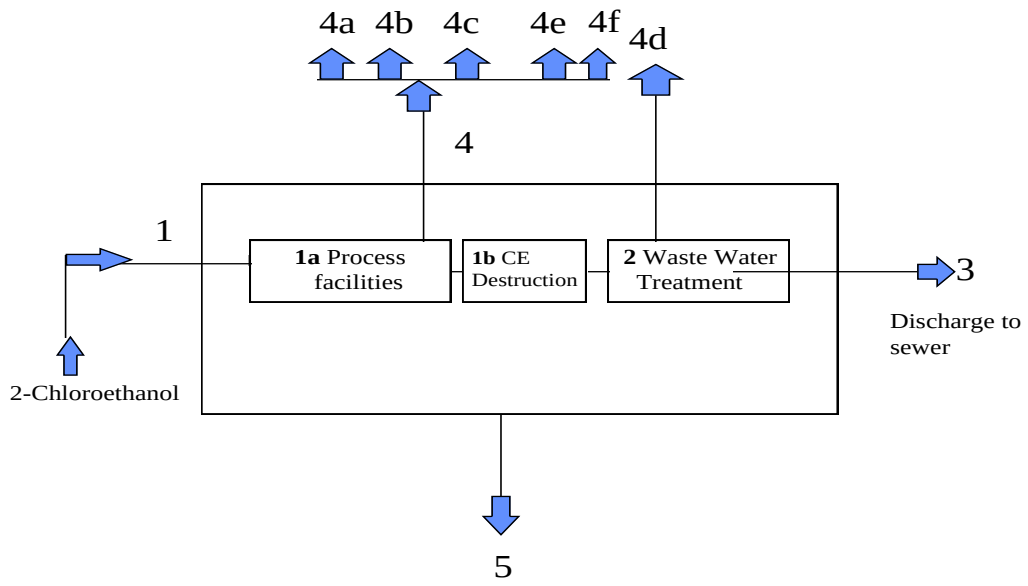
2.2.1 Process Description

2-Chloroethanol is charged to the process from 200 litre drums in a dedicated drum charging area. A portion of the Chloroethanol is reacted as part of the manufacturing process. The remainder is chemically destroyed by treatment with sodium hydroxide to form ethylene glycol. The waste water is treated in the on site waste water treatment facilities. The vents from the vessels containing Chloroethanol are directed to the catalytic abator.

The destruction routes for CE have been verified by measurements at the Abator Outlet, the CE destruction vessel and the outlet to the sewer. Additional measurements of these locations made during 1999 have been used to verify the balances in the above table.

2.2.2 Final Mass Balance

A final mass balance for 2-ChloroEthanol is shown below. This is based on the actual usage data for year 2015~~3~~



Stream No.	1	1a	1b	2	3	4a
Description	CE in	CE Reacted	CE Destroyed	Degraded in WWT	Emit to Sewer	Drum Charge Losses - FE
Kgs p.a. 2015	~~170,000~~ 216,000	73202.400	142754.50	6.912	0.000	0.010
%	100	33.89	66.090	0.003	0	0.000

Stream No.	4b	4c	4d	4e	4f	5
Description	ETO Abator Outlet	Building Vent Losses- FE	Air Strip Loss - FE	HS Waste Tank - FE	Other Fugitive Losses	To offsite incineration
Kgs p.a. 2015	35.338	0.279	0.253	0.309	0.000	0.000
%	0.01636	0.00013	0.00012	0.00014	0.00000	0.00000

The quantity in Streams 1 is based on the number of batches manufactured. Streams 2, 3, 4a, 4b, 4c, 4d are based on past measurements. Stream 1a is based on stoichiometry. Stream 4e is based on an estimate based on a measurement of TOC. Stream 1b is estimated by difference. No Chloroethanol is sent for incineration offsite.

The above table shows that the mass balance is close to less than 0.01%.

This is well within the 15% allowance for existing plant (and the 5% allowance for new plant) under EU Directive 1999/13/EC.

2.2.3 Fugitive Emissions

The measurements for the mass balance indicate that the extent of fugitive emissions (streams 4a, 4c, 4d, 4e) amount to less than 0.05 % of the solvent input. These values show the negligible extent of fugitive emissions of 2-Chloroethanol in the process.

3 FUTURE DEVELOPMENTS

3.1 TOTAL NITROGEN

As the total nitrogen discharge to Sewer is 6% of the licence limit we consider that the material is under excellent control with no negative impact arising. We believe that no further reduction measures are warranted at this time.

Mallinckrodt Medical Imaging Ireland, T/A Guerbet will endeavour to minimise the amount of nitrogen being discharged to sewer by ensuring that the treatment facilities operate to optimise the degradation of nitrogen containing wastes. The objective will be to remain within our licence limits on all parameters at all times.

3.2 2-CHLOROETHANOL (CE)

The overall reduction achieved since the CE usage optimisation commenced in 2002 is in excess of 10%. No further optimisation is planned at this time due to process chemistry constraints.

Mallinckrodt Medical Imaging Ireland, T/A Guerbet, will endeavour to minimise the amount of all solvents being directed to waste water treatment and will ensure that the treatment facilities operate to optimise the degradation of these wastes. The objective will be to remain within our licence limits on all parameters at all times.

4 CONCLUSIONS

The treatment of nitrogen containing compounds is well controlled and the destruction routes are well documented and environmentally friendly with no negative environmental impact.

The use of 2- Chloroethanol is well controlled and the destruction routes are well documented and very environmentally friendly with no negative environmental impact.

Appendix A

Pollution Emission Register Form

Pollution Emissions Register				PER does not apply to your license, please tick here										
		Input		Outputs										
Pollutant Name	CAS No.	Input	Gross Usage	Emissions to air	MOM	Emissions to waters	MOM	Waste	MOM	Product	MOM	Recovery	Treated	Unaccounted
2015														
2-Chloroethanol	107-07-3	216,000	216,000	36	C	0	M	6.912	M	73,202	M	0	142,755	0
Total Nitrogen	7727-37-9	82,646	31,067	31,767	E	19,812	M	0	C	31,067	M	0	0	0

APPENDIX 5 NOISE MONITORING REPORT 2016

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Guerbet

Damastown, Mulhuddart,

ENVIRONMENTAL NOISE MONITORING

Noise Monitoring for Industrial Emissions License Compliance

IEL P0050-02

25 February 2016

Report Author: David Cawley

Report: DC1479-01

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Signed:	

Date:	25 February 2016

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1	25/02/2016	FINAL	David Cawley BE MSc CEng MIEI MIOA	
2				
3				
4				
5				

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APPENDICES

1 INTRODUCTION

Allegro Acoustics Ltd. was retained by Guerbet to undertake day, evening and night time environmental noise monitoring at five locations at Guerbet, Damastown, Mulhuddart, Co. Dublin. The facility is operational 24hours a day 7 days a week.

Environmental noise monitoring was carried out to determine if the Guerbet facility is in compliance with the noise limits as applicable to the Guerbet facility by the IEL Register Number P0050-02 and the EPA document *NG4* [1].

The Guerbet facility is located in an industrial estate beside a busy local road (Damastown Road) and is also in close proximity to the N3 Navan Road and M3 motorway.

2 SCOPE OF WORKS

Noise monitoring was undertaken to verify compliance or otherwise with IEL P0050-02 for the Guerbet facility. Cognisance was also paid to the methodologies and noise emission limits as outlined in *Guidance Note for Noise: License Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4)* [1].

Noise monitoring was undertaken on the 23rd and 24th of February 2016. This report presents the results of the noise monitoring and discusses the findings.

3 NOISE MONITORING METHODOLOGY

3.1 Noise Monitoring Locations

Noise monitoring was undertaken at a total of five locations during daytime, evening and night time. The noise measurement locations are detailed in Table 1 and outlined on a schematic for the facility in Figure 1 below.

Monitoring Point	Location	Location Type
N1	Western Site Boundary	Site Boundary
N2	Northern Site Boundary	Site Boundary
N3	Southern Site Boundary (Guerbet Staff Car Park)	Site Boundary
N4	North Eastern Corner Site Boundary	Site Boundary
N5	Eastern Site Boundary	Site Boundary

Table 1: Description of noise measurement locations

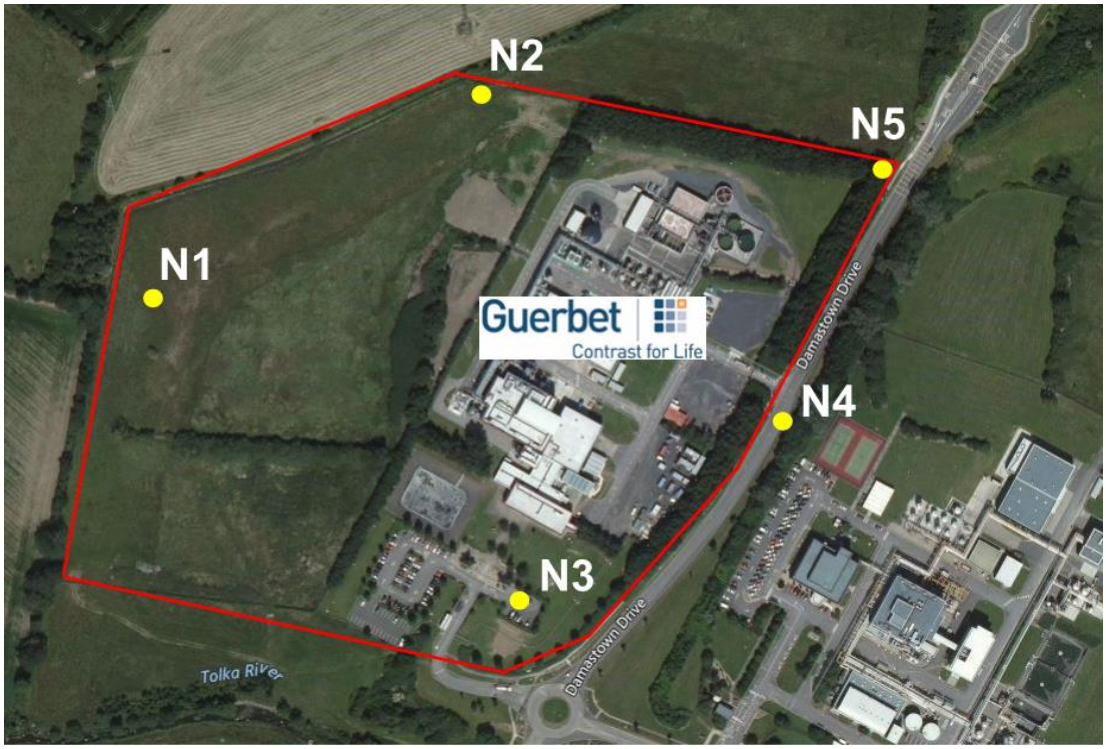

Figure 1: Noise Monitoring Locations with the site boundary outlined in red.

3.2 Survey Instrumentation and Methodology

The precise noise monitoring locations were chosen according to the guidelines in *Guidance Note for Noise: NG4* [1] and ISO 1996: *Acoustics – Description and Measurement of Environmental Noise* [2]. In all cases, the sound level meter (SLM) was mounted on a tripod at 1.5m above ground level and at least 3.5m away from any sound reflecting surfaces. The SLM was oriented towards the facility of interest for each measurement taken. A Bruel and Kjaer UA-1650 windshield with auto detect was placed on the microphone to reduce any wind interference during measurements.

The measurements were made using a Cirrus CR:171B Sound Level Meter (SLM) which measures simultaneously in every 1/3rd octave frequency band from 12.5Hz to 20 kHz. The SLM was calibrated before, during and after the noise monitoring survey was carried out using a Bruel and Kjaer acoustic calibrator. Calibration certification, SLM serial number, calibrator used and microphone serial number for the SLM are presented in the factory calibration certificate as displayed in Appendix B. The Cirrus CR:171B SLM is a Class 1 instrument in accordance with IEC 61672 regulations. The Time Weighting used was Fast and the Frequency Weighting was A-weighted as per IEC 61672. A glossary of noise related terms is presented in Appendix C.

The primary measurement parameter was the equivalent continuous A-Weighted Sound Pressure Level, $L_{Aeq,T}$. A statistical analysis of the measurement results was also completed so that the percentile levels, $L_{AN,T}$ for N = 1%, 5%, 10%, 50%, 90%, 95% and 99% over each measurement were recorded. The percentile levels represent the noise level in dB(A) exceeded for N% of the measurement time. L_{A10} values are used to describe intermittent, high-energy noise events such as road traffic whereas L_{A90} values are representative of background noise levels. 1/3rd octave graphs for all noise measurements is presented in Appendix A.

3.3 Assessment Criteria

The recommended noise limit criteria as outlined in *Guidance Note for Noise (NG4)* [1] has been referenced for the purposes of this assessment. This document outlines the following recommended noise limits for areas which do not display particularly low background noise levels:

- Daytime Noise Criterion, dB $L_{Ar,T}$ (07:00 to 19:00hrs): 55dB
- Evening Noise Criterion, dB $L_{Ar,T}$ (19:00 to 23:00hrs): 50dB
- Night-time Noise Criterion, dB $L_{Aeq,T}$ (23:00 to 07:00hrs): 45dB

The $L_{Ar,T}$ indicator refers to the Rated Noise Level which is equal to the measured $L_{Aeq,T}$ with any penalties added due to impulsive or tonal characteristics. Hence, without such penalties, the Rated Noise Level is equal to the measured $L_{Aeq,T}$; assuming that this measured level is attributable solely to the facility in question. The derivation of the Rated Noise Level is discussed in Section 3.4 below.

3.4 Determination of the Rated Noise Level

The Rated Noise Level, $L_{Ar,T}$ is defined in *Guidance Note for Noise (NG4)* [1] as follows:

> *The Rated Noise Level, equal to the L_{Aeq} during a specified time interval (T), plus specified adjustments for tonal character and / or impulsiveness of sound.*

In order to determine the Rated Noise Level, the L_{Aeq} or specific noise level for the facility must firstly be determined. This is normally the measured $L_{Aeq,T}$ for the facility. However, as measured noise levels take all audible noise into consideration, the measured noise level can often include the noise generated by other sources such as passing road traffic and localised people movements. In such instances, the measured $L_{Aeq,T}$ cannot be attributed solely to the facility in question.

Depending on the nature of noise generated by a facility, statistical analysis can be used to determine the specific noise level attributable solely to the facility at each measurement location. In the simplest case, where audible noise from a facility is constant and does not include intermittent or impulsive characteristics, the measured background noise level depicted by the L_{A90} statistical indicator can be considered to be representative of the specific noise level attributable to the facility. The L_{A90} statistical indicator is recognised as being representative of the background noise level at a location. This indicator is defined as follows:

> *The noise level that is equalled or exceeded for 90% of the time – the L_{90} statistical noise indicator is an indicator of the constant background noise level at any location.*

Where the specific audible noise from a facility is constant and does not include any noticeable intermittent or impulsive noise, the L_{A90} is therefore deemed suitable to depict the specific noise level from such a facility whereby there are no other dominant sources of constant noise at the measurement location. In the case of the Guerbet facility, the L_{A90} can be considered representative of the specific noise level from the facility.

In the determination of the Rated Noise Level, it is therefore assumed that any penalties to be added to the specific noise level for the facility can be added to the $L_{Aeq,T}$ or the L_{A90} depending on which is most appropriate based on the above discussion of measured noise levels and statistical indicators. An impulsive characteristic can be identified by audible observation. Tonal characteristics and the determination of the tonal character of noise are discussed in Section 3.5 below.

3.5 Determination of Tonal Character

The L_{A90} and L_{Aeq} values in each 1/3rd octave frequency band as displayed in Appendix A were analysed to determine if the measured noise from the facility is tonal at any of the five noise monitoring locations. The determination of tonality can be concluded by determining if one particular 1/3rd octave frequency band exceeds both its adjacent 1/3rd octave frequency bands by a significant number of decibels. The following guidelines are outlined in *Guidance Note for Noise (NG4)* [1] to conclude a tonal characteristic to the specific noise emanating from a facility:

> Referring to the sound pressure levels in each 1/3rd octave band: *The appropriate level differences vary with frequency. They should be greater than or equal to the following values in both adjacent 1/3rd octave bands:*
>
> - *15dB in low-frequency 1/3rd octave bands (25Hz to 125Hz)*
> - *8dB in middle-frequency bands (160Hz to 400Hz)*
> - *5dB in high-frequency bands (500Hz to 10,000Hz)*

3.6 Meteorological and Local Environmental Conditions

There was no rain and no signs of recent precipitation during noise measurements on the 23rd of February 2016. The wind speed and temperature was measured during each noise measurement using a Skywatch Explorer 2 hand held anemometer. During all measurements, the average wind speed and occasional gusts were observed to remain below 5m/s. Air temperatures were observed to range from 8˚C to -2˚C during day, evening and night time measurements. There was no mist or fog observed during noise measurements with conditions being described as “clear”. Due to the absence of a prevailing wind, there was no particular wind direction during noise measurements with any wind movement being localised.

4 RESULTS

4.1 Noise Measurements

The results for the day, evening and night time noise monitoring survey are presented in Table 2 below. The 1/3rd octave band spectrums for the L_{Aeq} and L_{A90} of each measurement are displayed in Appendix A.

Location	Meas No.	Start Time	Period	Duration	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}	L_{Amin}
					dB	dB	dB	dB	dB
N1	2	23/02/2016 13:09	Day	00:30:00	48.3	44.5	50.5	64.7	41.2
	7	23/02/2016 20:23	Eve	00:30:00	52	47.3	53.2	66	45.5
	14	24/02/2016 01:06	Night	00:15:00	53	52.2	53.7	57.4	51.2
N2	1	23/02/2016 12:33	Day	00:30:00	58.4	49.5	61.9	73.2	47
	6	23/02/2016 19:48	Eve	00:30:00	55	50.8	57.3	70.1	49.9
	15	24/02/2016 01:31	Night	00:15:00	47.9	46.7	48.8	57.3	45.5
N3	3	23/02/2016 14:10	Day	00:30:00	52.4	49.5	54.5	62.8	47.2
	8	23/02/2016 21:25	Eve	00:30:00	52.5	48	55.2	69.2	46.5
	13	24/02/2016 00:40	Night	00:15:00	46.8	45.3	47.9	55.6	44

Location	Meas No.	Start Time	Period	Duration	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}	L_{Amin}
					dB	dB	dB	dB	dB
N4	5	23/02/2016 16:47	Day	00:30:00	69.2	59.4	73.2	81.6	53.4
	10	23/02/2016 22:29	Eve	00:30:00	57.3	44.3	58.1	82.1	42.6
	11	24/02/2016 00:01	Night	00:15:09	42.9	41.4	44.1	57.3	40.2
N5	4	23/02/2016 14:45	Day	00:30:00	70.4	50.7	73	89.3	48.7
	9	23/02/2016 21:57	Eve	00:30:00	59	49.7	55.8	85.8	47.8
	12	24/02/2016 00:19	Night	00:15:00	50	48.9	50.9	56.3	47.9

Table 2: Summary of Noise Monitoring Survey Results – See Appendix A for 1/3rd octave band data and graphs.

5 DISCUSSION

5.1 N1 – Western Site Boundary

This is an onsite monitoring location used for indicative purposes and is not a required monitoring location under the terms of IEL P0050-02. This monitoring location is situated along the western site boundary in a field adjacent to the Guerbet facility. The major noise source at this location was noise from distant road traffic on the nearby N3 Navan Road and M3 motorway overpass as well as construction work being carried out in the site adjacent to the facility's western site boundary during daytime. A constant low level hum was audible from the Guerbet facility during measurements.

The sound level meter was mounted on a tripod and oriented towards the Guerbet facility. The L_{Aeq} for the day, evening and night time measurement was 48.3dB, 52dB and 53dB respectively. The major contributor to the measured L_{Aeq} values was road traffic along Damastown Road, the N3 Navan Road and M3 motorway. A constant broadband noise could be heard emanating from the Guerbet facility. The L_{A90} for the day, evening and night time measurement was 44.5dB, 47.3dB and 52.2dB respectively. The major contributor to the measured L_{A90} values was constant road traffic throughout the surrounding road network. The L_{A90} for the night time at N1 is above the night time limit of 45dB as set out in IEL P0050-02 for the facility. However, the nearest residential receptor is approximately 650 metres away from this measurement location, on this side of the facility. The noise level due to the Guerbet facility at the nearest residential receptor on this side of the facility, is therefore considered likely to be below the noise limit values as set out in IEL P0050-02.

Audible noise from the Guerbet facility is not describable as tonal or impulsive in character at N1. By viewing the 1/3rd octave band spectrums for the day, evening and night time measurements in Appendix A, it can be seen that the L_{eq} at each 1/3rd octave band does not exceed adjacent bands by the allowable margin as outlined in Section 3.4. Therefore, it is considered that there are no tonal noise characteristics at this location. Due to the measured L_{A90} levels and the distance of the Guerbet facility from the nearest residential receptor, the specific noise level due to the Guerbet facility is considered to demonstrate compliance with the noise limits as set out in IEL P0050-02, relative to this measurement location.

5.2 N2 – Northern Site Boundary

This is an onsite monitoring location used for indicative purposes and is not a required monitoring location under the terms of IEL P0050-02. This monitoring location is situated along the northern site boundary in a field adjacent to the Guerbet facility. The major noise source at this location was noise from distant road traffic on the nearby N3 Navan Road and M3 motorway overpass as well as construction work being carried out in the site adjacent to

the facility's western site boundary during daytime. A constant broadband hum was audible from the Guerbet facility during measurements.

The sound level meter was mounted on a tripod and oriented towards the Guerbet facility. The L_{Aeq} for the day, evening and night time measurement was 58.4dB, 55dB and 47.9dB respectively. The major contributor to the measured L_{Aeq} values was road traffic along Damastown Road, the N3 Navan Road and M3 motorway. A constant broadband noise could be heard emanating from the Guerbet facility. The L_{A90} for the day, evening and night time measurement was 49.5dB, 50.8dB and 46.7dB respectively. The major contributor to the measured L_{A90} values was constant road traffic throughout the surrounding road network. The L_{A90} for the evening and night time at N2 is above the evening and night time limits of 50dB and 45dB as set out in IEL P0050-02 for the facility. However, the nearest residential receptor is approximately 800 metres away from this measurement location, on this side of the facility. The noise level due to the Guerbet facility at the nearest residential receptor on this side of the facility, is therefore considered likely to be below the noise limit values as set out in IEL P0050-02.

Audible noise from the Guerbet facility is not describable as tonal or impulsive in character at N2. By viewing the 1/3rd octave band spectrums for the day, evening and night time measurements in Appendix A, it can be seen that the L_{eq} at each 1/3rd octave band does not exceed adjacent bands by the allowable margin as outlined in Section 3.4. Therefore, it is considered that there are no tonal noise characteristics at this location. Due to the measured L_{A90} levels and the distance of the Guerbet facility from the nearest residential receptor, the specific noise level due to the Guerbet facility is considered to demonstrate compliance with the noise limits as set out in IEL P0050-02, relative to this measurement location.

5.3 N3 – Southern Site Entrance (Guerbet Staff Car Park)

This is an onsite monitoring location used for indicative purposes and is not a required monitoring location under the terms of IEL P0050-02. This monitoring location is situated along the Southern site boundary in a field adjacent to the Guerbet facility. The major noise source at this location was noise from distant road traffic on the nearby Navan Road and M3 motorway overpass as well as construction work being carried out in the site adjacent to the facility's western site boundary during daytime. A constant broadband hum was audible from the Guerbet facility during measurements.

The sound level meter was mounted on a tripod and oriented towards the Guerbet facility. The L_{Aeq} for the day, evening and night time measurement was 52.4dB, 52.5dB and 46.8dB respectively. The major contributor to the measured L_{Aeq} values was road traffic along Damastown Road, the N3 Navan Road and M3 motorway. A constant broadband noise could be heard emanating from the Guerbet facility. The L_{A90} for the day, evening and night time measurement was 49.5dB, 48dB and 45.3dB respectively. The major contributor to the measured L_{A90} values was constant road traffic throughout the surrounding road network. The L_{A90} for the night time at N3 is above the night time limit of 45dB as set out in IEL P0050-02 for the facility. However, the nearest residential receptor is approximately 560 metres away from this measurement location, on this side of the facility. The noise level due to the Guerbet facility at the nearest residential receptor on this side of the facility, is therefore considered likely to be below the noise limit values as set out in IEL P0050-02.

Audible noise from the Guerbet facility is not describable as tonal or impulsive in character at N3. By viewing the 1/3rd octave band spectrums for the day, evening and night time measurements in Appendix A, it can be seen that the L_{eq} at each 1/3rd octave band does not exceed adjacent bands by the allowable margin as outlined in Section 3.4. Therefore, it is

considered that there are no tonal noise characteristics at this location. Due to the measured L_{A90} levels and the distance of the Guerbet facility from the nearest residential receptor, the specific noise level due to the Guerbet facility is considered to demonstrate compliance with the noise limits as set out in IEL P0050-02, relative to this measurement location .

5.4 N4 – North Eastern Site Boundary

This is an onsite monitoring location used for indicative purposes and is not a required monitoring location under the terms of IEL P0050-02. This monitoring location is situated along the north eastern site boundary in a field adjacent to the Guerbet facility. The major noise source at this location was noise from distant road traffic on the nearby N3 Navan Road and M3 motorway overpass as well as construction work being carried out in the site adjacent to the facility's western site boundary during daytime. A constant broadband hum was audible from the Guerbet facility.

The sound level meter was mounted on a tripod and oriented towards the Guerbet facility. The L_{Aeq} for the day, evening and night time measurement was 69.2dB, 57.3dB and 42.9dB respectively. The major contributor to the measured L_{Aeq} values was road traffic along Damastown Road, the N3 Navan Road and M3 motorway. A constant broadband noise could be heard coming from the Guerbet facility. The L_{A90} for the day, evening and night time measurement was 59.4dB, 44.3dB and 41.4dB respectively. The major contributor to the measured L_{A90} values was constant road traffic throughout the surrounding road network. The L_{A90} for the day time at N4 is above the day time limit of 55dB as set out in IEL P0050-02 for the facility. However, this was observed to be attributable to constant road traffic exiting the neighbouring IBM facility and passing the measurement location on Damastown Road.

Audible noise from the Guerbet facility is not describable as tonal or impulsive in character at N4. By viewing the 1/3rd octave band spectrums for the day, evening and night time measurements in Appendix A, it can be seen that the L_{eq} at each 1/3rd octave band does not exceed adjacent bands by the allowable margin as outlined in Section 3.4. Therefore, it is considered that there are no tonal noise characteristics at this location. Due to the measured L_{A90} levels and the distance of the Guerbet facility from the nearest residential receptor, the specific noise level due to the Guerbet facility is considered to demonstrate compliance with the noise limits as set out in IEL P0050-02 at this location.

5.5 N5 – Eastern Site Boundary

This is an onsite monitoring location used for indicative purposes and is not a required monitoring location under the terms of IEL P0050-02. This monitoring location is situated along the Eastern site boundary in a field adjacent to the Guerbet facility. The major noise source at this location was noise from distant road traffic on the nearby N3 Navan Road and M3 motorway overpass as well as construction work being carried out in the site adjacent to the facility's western site boundary during daytime. A constant broadband hum was audible from the Guerbet facility during measurements.

The sound level meter was mounted on a tripod and oriented towards the Guerbet facility. The L_{Aeq} for the day, evening and night time measurement was 70.4dB, 59dB and 50dB respectively. The major contributor to the measured L_{Aeq} values was road traffic along Damastown Road, the N3 Navan Road and M3 motorway. A constant broadband noise could be heard coming from the Guerbet facility. The L_{A90} for the day, evening and night time measurement was 50.7dB, 49.7dB and 48.9dB respectively. The major contributor to the measured L_{A90} values was constant road traffic throughout the surrounding road network. The

L_{A90} for the night time at N5 is above the night time limit of 45dB as set out in IEL P0050-02 for the facility. However, the nearest residential receptor is approximately 700 metres away from this measurement location, on this side of the facility. The noise level due to the Guerbet facility at the nearest residential receptor on this side of the facility, is therefore considered likely to be below the noise limit values as set out in IEL P0050-02.

Audible noise from the Guerbet facility is not describable as tonal or impulsive in character at N5. By viewing the 1/3rd octave band spectrums for the day, evening and night time measurements in Appendix A, it can be seen that the L_{eq} at each 1/3rd octave band does not exceed adjacent bands by the allowable margin as outlined in Section 3.4. Therefore, it is considered that there are no tonal noise characteristics at this location. Due to the measured L_{A90} levels and the distance of the Guerbet facility from the nearest residential receptor, the specific noise level due to the Guerbet facility is considered to demonstrate compliance with the noise limits as set out in IEL P0050-02, relative to this measurement location .

6 CONCLUSION

In conclusion to the measurement and assessment of environmental noise as a result of the operation of the Guerbet facility, it has been observed that the specific noise level from the Guerbet facility at all measurement locations appears to be in excess of day, evening and night time noise limits as outlined in IEL P0050-02 for the facility. While measured L_{Aeq} levels has been shown to be in excess of day, evening and night limits; such levels are not attributable to the Guerbet facility and are largely attributable to passing traffic and other extraneous noise sources as described above.

Due to the constant nature of noise emanating from the Guerbet facility, the L_{A90} noise indicator; typically used to determine the background noise level at a location was used to depict the specific noise from the Guerbet facility. The L_{A90} value at the measurement locations was observed to be above day, evening and night time noise limits as set out in IEL P0050-02 for the Guerbet facility. However, as previously mentioned, due to the distance of approximately 650 metres between the Guerbet facility and the nearest residential receptor, the noise levels due to the Guerbet facility at that residential receptor is therefore considered to be significantly lower than the day, evening and night time limits as set out in IEL P0050-02.

By viewing the 1/3rd octave band noise spectrums for day, evening and night time measurements at residential receptor locations, it can also be seen that the specific noise from the Guerbet facility is not deemed to be tonal in character. During the noise measurement survey, there were no individual noise events or impulsive noises audible from the Guerbet facility.

Allegro Acoustics therefore considers that the Guerbet facility at Damastown, Co. Dublin is currently demonstrating compliance with the day, evening and night time noise limits as set out in IEL P0050-02.

7 REFERENCES

[1] Guidance Note for Noise: License Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4)

ENVIRONMENTAL PROTECTION AGENCY: 2012

[2] ISO 1996 Acoustics – Description and Measurement of Environmental Noise

INTERNATIONAL STANDARDS ORGANISATION: 2003

[3] Guidelines for Community Noise

WORLD HEALTH ORGANISATION: 2000

[4] BS4142 Method for Rating industrial noise affecting mixed residential and industrial areas

BRITISH STANDARDS: 1997

Appendix A

L_{eq} and L_{90} 1/3rd Octave Frequency Band Data and Graphs

ALLEGRO acoustics

Cirrus Research plc
dedicated to noise measurement

Testing Agency:	Allegro Acoustics
Testing Operator:	Shane Armstrong BE MIEI
SLM:	Cirrus Optimus
SLM Serial Number:	G066777
SLM Factory Calibration Date:	07/01/2016
Sound Field Correction:	Free Field
Bandwidth:	1/3rd Octave - Fully Integrating
Time Weighting:	Fast

dB Leq Measurement Data

Location	Period	Measurement	Start Time	Elapsed	LZeq	LZeq	LZeq	LZeq	LZeq	LZeq	LZeq	LZeq	LZeq	LZeq	LZeq	LZeq	LZeq	LZeq	LZeq	LZeq	LZeq	LZeq	LZeq	LZeq	LZeq	LZeq	LZeq	LZeq	LZeq	LZeq	LZeq	LZeq	LZeq	LZeq	LZeq	LZeq
				Time	12.5Hz	16Hz	20Hz	25Hz	31.5Hz	40Hz	50Hz	63Hz	80Hz	100Hz	125Hz	160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.5 kHz	3.15 kHz	4 kHz	5 kHz	6.3 kHz	8 kHz	10 kHz	12.5 kHz	16 kHz	20 kHz
N1	Day	2	23/02/2016 13:09	00:30:00	69.7	69.1	67.6	66.4	64.9	62.6	60.7	58.7	55	53.5	48	44.5	41.8	40.6	40.1	40.5	40.9	39.5	40	40.3	38	35.7	33.6	29.8	28.9	27.5	23.9	22.7	21.9	20.5	20.5	21.5	24.2
	Eve	7	23/02/2016 20:23	00:30:00	49.5	51.7	51.9	53.4	53.7	54.4	55.5	56	52.8	49.9	49.2	50.3	49.9	48.2	45.8	46.3	45.3	45.4	44.3	43.4	40.4	38.7	34.8	29.9	26	21.8	16.3	14.6	14.1	13.8	14.9	16.5	19.5
	Night	14	24/02/2016 01:06	00:15:00	47.3	52.3	51.4	52.1	50.1	52.9	54.5	58.4	55.2	58.3	51.6	52.5	49.9	43.8	42.2	37.5	41.3	45.5	46	44.5	42.1	43.5	39.9	36.6	34.1	32	25.8	21.5	17.9	15.7	15.6	16.6	19.5
N2	Day	1	23/02/2016 12:33	00:30:00	64.4	65.3	65.9	66.4	80.5	69.1	65.4	67.2	66.6	62.8	60.6	56.5	55.1	54.9	51.8	50.4	50.4	48.5	49.3	49	47.5	45.7	44.7	42.3	39.4	36.9	32.9	30.2	25.7	23.1	23.4	24.8	27.8
	Eve	6	23/02/2016 19:48	00:30:00	49.2	51.8	52.7	54.8	54.6	55.7	56.3	58.2	56.3	59.9	53.5	54.3	54	51.2	50.4	50	48.6	47.3	46.5	44.9	42	40.9	39.5	35.5	33	30.9	24.8	20.6	16.8	15.3	15.6	16.9	19.6
	Night	15	24/02/2016 01:31	00:15:00	46.9	50.1	48.5	48.4	47.7	50.1	51.1	51.5	47.8	46.4	42.3	37.9	35.4	33.5	31.8	33.7	37.9	41.8	42.3	41.1	39.1	37.1	33.4	28.9	25.4	21.5	17.1	16.3	14.7	14	14.8	16.5	19.5
N3	Day	3	23/02/2016 14:10	00:30:00	56.8	56.6	57	59.4	66.1	62.3	61.5	61.7	60.4	55	52.3	50	49.1	49.5	48.7	47	45.5	43.8	42.9	42.4	40.6	39.1	35.9	32	29.2	25.3	21.6	19.2	17.1	15.1	15.6	17.1	19.9
	Eve	8	23/02/2016 21:25	00:30:00	49.8	51.6	52.5	54.2	55.3	57.1	57.7	55.2	52.5	50.1	49	48.7	50.2	49.5	46.5	46.7	46	43.3	43.5	44.7	42.4	40.7	36.4	31.7	27.7	21.9	17.2	14	12.8	13	14.4	16.4	19.5
	Night	13	24/02/2016 00:40	00:15:00	46.3	49.1	50	52.3	50.6	50.8	52.6	49.9	47.2	47	44	43.3	39.4	40.3	39.5	40.5	41.2	38.5	38.9	40.1	36.3	33.9	30.5	27.3	23.8	18.6	15.2	13.3	12.6	13	14.4	16.5	19.6
N4	Day	5	23/02/2016 16:47	00:30:00	59.4	63.5	61.6	64	75.6	66.8	67.1	69.2	66.2	63.4	63.1	59.3	59.9	60.7	59.1	57.9	58.3	59.5	62.2	63.5	60.6	59.4	56.3	52.2	48.6	44	39.3	36.3	34.2	28.8	28.5	24.8	24.7
	Eve	10	23/02/2016 22:29	00:30:00	60.5	57.8	56.9	58.2	58.5	57.7	57.2	56.3	54.2	53.5	53.3	49	48.6	49	47.7	47	47.2	47.9	49.4	50.8	48.5	47	44.6	41.9	39.1	36	35.3	37.4	34.7	26.9	24.1	20.9	21.6
	Night	11	24/02/2016 00:01	00:15:09	46.4	50.1	49.2	50.7	49.4	49.9	49.8	50.1	48.1	47.2	42.2	40.5	38.1	36.9	34.9	34.2	36	36.2	36.1	35.1	31.8	29.2	26.1	20.8	16.4	13.7	11.7	12.1	12.6	13.2	14.7	16.6	19.7
N5	Day	4	23/02/2016 14:45	00:30:00	59.2	60.6	61.4	60.5	71.1	61.3	63.9	66.6	63.6	59.5	58.3	60.2	58.3	59.6	59.2	58.2	59.7	61.3	64.3	65.3	62.4	59.2	55.1	51.4	47.9	45.1	42.3	39.4	36.8	34.2	31.9	28.8	25.7
	Eve	9	23/02/2016 21:57	00:30:00	51.7	50.5	53	56	55.5	56.2	58.4	54.8	52.6	50.8	49.6	49.7	50.5	50.7	49.7	50.8	49.9	50	51.4	53.2	50.4	48.8	45.3	40.7	37	33.5	29.2	26.3	24	21.9	19.9	19.3	21
	Night	12	24/02/2016 00:19	00:15:00	47.8	48.7	50.8	54.3	51.5	52.4	54.8	52.1	50	49.2	46.2	44.8	45.6	46	42	41.7	45.8	43.3	41	39.7	37.2	39.8	37.2	31.1	28.7	26.7	20.5	16.7	14.8	14.9	14.9	16.6	19.6

dB L90 Measurement Data

Location	Period	Measurement	Start Time	Elapsed	LZ90	LZ90	LZ90	LZ90	LZ90	LZ90	LZ90	LZ90	LZ90	LZ90	LZ90	LZ90	LZ90	LZ90	LZ90	LZ90	LZ90	LZ90	LZ90	LZ90	LZ90	LZ90	LZ90	LZ90	LZ90	LZ90	LZ90	LZ90	LZ90	LZ90	LZ90	LZ90
				Time	12.5Hz	16Hz	20Hz	25Hz	31.5Hz	40Hz	50Hz	63Hz	80Hz	100Hz	125Hz	160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.5 kHz	3.15 kHz	4 kHz	5 kHz	6.3 kHz	8 kHz	10 kHz	12.5 kHz	16 kHz	20 kHz
N1	Day	2	23/02/2016 13:09	00:30:00	57.3	56.7	55.5	54.5	54.2	51.9	51.7	51.4	47.5	46.4	42.5	40.2	37.7	35.8	33.6	30.8	32.3	33.8	35.4	35.8	34.4	32.7	30.7	25.9	22.6	19.2	15	13.3	13.1	13.4	14.7	16.5	19.5
	Eve	7	23/02/2016 20:23	00:30:00	41.5	44.3	44.6	46.6	46.3	46.6	49.3	49.3	45.6	43.7	39.6	37.2	35.4	32.3	29.3	32.8	36.8	39.7	40.9	40.7	38.3	36.6	32.3	26.8	23.2	18.1	12.5	11.1	11.7	12.6	14.2	16.1	19.3
	Night	14	24/02/2016 01:06	00:15:00	40.6	45.4	45.2	46.3	45.2	47.8	50.2	51.8	52.5	56.5	48.4	49.7	46.7	41	40.4	35.7	39.5	43.8	44.9	43.4	40.8	42	38.9	35.2	32.9	30.3	23.9	19.4	15.4	13.6	14.3	16.2	19.3
N2	Day	1	23/02/2016 12:33	00:30:00	47.4	48.4	49	54.3	58.8	56.4	53	56	53.1	57.9	53.8	49	46.9	42.8	43.4	36.7	35.5	36.7	38.7	39.4	38	37.1	35.7	31.7	30	26.9	21.5	17.3	14.4	13.6	14.6	16.5	19.5
	Eve	6	23/02/2016 19:48	00:30:00	41.1	44.3	45.2	46.9	46.6	48.3	50.1	51.5	52.7	58.2	47.2	48.5	44.8	39.9	36.8	32.8	37.4	41.2	43.3	42.8	39.9	39.9	38.5	34.1	31.8	29.7	23.4	18.9	14.5	13.2	14.3	16.2	19.3
	Night	15	24/02/2016 01:31	00:15:00	38.8	42.8	42.3	42.9	42.5	44.3	46.7	47.2	44.3	43.1	39.4	35.5	33.1	31.1	28.9	31.5	36	40.6	40.9	39.4	37	35.2	31.9	26.9	22.3	17.4	12.1	11	11.7	12.5	14.2	16.1	19.3
N3	Day	3	23/02/2016 14:10	00:30:00	44.8	46.9	47.6	52.4	55.3	52.1	53.9	54.8	53.1	48.9	46.3	43.5	43.3	45.6	45.4	43.9	42.2	40.4	39.4	38.7	37.2	34.6	31.1	27	23.9	18.8	15	12.9	12.3	12.9	14.5	16.4	19.6
	Eve	8	23/02/2016 21:25	00:30:00	41.1	43.9	45.7	47.9	49.2	48.9	50.6	49	46.5	44.9	43.5	41.5	40	40.9	39.8	40.7	40.9	39.6	39.7	40.9	37.6	34.5	31	27.9	24.2	18	14.5	12.5	12	12.6	14.1	16.1	19.3
	Night	13	24/02/2016 00:40	00:15:00	39.3	42.2	44.4	46.7	46	46.5	48.7	45.6	43.5	42.2	41.5	40.7	36.9	38.3	37.9	39.1	39.6	36.8	36.2	37.5	33.7	31.7	29	26.2	22.7	17.7	14.5	12.7	12.1	12.7	14.2	16.2	19.4
N4	Day	5	23/02/2016 16:47	00:30:00	44.3	49.1	49.8	54.5	63.6	57.3	58.3	59.9	59	54.6	50.9	48.5	47.6	48.8	48.2	47	47.2	47.6	50.3	52.5	51.2	49.9	45.9	41.9	37.7	31	25.2	19.2	14.9	13.6	14.7	16.5	19.5
	Eve	10	23/02/2016 22:29	00:30:00	39.5	43.6	43.5	45.7	45.9	46	46.9	45.8	44.7	42	39.9	41.1	35.6	34.8	33.3	35.7	37.4	37.9	36.8	35.7	33.9	32.2	29	23.8	19.4	15.4	11.5	11.5	11.7	12.5	14.1	16.2	19.3
	Night	11	24/02/2016 00:01	00:15:09	38.8	43	43	46.1	45.1	45.3	45.1	44.5	42.8	44.4	39.2	38.1	35.6	34.4	32.7	31.5	33.1	33.9	34	33.2	29.8	27.1	23.9	18.6	14.3	11.6	10.4	11	11.8	12.7	14.4	16.4	19.5
N5	Day	4	23/02/2016 14:45	00:30:00	45.9	49.6	49.4	52.3	60.5	54.4	54.2	55.2	55.5	50.6	47.7	46.2	45.5	45.2	43.2	40.6	43.5	43	41.9	41.4	38.9	38.1	35.5	31	28.3	25.4	19.7	15.7	13.3	13.4	14.6	16.4	19.6
	Eve	9	23/02/2016 21:57	00:30:00	41.2	43.1	45	47.7	49.3	48.2	49.8	48.7	46.6	45.1	44	42.1	42.8	44.5	42.7	41.6	44.2	42.4	40.9	40.2	37.5	36.9	35.6	31.6	29.4	27.2	20.7	17.2	14.7	14.1	14.5	16.2	19.3
	Night	12	24/02/2016 00:19	00:15:00	40.7	42.2	44.8	48.5	46.6	47.7	50.5	48.3	46.3	45.8	43.7	42.6	43.7	43.9	40.1	40.2	44.3	41.8	39.7	38.4	35.6	35.6	34	30.1	27.5	25.6	19.4	15.5	14	14.4	14.5	16.3	19.4

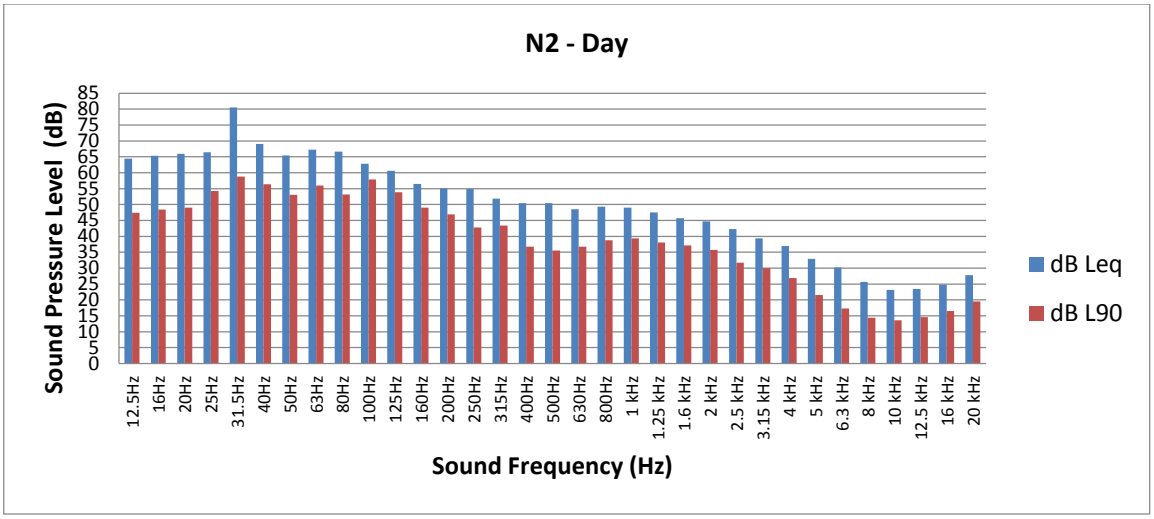

Figure A1: N2 Day time 1/3rd Octave Band Frequency Analysis

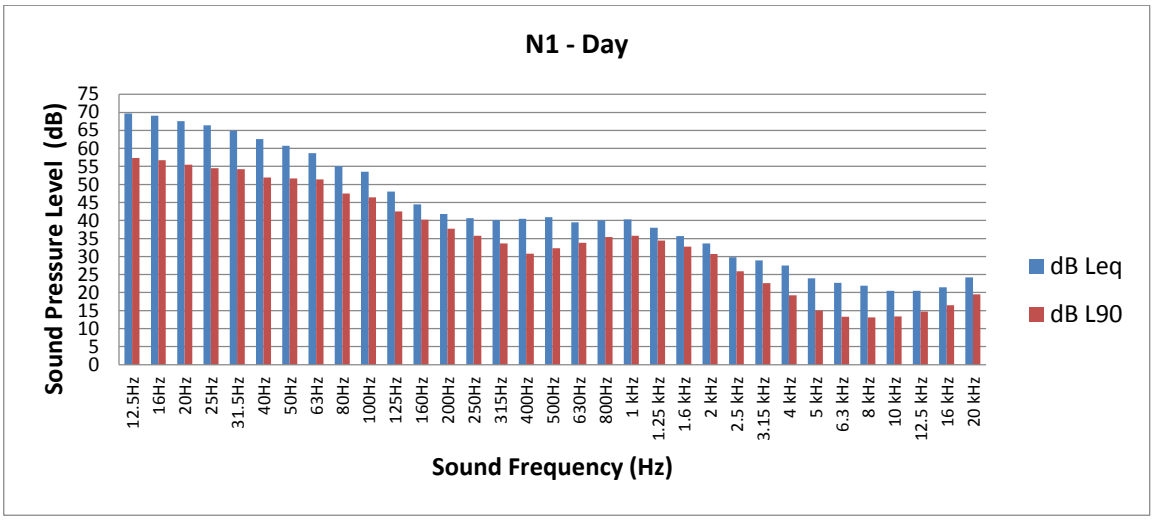

Figure A2: N1 Day time 1/3rd Octave Band Frequency Analysis

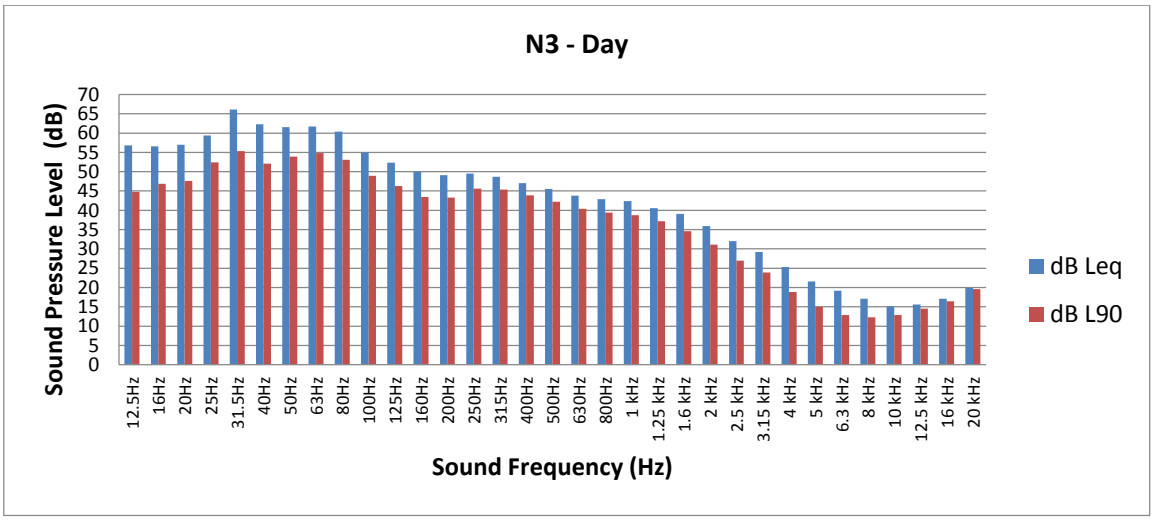

Figure A3: N3 Day time 1/3rd Octave Band Frequency Analysis

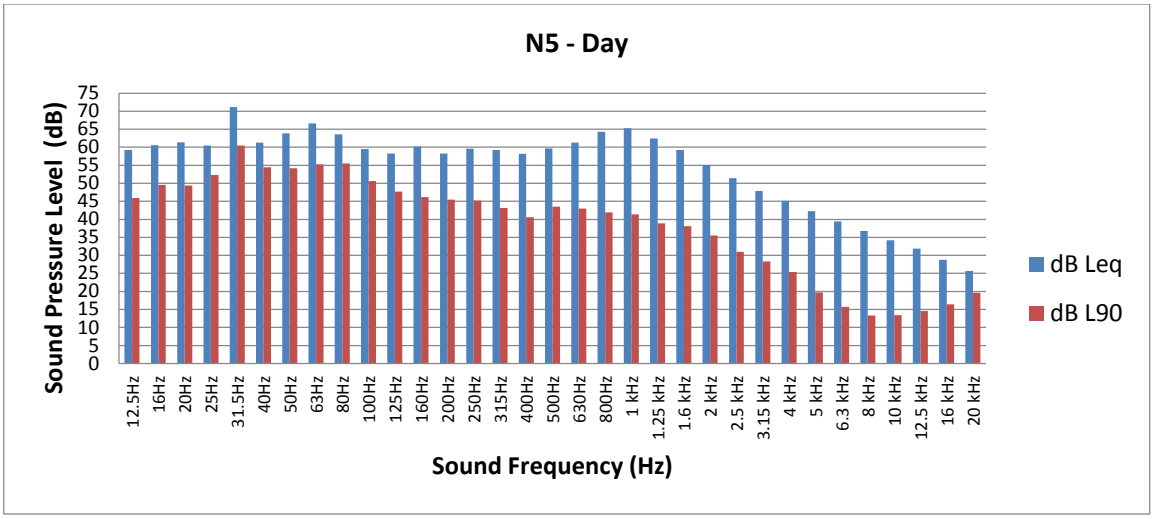

Figure A4: N5 Day time 1/3rd Octave Band Frequency Analysis

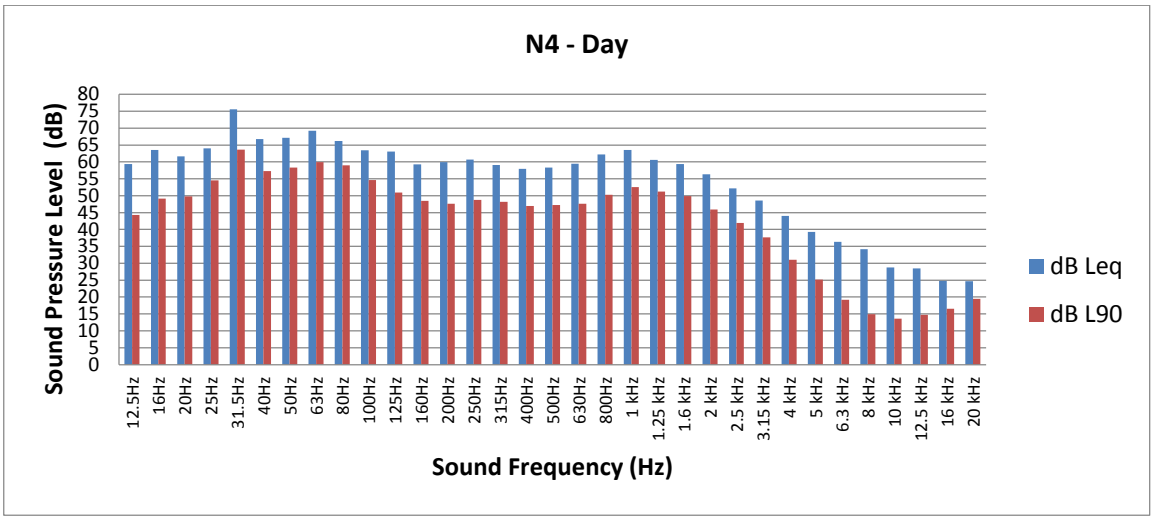

Figure A5: N4 Day time 1/3rd Octave Band Frequency Analysis

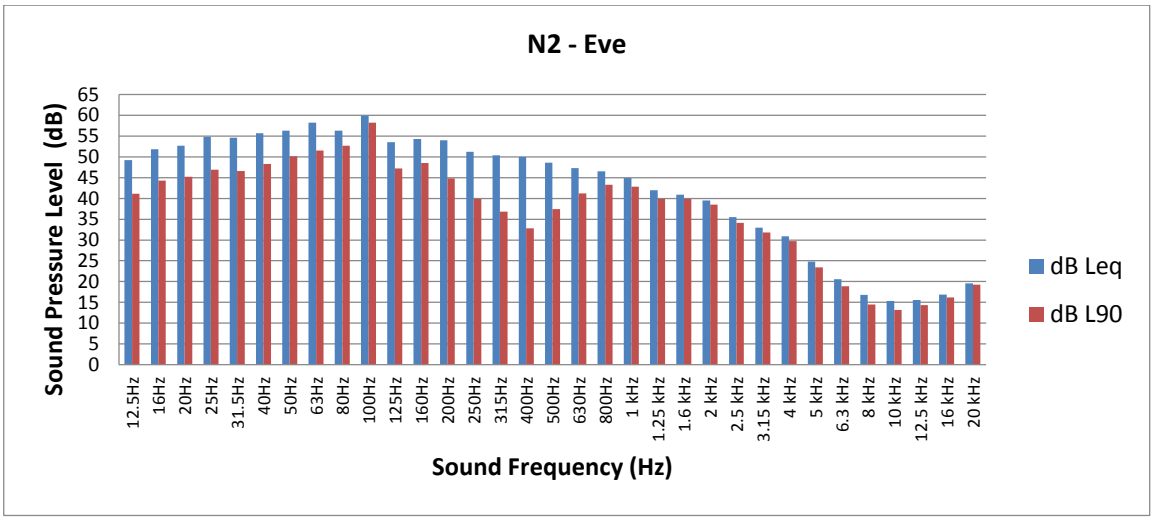

Figure A6: N2 Eve time 1/3rd Octave Band Frequency Analysis

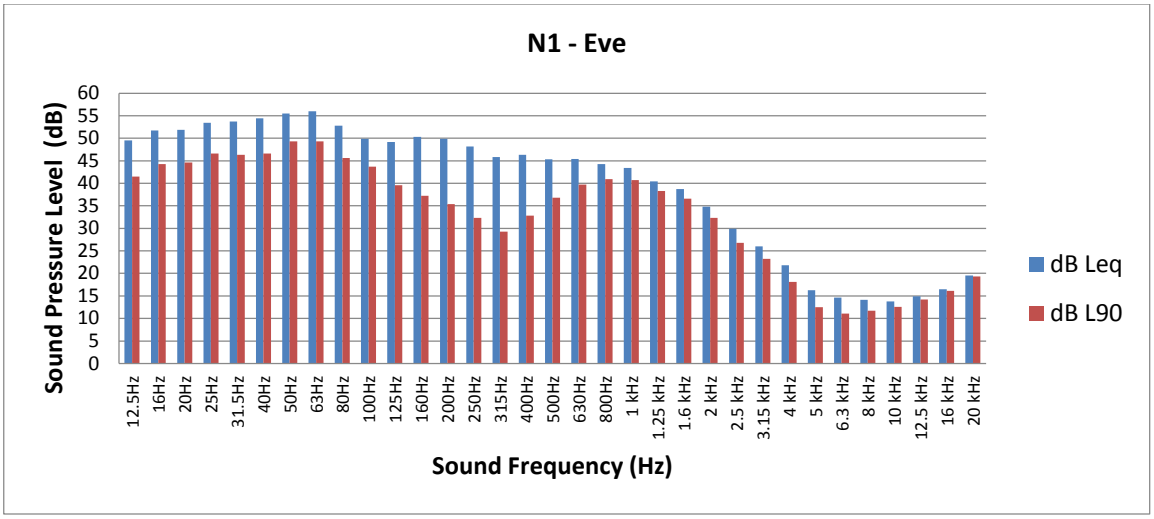

Figure A7: N1 Eve time 1/3rd Octave Band Frequency Analysis

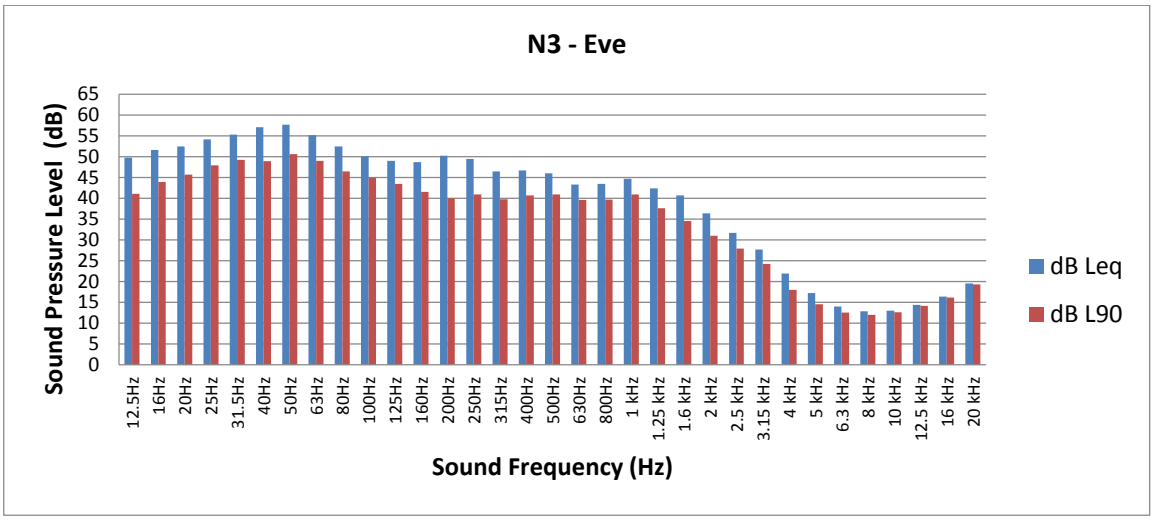

Figure A8: N3 Eve time 1/3rd Octave Band Frequency Analysis

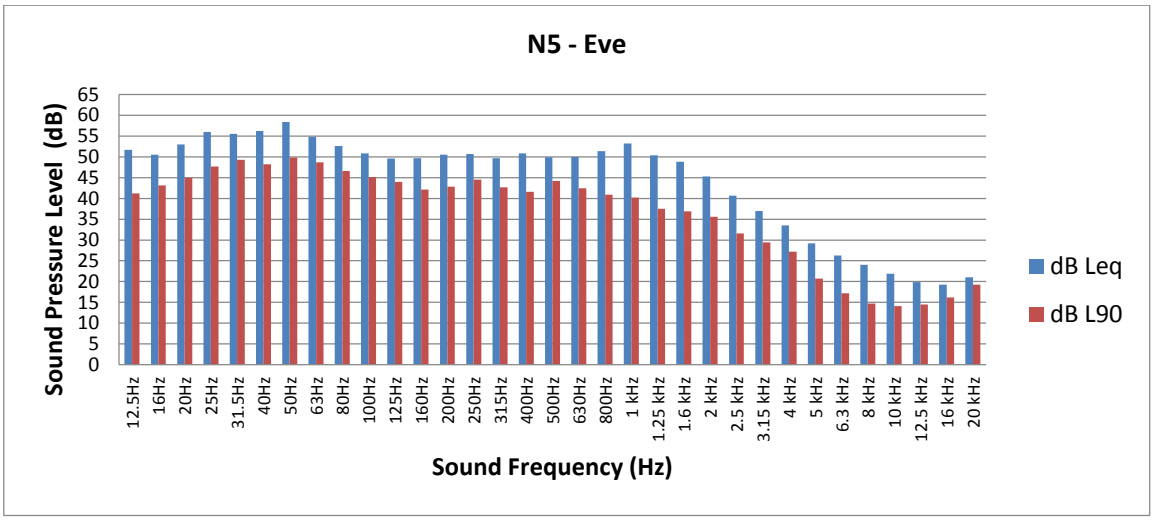

Figure A9: N5 Eve time 1/3rd Octave Band Frequency Analysis

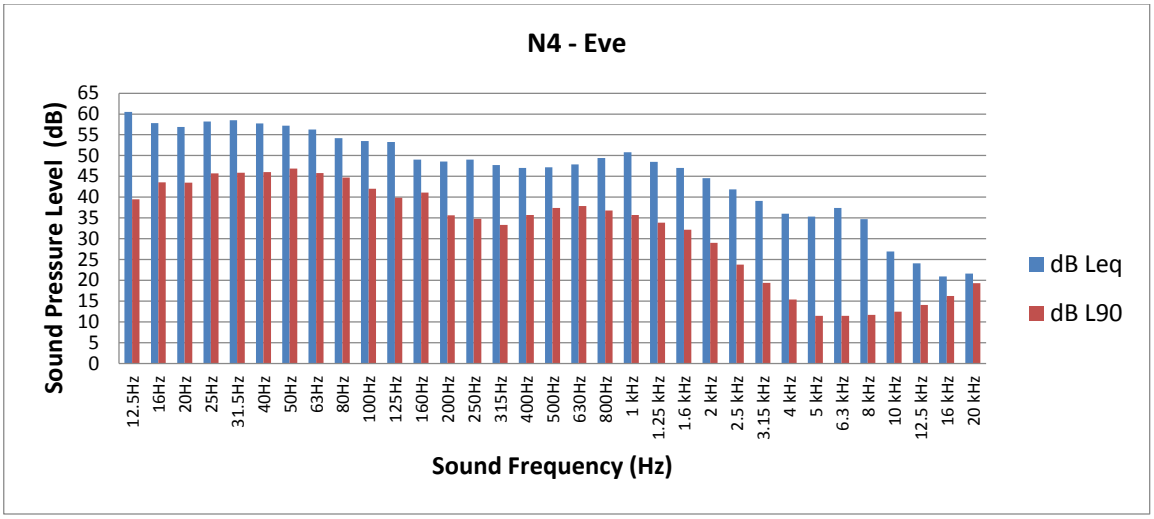

Figure A10: N4 Eve time 1/3rd Octave Band Frequency Analysis

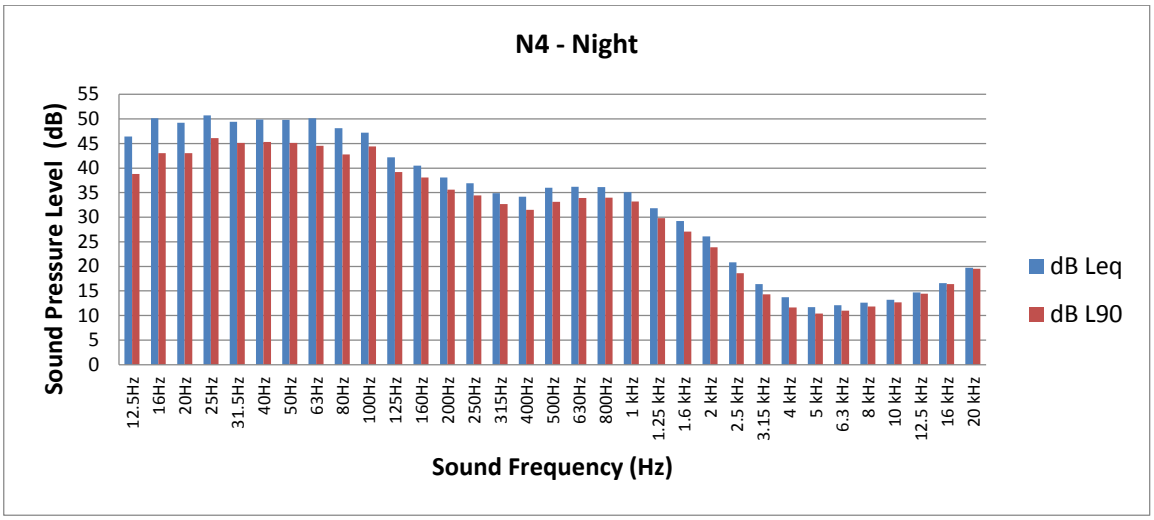

Figure A11: N4 Night time 1/3rd Octave Band Frequency Analysis

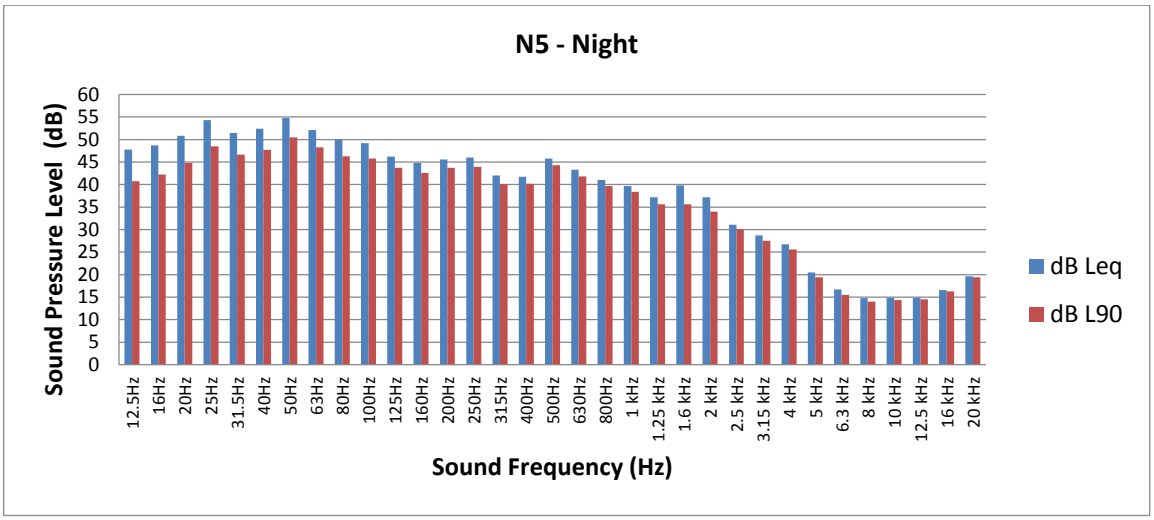

Figure A12: N5 Night time 1/3rd Octave Band Frequency Analysis

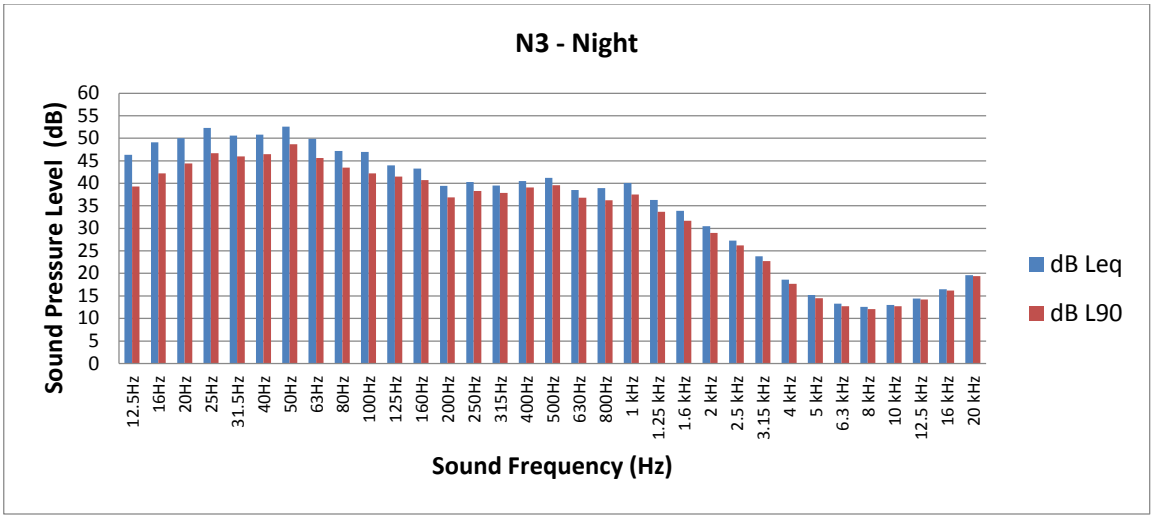

Figure A13: N3 Night time 1/3rd Octave Band Frequency Analysis

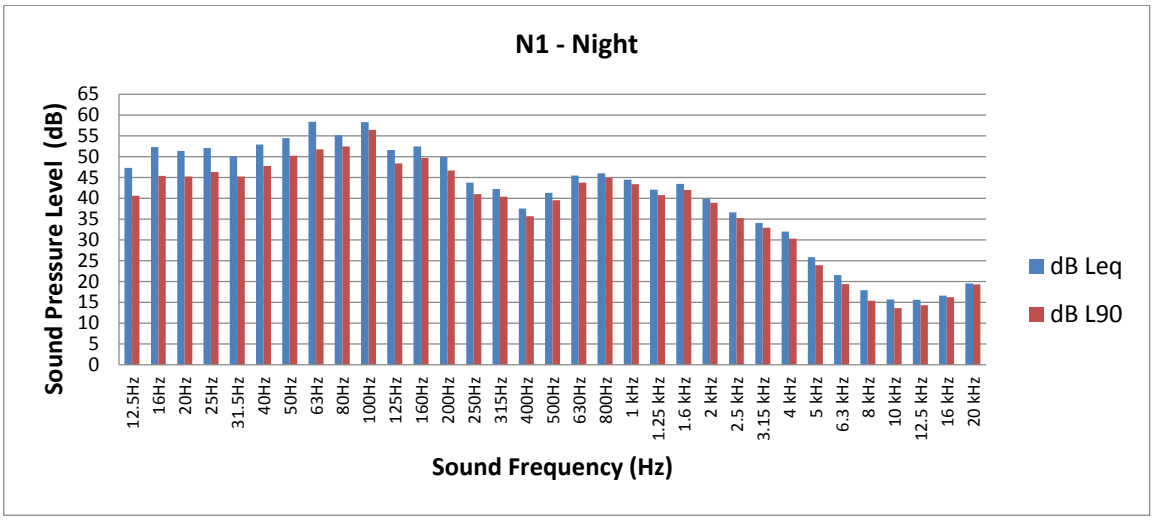

Figure A14: N1 Night time 1/3rd Octave Band Frequency Analysis

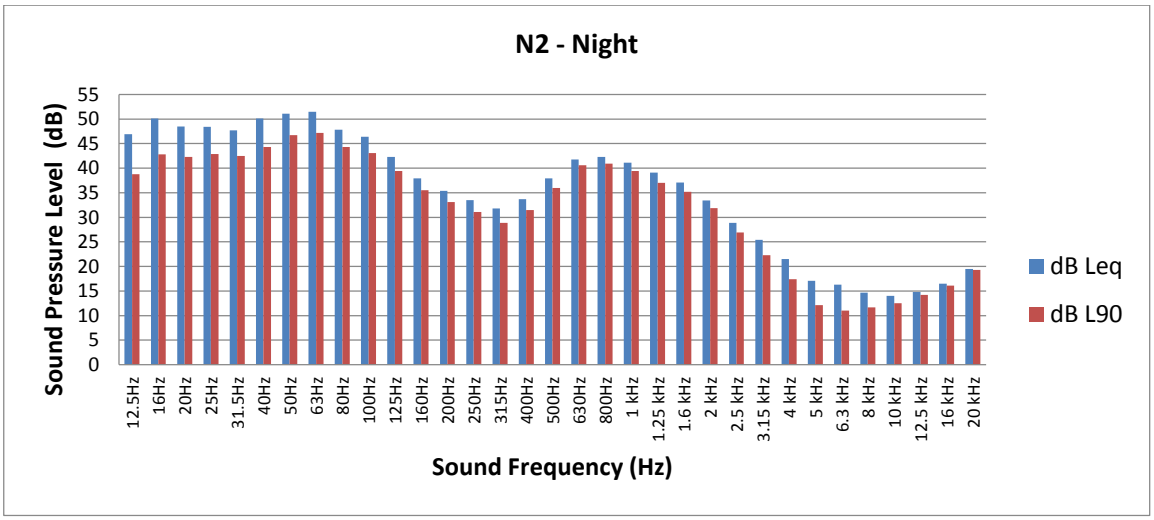

Figure A15: N2 Night time 1/3rd Octave Band Frequency Analysis

Appendix B

Calibration Certification

Certificate of Calibration

Cirrus Research plc
dedicated to noise measurement

Equipment Details

Instrument Manufacturer	Cirrus Research plc
Instrument Type	CR:171B
Description	Sound Level Meter
Serial Number	G066777

Calibration Procedure

The instrument detailed above has been calibrated to the publish test and calibration data as detailed in the instrument hand book, using the techniques recommended in the latest revisions of the International Standards IEC 61672-1:2002, IEC 60651:1979, IEC 60804:2001,IEC 61260:1995, IEC 60942:1997, IEC 61252:1993, ANSI S1.4-1983, ANSI S1.11-1986 and ANSI S1.43-1997 where applicable.
Sound Level Meters: All Calibration procedures were carried out by subsitituting the microphone capsule with a suitable electrical signal, apart from the final acoustic calibration.

Calibration Traceability

The equipment detailed above was calibrated against the calibration laboratory standards held by Cirrus Research plc. These are traceable to International Standards {A.0.6}. The standards are:

Microphone Type	B&K 4192	Serial Number	1920791	Calibration Ref.	S6450
Pistonphone Type	B&K 4220	Serial Number	613843	Calibration Ref.	S6388

Calibrated by M. BERRY

Calibration Date	07 January 2016
Calibration Certificate Number	234527

This Calibration Certificate is valid for 12 months from the date above.

Cirrus Research plc, Acoustic House, Bridlington Road, Hunmanby, North Yorkshire, YO14 0PH
Telephone: +44 (0) 1723 891655 Fax: +44 (0) 1723 891742
Email: sales@cirrusresearch.co.uk

Appendix C

Glossary of Noise Terminology

Glossary of Acoustic Terminology

Decibel (dB)
The unit of sound pressure level, calculated as a logarithm of the intensity of sound. 0dB is the threshold of hearing, 140dB is the threshold of pain. A change of 1 dB is detectable only under laboratory conditions. A change of 10dB corresponds approximately to halving or doubling the loudness of sound.

dB(A)
Decibels measured on a sound level meter incorporating a frequency weighting (A weighting) which differentiates between sound of different frequency (pitch) in a similar way to the human ear. Measurements in dB(A) broadly agree with peoples assessment of loudness.

dB(Z)
Decibels measured on a sound level meter with no frequency weighting (0 weighting) across the frequency range of measurement.

Daily Noise Exposure Level, LEX,8h (dB)(A) re: 20μPa)
The Daily Noise Exposure Level is the time-weighted average of the noise exposure level for a nominal eight hour working day as defined by international standard ISO 1999: 1990, Point 3.6, covering all noises present at work including impulsive noise.

Sound Reduction Index, Rw
The sound reduction index of an element is a measure of sound insulation provided by the element when the element is tested in an acoustic testing laboratory.

Apparent Sound Reduction Index, R'w
The apparent sound reduction of a building element is the sound reduction provided by the element when the element is tested as part of a building.

Ambient Noise
Totally encompassing sound in a given situation at a given time usually composed of a sound from many sources near and far.

Background noise level
The A-weighted sound pressure level of the residual noise at the assessment position that is exceeded for 90% of a given time interval, T, measured using time weighting F, and quoted to the nearest whole number of decibels.

Day: Night:
0800 hrs to 2200 hrs: 2200 hrs to 0800hrs

Hertz (Hz)
Unit of frequency (pitch) of a sound.

Impulsive Noise
A noise which is of short duration (typically less than one second), the sound pressure level of which is significantly higher than the background.

1/3 Octave band analysis
Frequency analysis of sound such that the frequency spectrum is sub divided into bands of one third of an octave each. An octave is taken to be the frequency interval, the upper limit of which is twice the lower limit (in Hertz).

L(A)eq
Equivalent Continuous A-weighted Sound Level. The continuous steady noise level, which would have the same total A-weighted acoustic energy as the real fluctuating noise measured over the same period of time.

L(A)10
The A-weighted noise level that is equaled or exceeded for 10% of the measurement period.

L(A)90
The A-weighted noise level that is equaled or exceeded for 90% of the measurement period.

L(Z)max
The unweighted maximum instantaneous noise level that is measured throughout a noise measurement.

L(Z)min
The unweighted minimum instantaneous noise level that is measured throughout a noise measurement.

Noise
Unwanted sound. Any sound which has the potential to cause disturbance, discomfort or psychological stress to a subject exposed to it, or any sound which has the potential to cause actual physiological harm to a subject exposed to it or physical damage to any structure exposed to it, is known as noise.

Noise Sensitive Receptor
A noise sensitive receptor is regarded as any dwelling house, hotel or hostel, health building, educational establishment, places of worship or entertainment, or any other facility or area of high amenity which for its proper enjoyment requires the absence of noise at nuisance levels.

Peak Particle Velocity
The rate of change of displacement of the particles in a solid medium. It is the term usually used to describe vibration in relation to activities involving blasting. Velocity will vary from zero to a maximum value – the peak particle velocity, and the units used are millimeters per second.

Rating level L,ArTr
The specific noise level plus any adjustment for the characteristic features of the noise.

Residual Noise
The ambient noise remaining at a given position in a given situation when the specific noise source is suppressed to a degree such that it does not contribute to the ambient noise.

Sound Power
The energy output from a source. It is measured in Watts (W).

Specific Noise source
The noise source under investigation for assessing the likelihood of complaint.

Tone
A noise with a narrow frequency composition identified in ISO 1996 as where the sound pressure level in any given third octave band is equal to or in excess of 5dB above the sound pressure levels in both adjacent one third octave bands.

Vibration
Regularly repeated movement about a fixed point.

APPENDIX 6 CRAMP – UPDATE 2016

Licensing Notice Details

Welcome
Mercedes.Kavanagh@mallinckrodt.com
SIGN OUT

Subject
LS Approval - Notice - ELRA/CRAMP Approval

Created Date
19/01/2016

Dear Mr Donnelly,

I refer to your submission LR011582, "Updated CMP as per Agency Request".

The approval is sought under Condition 14.2 of Licence P0050-02. I am to advise you that on the basis of the information provided, the Agency approves your RMP as updated in the requests for information submitted under this return subject to the following:

1. It is noted that line item 11, Table 6.2, "CAC in tankers unload by vacuum tankers at HTI plant in Antwerp" should refer to a quantity of 30 (not "30???47").

2. Note 16 on Table 6.1 states that the net cost of €1,934,199 is "To be amended when agreeing the Financial Provision to take into consideration the asset value of the product and raw materials on site at the time of closure." This is incorrect - financial provision must now be made to cover the net liability in full - €1,934,199.

3. The Agency may at any time, if it considers necessary, revisit and/or revoke this approval.

Agreement by the Agency of the RMP does not constitute an acceptance on the part of the Agency that the RMP constitutes a description of all potential risks or liabilities or costs that may arise or materialise in relation to the facility, but, rather, constitutes in the view of the Agency as of this time a general assessment of risk and general estimate of costs to inform the overall environmental management and understanding of the licensed site and the putting in place of financial provision. Where additional costs arise relating to prevention or remediation of environmental pollution, these remain the responsibility of the Licensee.

This approval does not extend to financial provision for the RMP costs. The licensee shall provide proposals for financial provision in accordance with Agency's *Guidance on Financial Provision for Environmental Liabilities* by 26/02/16. The proposals shall be submitted via EDEN as a financial provision licensee return.

You are reminded of the requirement to comply with the Conditions of Licence P0050-02 at all times.

Yours sincerely,

Linda Dalton O'Regan

Office of Environmental Enforcement, Cork

Tel: 021 487 5540

Licence Details

APPENDIX 7 ELRA - UPDATE 2016

23/02/16
ELRA Agreed
€2,808,316

Licensing Notice Details

Subject
LS Approval - Notice - ELRA/CRAMP Approval

Created Date
23/02/2016

Dear Mr Donnelly,

I refer to your submission LR011583, "Updated ELRA as per the required by the Agency".

On the basis of the information provided, the Environmental Protection Agency (EPA) approves your ELRA.

Agreement by the EPA of the ELRA does not constitute an acceptance on the part of the EPA that the ELRA constitutes a description of all potential risks or liabilities or costs that may arise or materialise in relation to the facility, but, rather, constitutes in the view of the EPA as of this time a general assessment of risk and general estimate of costs to inform the overall environmental management and understanding of the licensed site and the putting in place of financial provision. Where additional costs arise relating to prevention or remediation of environmental pollution, these remain the responsibility of the Licensee.

The EPA may at any time, if it considers necessary, revisit and/or revoke this approval.

This approval does not extend to financial provision for the ELRA costs. The licensee shall provide proposals for financial provision for the ELRA in accordance with EPA *Guidance on Financial Provision for Environmental Liabilities* by 18/03/16. The proposals shall be submitted via EDEN as a financial provision licensee return.

If you have any queries, please contact the undersigned at 021 487 5540.

Yours sincerely,

Linda Dalton O'Regan

Inspector

Environmental Protection Agency

Office of Environmental Enforcement

APPENDIX 8 GROUNDWATER MONITORING REPORT 2016

Main Street Newbridge
Co. Kildare
Ireland

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BIENNIAL IPPC COMPLIANCE MONITORING OF GROUNDWATER AT MALLINCKRODT MEDICAL IMAGING IRELAND, DAMASTOWN, MULHUDDART, DUBLIN 15. IN ACCORDANCE WITH IPPC LICENCE P0050-02

For the Attention of:	Ms. Mercedes Kavanagh Environmental Officer Mallinckrodt Medical Imaging Ireland Damastown Industrial Estate, Mulhuddart, Dublin 15
Monitoring Completed by:	Ms. Kate Tynan
Report Prepared by:	Ms. Kate Tynan Environmental Scientist
Reviewed by:	Mr. Stephen Stapleton Environmental Scientist
Report No:	ECS5229
Monitoring Date:	8th February 2016
Report Date:	24th March 2016

EXECUTIVE SUMMARY

The Mallinckrodt Medical Imaging Ireland site was visited by a Bord na Mona Environmental Scientist on the 8th of February 2016 for the purpose of conducting the company's biennial groundwater monitoring programme for 2016, in accordance with IPPC Licence Reg. No. P0050-02. During the monitoring event, samples were obtained from six groundwater monitoring wells, namely; MW1, MW2, MW3, MW4, MW5 and MW6.

The results of the groundwater are compared with the Groundwater Threshold Values (GTV) as set out in the Report "European Communities Environmental Objectives (Groundwater) Regulations 2010 (S.I. N o. 9 of 2010) and the EPA Interim Guideline Values (IGV) as set out in the Interim Report "Towards Setting Guideline Values for the Protection of Groundwater in Ireland". Any parameters which exceed their respective guideline values are compared to the previous monitoring event in February 2014 (See ANUA Report Ref. – ECS4774).

Exceedences of their respective GTV's / IGV's have occurred for the following parameters:

Inorganics	Calcium (MW-3)
Metals	Manganese (MW-5)
TPH	MW-1 and MW-4

The results of the monitoring event show general improvement compared to the 2014 monitoring event. There has been a slight drop on the concentration of many heavy metals, with less exceedances noted. VOC's remain undetected for this monitoring event.

Total Particulate Hydrocarbons (TPH) was detected at locations MW-1 (C12-35) and MW-4 (C16-35). This would suggest that these monitoring locations, which are up-gradient of the main site activity, are contaminated with Diesel/Gas or lube oil. TPH parameters were not detected above their respective laboratory limits at the remaining boreholes sampled.

Respectively Submitted,

Kate Tynan

Ms. Kate Tynan
Environmental Scientist

Stephen Stapleton

Mr. Stephen Stapleton
Environmental Scientist

CONTENTS

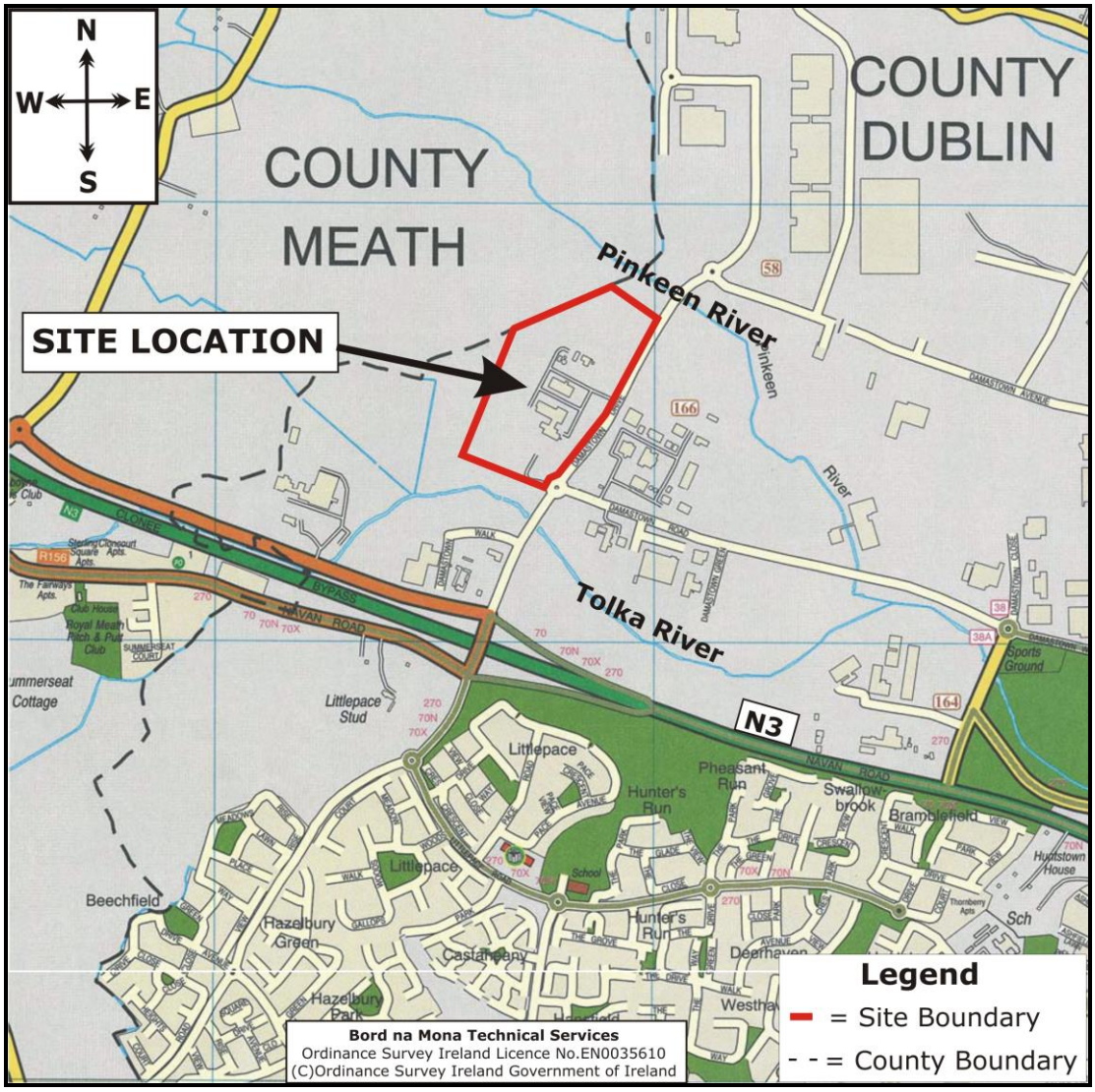
1.0 INTRODUCTION

In accordance with the company's IPPC Licence, Register No. P0050-02 [Schedule 4 (ii)], Mallinckrodt Medical Imaging Ireland is required to conduct a biennial monitoring programme of the groundwater monitoring boreholes at the site.

BNM Environmental was commissioned to perform the sampling and analysis for this monitoring event. The site was subsequently visited by a BNM Environmental Scientist on the 8th of February 2016 to carry out a groundwater monitoring event. Groundwater samples were returned to the laboratory for analysis. This report outlines the accurate sampling and analytical methodologies adopted, including an interpretation of the results obtained.

The Mallinckrodt Medical Imaging Ireland site is located in Damastown, Mulhuddart, Co. Dublin, as shown in Figure 1.1 below.

Figure 1.1 Site Location Map



2.0 METHODOLOGY

2.1 Borehole Locations

The locations of all groundwater monitoring boreholes (MW-1, MW-2, MW-3, MW-4, MW-5 & MW6) are presented in Table 2.1 below, and are illustrated on the site map provided *in Appendix 1*.

TABLE 2.1:LOCATION OF GROUNDWATER MONITORING BOREHOLES

Borehole ID	Well Location	Location
MW-1	Up gradient	North of site Approx. 50m west of fire pump house
MW-2	Down Gradient	Eastern boundary of site Near contractors portacabin offices.
MW-3	Up gradient	South of site Approx. 6m west of the south east car-park
MW-4	Up gradient	Western boundary of site Midway along established electric fence-wire
MW-5	Down Gradient	North-east boundary of site Approx. 25m north of contractors entrance
MW-6	Down Gradient	South-east boundary of site On grass lawn south east of main reception area.

2.2 Representative Groundwater Sampling

Groundwater's were extracted in accordance with the following recognised standards;

TABLE 2.2: STANDARDS

ISO Standard	Description
ISO 5667-1-2006	*Guidance on the design of sampling programmes and sampling techniques*
ISO 5667-3-2012	*Guidance on sample preservation and handling*
ISO 5667-14-2014	*Guidance on quality assurance of environmental sampling & handling*
ISO 5667-11-2009	*Guidance on sampling groundwater's*

Groundwater in the well casing and in close proximity to the well is not considered representative of the general groundwater at a given location. In order to ensure that the groundwater samples extracted from the monitoring bores were representative of the water held in the subsurface strata and not water held stagnant in the borehole casing, it was necessary to evacuate the monitoring bores prior to sampling. A common procedure is to pump a well until between 2 and 6 bore volumes have been removed as cited in BNM Environmental Ltd's Standard of Field Protocols (SOP) and as recommended in numerous technical publications (e.g. Marsh and Lloyd 1980 and Boateng 1987). The purged volumes were calculated on-site from the measured static water levels (measured using an electronic well dipper) and the total depth of the bores.

In order to ensure the efficiency of the evacuation procedure, the temperature and conductivity of the extracted water was continually monitored. Evacuation was deemed to be complete on

stabilisation of both parameters. Therefore samples were extracted for both non-volatile and volatile organic analysis from the monitoring wells after purging the required volumes from each of the monitoring boreholes and on stabilisation of the parameters outlined above. The "Waterra inertial lift pump" system was used to evacuate all of the monitoring bores. The system comprises of three main components:

a. Manual drive HDPE
b. Riser tubing (HDPE or Teflon)
c. Submersible Pump

The required length of tubing was cut so as to allow a 1–m excess above the top of the well casing. A non-return stainless steel foot valve was fitted to the bottom of the tubing and inserted into the bore to the required depth. The pump was operated by vertically oscillating the tubing in the bore. A discharge rate of 2 - 3 l min^{-1} was achieved using the system described. Separate tubing and foot valves were used at each monitoring bore to eliminate the possibility of cross contamination.

- Samples for analysis of Diesel Range Organics (DRO) and Petrol Range Organics (PRO) were taken in 1 litre PTFE capped glass bottles.
- Samples for analysis of heavy metals were taken in 100 ml plastic bottles.

The methodology for sampling of the boreholes for organics are as follows:

(i) A 1–m long narrow diameter Waterra organic sampling bailer is inserted (2 to 5m) into the wider diameter riser tubing.
(ii) Samples from the narrow bore tubing are filled directly into a 100 ml amber conditioned bottle with a PTFE stoppered lid. The sampling bottles are brim filled.
(v) Separate VOC sampling tubes are used at each monitoring borehole.
(vi) Samples are taken in 1 litre polypropylene containers (inorganic) and 100–ml PTFE capped glass bottles (organic), returned to the laboratory for immediate analysis.

All samples were returned to the laboratory, and stored between 1-8°C.

3.0 ENVIRONMENTAL SETTING

3.1 Surrounding Land Use

The Mallinckrodt Medical Imaging Ireland facility is located in Damastown, Mulhuddart, Co. Dublin in a predominantly industrial area. Other facilities in the area include Astellas, Rottapharm, Clarochem, Helsinn Pharmacueticals and Kepak.

The topography in the vicinity of the site is generally flat. Residential developments are located approximately 1.5 kilometres to the east and southeast (Mulhuddart) with the nearest private residences located approximately 1km to the west and north of the site.
There have reportedly been no historical incidents at the site that would have affected groundwater quality and currently there are no known licensed operational emissions to ground.

3.1 Geology and Hydrology

According to the Geological Survey of Ireland (GSI) the site is underlain by dark-grey to black limestone and shale of the Calp formation. This formation is generally unproductive but with some high yielding zones.

During sampling, the depth to the water level below the top of the plastic pipe level (mbpl) was recorded for each of the monitoring wells. All wells were previously surveyed by Murphy Surveys Limited and results tied into the Malin Head Datum. Both the field measurements and survey data were used to determine groundwater flow direction. The results of field measurements taken at each monitoring borehole are presented in Table 5.1.

The site is located between the River Pinkeen to the north and the River Tolka to the south. The resultant groundwater flow direction is influenced by both these rivers with shallow groundwater on the northern side of the site flowing to the northeast and shallow groundwater on the southern side of the site flowing to the southeast.

5.0 RESULTS

The results of the onsite investigations carried out by BNM Environmental are presented as follows;

Table 5.1: Results of Field Measurements taken at each Monitoring Borehole.

Table 5.2: Results of Inorganic Chemical Analysis of Groundwater Samples.

Table 5.3: Results of Heavy Metal Screening of Groundwater Samples.

Table 5.4: Results of Organic Analysis of Groundwater Samples.

TABLE 5.1: RESULTS OF FIELD MEASUREMENTS TAKEN AT MONITORING BOREHOLE

Borehole ID	Elevation of top of well (mOD)	Static Water Level (mbpl) Note 1	Elevation of static water level (mOD)	Recharge Rate m/s	Final Drawdown (m)
MW-1	63.11	1.86	61.25	2cm/ 3sec	2.74
MW-2	NA	1.43	-	1cm/ 2sec	1.47
MW-3 Note 2	61.695	0.61	61.09	Instant	0.82
MW-4 Note 2	64.161	0.92	63.24	1cm/ 10sec	3.97
MW-5	62.241	1.17	61.07	2cm/ sec	2.43
MW-6	61.975	6.08	55.90	1cm/ 5sec	2.46

Note 1: mbpl – meters below pipe level.

Note 2: Wells were purged and left to recharge several times before a sample was taken as the recharge rate was very slow.

.

TABLE 5.2 RESULTS OF INORGANIC CHEMICAL ANALYSIS OF GROUNDWATER SAMPLES							
Parameter	**Borehole Identification**						**Guideline Threshold Values** [Note1]
	MW1	**MW3**	**MW4**	**MW2**	**MW5**	**MW6**	
	Up gradient			**Down gradient**			
pH (pH units)	7.6	7.9	8	7.4	7.8	7.5	*6.5-9.5*
Alkalinity(mg/l)	298	258	242	269	153	288	-
Conductivity (µS/cm)	728	978	524	1143	478	975	*800-1875*
COD (mg/l)	172	18	485	26	22	18	-
Calcium (mg/l)	62	**306**	79	133	83	131	*200* [Note 2]
Magnesium (mg/l)	25	8.6	8.3	22	9.5	28	*50* [Note 2]
Potassium (mg/l)	2.0	0.4	1.6	1.1	0.5	1.2	*5* [Note 2]
Sodium (mg/l)	22	7.9	8.2	13	8.6	22	*150*
Chloride (mg/l)	13	11	14	12	11	16	*24 – 187.5*
Nitrate (mg/l)	0.09	0.07	0.05	0.05	<0.04	0.05	*8.47*[1*]

Note:

Note 1: GTV = Groundwater Threshold Values refers to "*European Communities Environmental Objectives (Groundwater) Regulations, 2010 (S.I. No. 9 of 2010*)". "Threshold Values" have been established for pollutants that are causing a risk to groundwater bodies. Exceedance of a relevant threshold value at a representative monitoring point triggers further investigation to confirm whether the criteria for poor groundwater chemical status are being met.

Note 2: Guide Values refers to EPA Guideline Values for the Protection of Groundwater in Ireland, IGV = Interim Guideline Value. Note these standards are presented for guideline purposes only, therefore, due care should be exercised in cross-referencing these standards with the groundwater results obtained.

* Converted GTV for Nitrate as N mg/l.

Results highlighted in red bold represent results in exceedence of their respective GTV's/IGV's

TABLE 5.3 RESULTS OF HEAVY METAL SCREENING OF GROUNDWATER SAMPLES								
Parameter	**Unit**	**Borehole Identification**						**Guideline Threshold Values** Note1
		MW1	**MW3**	**MW4**	**MW2**	**MW5**	**MW6**	
		Up gradient			**Down gradient**			
Nickel	ug/l	<2	<2	3	<2	<2	<2	*15*
Manganese	ug/l	<2	<2	<2	<2	**67**	<2	*50* Note 2
Chromium	ug/l	<2	<2	<2	<2	<2	<2	*37.5*
Copper	ug/l	<2	<2	3	<2	<2	2	*1500*
Tin	ug/l	<2	<2	<2	<2	<2	<2	-
Zinc	ug/l	<2	<2	<2	<2	<2	<2	*100* Note 2
Cadmium	ug/l	<2	<2	<2	<2	<2	<2	*3.75*
Arsenic	ug/l	<2	<2	<2	<2	<2	<2	*7.5*
Aluminium	ug/l	<2	<2	<2	<2	<2	<2	*150*
Barium	ug/l	63	28	89	44	20	71	*100* Note 2
Antimony	ug/l	<2	<2	3	<2	<2	<2	-
Selenium	ug/l	4	<2	<2	2	<2	<2	-
Cobalt	ug/l	<2	<2	<2	<2	<2	<2	-
Silver	ug/l	<2	<2	<2	<2	<2	<2	-
Berylium	ug/l	<2	<2	<2	<2	<2	<2	-
Lead	ug/l	<2	<2	<2	<2	<2	<2	*18.75*
Mercury	ug/l	<1	<1	<1	<1	<1	<1	*0.75*
Iron	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	*0.2*

Note:

Note 1: GTV = Groundwater Threshold Values refers to "*European Communities Environmental Objectives (Groundwater) Regulations, 2010 (S.I. No. 9 of 2010*)". "Threshold Values" have been established for pollutants that are causing a risk to groundwater bodies. Exceedance of a relevant threshold value at a representative monitoring point triggers further investigation to confirm whether the criteria for poor groundwater chemical status are being met.

Note 2: Guide Values refers to EPA Guideline Values for the Protection of Groundwater in Ireland, IGV = Interim Guideline Value. Note these standards are presented for guideline purposes only, therefore, due care should be exercised in cross-referencing these standards with the groundwater results obtained.

Results highlighted in bold represent results in exceedence of their respective GTV's / IGV's

TABLE 5.4: RESULTS OF ORGANIC ANALYSIS OF GROUNDWATER SAMPLES								
Parameter	**Unit**	**Borehole Identification**						**Guideline Threshold Values**
		MW1	**MW3**	**MW4**	**MW2**	**MW5**	**MW6**	
		Up gradient			**Down gradient**			
Dichloromethane	µg/l	<3	<3	<3	<3	<3	<3	-
Remaining USEPA 524.2 Note 1	µg/l	<1	<1	<1	<1	<1	<1	-
Methanol	mg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-
Ethanol	mg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-
Acetonitrile	mg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-
Acetone	mg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-
IPA	mg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-

TABLE 5.5: RESULTS FOR TOTAL PERTOLEUM HYDROCARBONS								
Parameter Note 1	**Unit**	**Borehole Identification**						**Interim Guideline Values**
		MW1	**MW3**	**MW4**	**MW2**	**MW5**	**MW6**	
		Up gradient			**Down gradient**			
C5-C6 Aliphatic	µg/l	<10	<10	<10	<10	<10	<10	<10
C6-C8 Aliphatic	µg/l	<10	<10	<10	<10	<10	<10	<10
C8-C10 Aliphatic	µg/l	<10	<10	<10	<10	<10	<10	<10
C10-C12 Aliphatic	µg/l	<10	<10	<10	<10	<10	<10	<10
C12-C16 Aliphatic	µg/l	**12**	<10	<10	<10	<10	<10	<10
C16-C21 Aliphatic	µg/l	**15**	<10	**36**	<10	<10	<10	<10
C21-C35 Aliphatic	µg/l	**45**	<10	**140**	<10	<10	<10	<10
Total Aliphatics	µg/l	**72**	<10	**176**	<10	<10	<10	<10
C5-C7 Aromatic	µg/l	<10	<10	<10	<10	<10	<10	<10
C7-C8 Aromatic	µg/l	<10	<10	<10	<10	<10	<10	<10
C8-C10 Aromatic	µg/l	<10	<10	<10	<10	<10	<10	<10
C10-C12 Aromatic	µg/l	<10	<10	<10	<10	<10	<10	<10
C12-C16 Aromatic	µg/l	<10	<10	<10	<10	<10	<10	<10
C16-C21 Aromatic	µg/l	<10	<10	<10	<10	<10	<10	<10
C21-C35 Aromatic	µg/l	<10	<10	**14**	<10	<10	<10	<10
Total Aromatics	µg/l	<10	<10	**14**	<10	<10	<10	<10

6.0 DISCUSSION

Reference is made throughout a number of sections in the discussion of this report to the EPA Interim Guideline Values IGV's and Guideline Threshold Values GTV's. IGV's are set out in the Interim Report "Towards Setting Guideline Values for the Protection of Groundwater in Ireland" 2004. GTV's are set out in the Report "*European Communities Environmental Objectives (Groundwater) Regulations 2010 (S.I. N o. 9 of 2010).* Any parameters which exceed their respective guideline values are compared to the previous monitoring event in February 2014 (*See ANUA Report Ref. – ECS4774*).

Inorganics

The results of in-organic chemical analysis are presented in Table 5.2. The Calcium concentration displayed a notable reduction at MW2 (283→133 mg/l) and is within the IGV limit of 200 mg/l. The calcium concentration has exceeded the IGV limit at MW3 (306mg/l). It is worth noting that Calcium displayed a slight reduction at locations; MW1, MW4, and MW5.

All remaining inorganic parameter results (See Table 5.2) were within their respective EPA guideline values (IGV's/GTV's).

Heavy Metals

The results of heavy metals analysis are presented in Table 5.3. Overall the number of exceedences for heavy metal parameters has reduced compared to the 2014 monitoring event.

The Manganese level displayed a significant reduction at MW-5 (185→67µg/l) however it is still exceeding its IGV limit (50µg/l). The remaining monitoring locations displayed significant reductions in Manganese concentration; MW-2 (516→<2µg/l), MW-3 (141→<2µg/l), MW-4 (2416→<2µg/l) and MW-6 (59→<2µg/l) and are now all within respective IGV limit.

The Arsenic concentration displays a decrease at MW-4 (10→<2µg/l) and is now within the respective GTV limit (7.5 µg/l).

All remaining heavy metal parameters were within their respective GTV/IGV limit values.

Volatile Organic Compounds (VOC)

The results of VOC analysis are presented in Table 5.4. No VOC's were detected for the 2016 monitoring event.

Hydrocarbons

The results of Total Particulate Hydrocarbon (TPH) analysis are presented in Table 5.5. TPH parameters were detected at location MW-1 and MW-4.

MW-1 is located to the north of the Mallinckrodt facility approximately 50m west of fire pump house.

The presence of Hydrocarbons in this well, would suggest that the Diesel/Gas or lube oil contamination originates from off-site sources travelling in the underlying groundwater's flowing from the north (see Appendix 1 for Piezometric flow and site layout map).

It is worth noting that the Total Aliphatics (<10→72µg/l) have displayed an increase when compared to the 2014 monitoring event.

MW-4 is located west of the Mallinckrodt facility approximately 80 meters up gradient of the nearest boundary in a green field area.

The presence of Hydrocarbons in this well, would suggest that the Diesel/Gas or lube oil contamination originates from off-site sources travelling in the underlying groundwater's flowing from the west (see Appendix 1 for Piezometric flow and site layout map).

It is worth noting that the Total Aliphatics (30→176µg/l) and Total Aromatics (23→14µg/l) have displayed an increase Aliphatics and a decrease in aromatics when compared to the 2014 monitoring event.

TPH parameters were not detected above their respective laboratory limits at the remaining boreholes sampled.

Figure 1 below presents a visual interpretation of the carbon bands at which each type of hydrocarbon originates from. Hydrocarbons found in the C16 to C35 indicated the presence of heavier Diesel and lubricant oils.

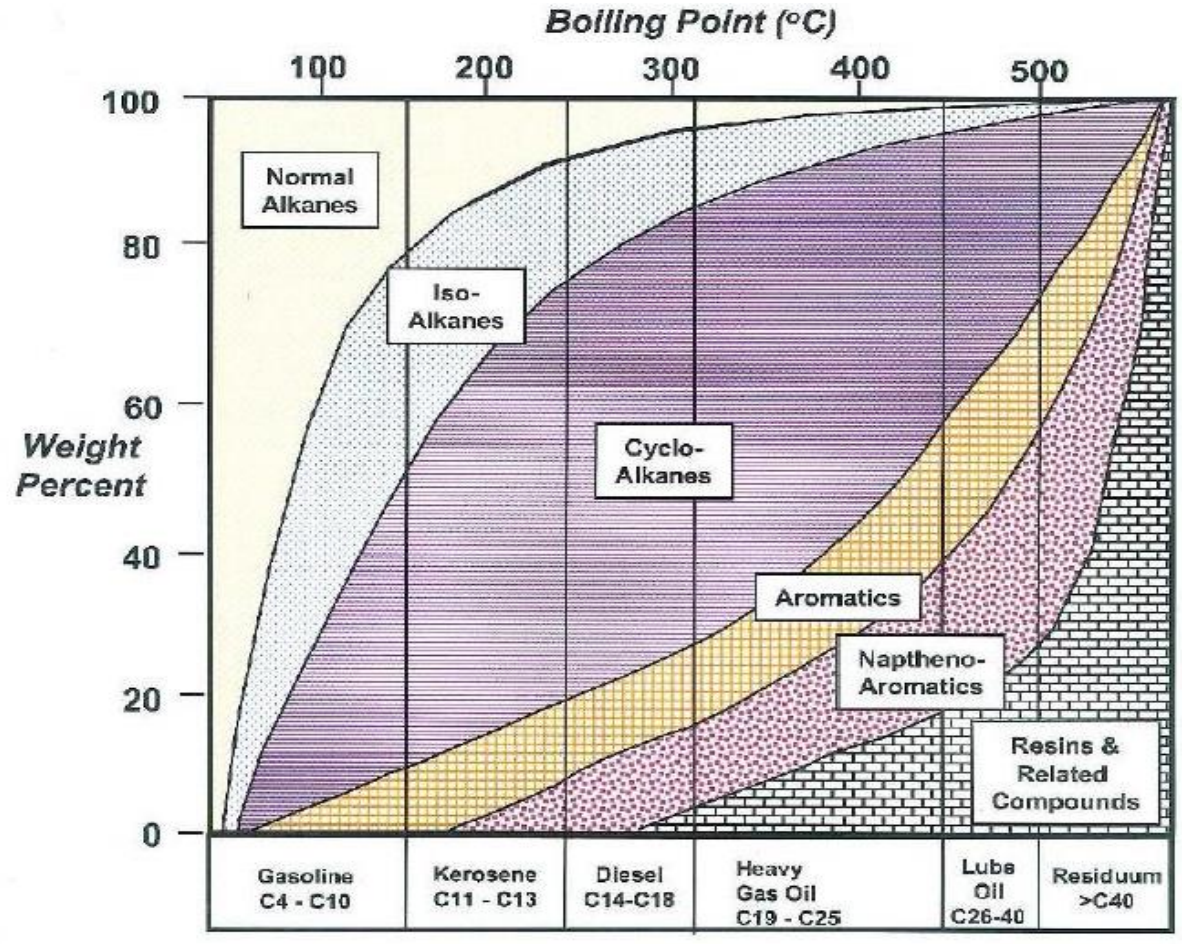
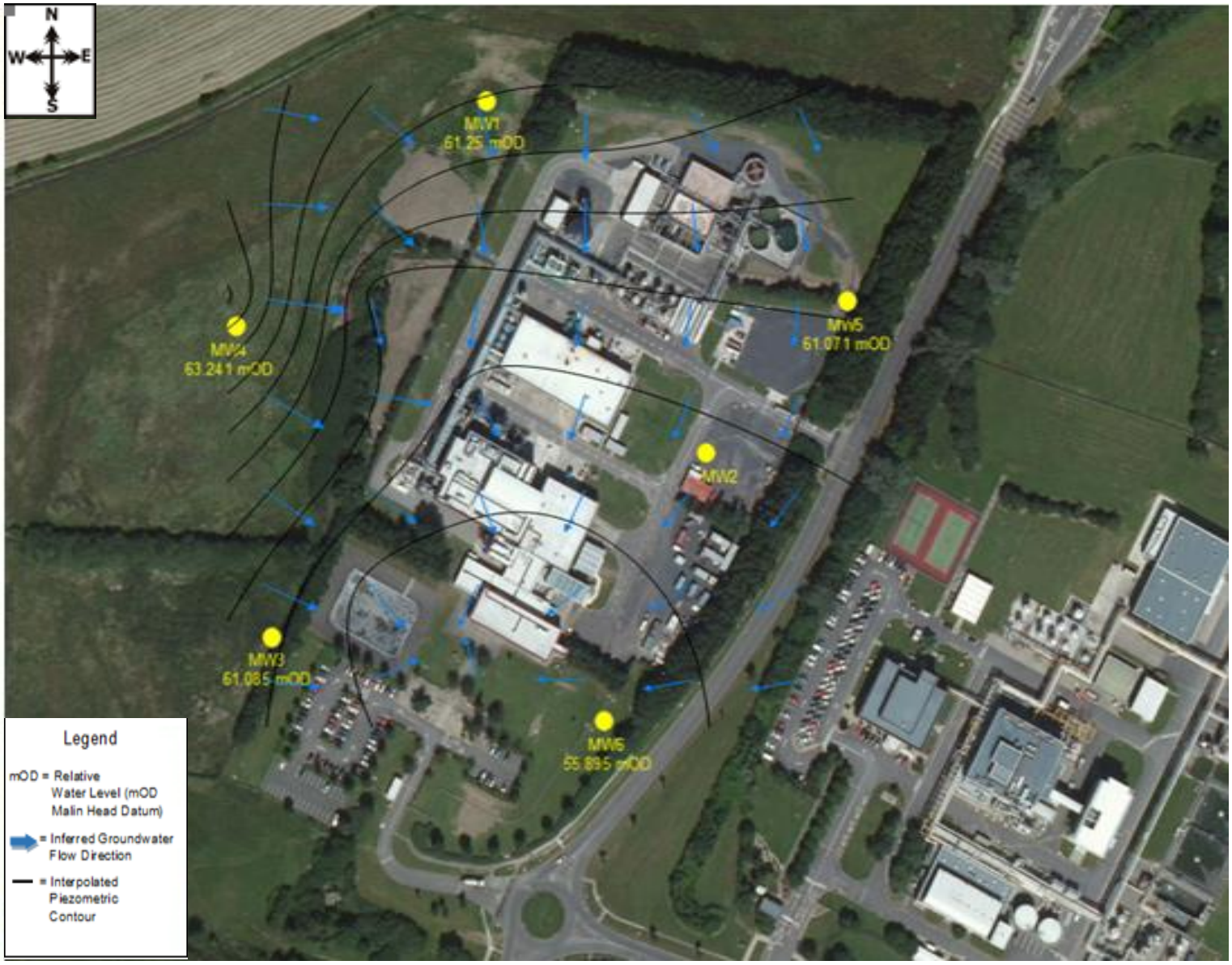


Figure 1: Hydrocarbon Ranges

APPENDIX 1

DRAWING ILLUSTRATING GROUNDWATER FLOW DIRECTION AND MONITORING LOCATIONS AT THE MALLINCKRODT FACILITY


N
W
E
S
MW1
61.25 mOD
MW4
63.241 mOD
MW5
61.071 mOD
MW2
MW3
61.085 mOD
MW6
55.895 mOD
Legend
mOD = Relative Water Level (mOD Malin Head Datum)
= Inferred Groundwater Flow Direction
= Interpolated Piezometric Contour

APPENDIX 2

Analytical Methods
Lab Accreditation
Chain of Custody

METHODS AND LIMITS OF DETECTION			
PARAMETER	**METHOD**	**L.O.D. / Range**	**Accredited**
pH (pH Units)	G/05	*0.1 - 14*	INAB ✓
COD (mg/l)	Based on APHA, 2012, 22nd Edition, 5220D, Closed Reflux, colourimetric method. (G/03)	<10 mg/l COD	INAB ✓
USEPA list 524.2 Volatile Organic Compounds (VOC) µg/l	G/61 Headspace GC-MS	<1µg/l <3 Dichloromethane	x
Speciated Total Petroleum Hydrocarbons	C5-8 fractions by Headspace GC-FID (036S). C8-35 fractions on as received sample extracted with hexane/acetone, aliphatic/aromatic splits run by GC-FID (005S),	TPH CWG (Aliphatics C5-6,>6-8,>8-10,>10-12,>12-16,>16-21,>21-35) (aromatics >C5-7,>7-8,>8-10,>10-12,>12-16,>16-21,>21-35) inc BTEX/MTBE if requested	x
Major Anions (mg/l)	G/67 Konelab Based on APHA, 2012, 22nd Edition, Ortho-P method- 4500-PE Ascorbic acid, Nitrate/Nitrite/TON-method 4500-NO2B Colorimetric method, Chloride-method 4500 Cl-E Ferricyanide Method	<0.2mg/l NO3-N <0.01 mg/l PO4-P <0.02mg/l NO2-N <2 mg/l Cl	x
Major Cations	G/57 ICP-MS	Hg <1µg/l Fe <0.1mg/l Others: <2µg/l	x
Total Alkalinity (mg/l)	G/20: Based on APHA, 2012, 22nd Edition, Method 2320D.	<10 mg/l	INAB ✓
GC-FID scan (Methanol, Ethanol, Acetone, IPA, Acetonitrile (mg/l)	Based on ASTM Method D3695. (G/14)	<0.5 mg/l	x

NOTES

APHA American Public Health Association, Standard Methods for the Examination of Waters and Wastewaters, 22nd Edition, 2012.

ASTM American Society for Testing Materials, Annual Book of ASTM Standards 1997

G = ANUA Environmental Analytical Laboratory Standard Operating Procedures Manual

< = Less than

✓ INAB Accredited Test Method – INAB Registration Reference No. 083T.

4.0 COMMITMENT TO QUALITY

4.1 INAB Accreditation

BNM Environmental analytical laboratories is accredited to ISO 17025 by the National Accreditation Board (INAB). ISO 17025 accreditation ensures that the laboratory operates a quality system with technically competent staff. The laboratory has accreditation since 1997 and it is the policy of the laboratory to achieve and maintain a high standard of quality consistent with client's requirements in all aspects of the work carried out within the laboratory.

4.2 Interlaboratory Proficiency Schemes

To ensure the accuracy of the analytical testing the laboratory participates in several external proficiency schemes. The ongoing competence of the laboratory and its staff is assessed by participation in various inter-laboratory proficiency testing schemes, such as LGC Aquacheck scheme and the EPA Intercalibration programme organised for environmental laboratories throughout Ireland. The BNM Environmental Analytical Laboratory is listed on the EPA's register of Quality Controlled Laboratories

4.3 Control Chain of Custody

As part of the Quality System in place at BNM Environmental., measures are taken to ensure controlled chain of custody. An outline of the chain of custody is given overleaf

CONTROLLED CHAIN OF CUSTODY

SITE		TRANSPORT		LABORATORY
Sampling and packaging of all samples were carried out by BNM Environmental Technical Team:	Transport Document Form	Transport to laboratory by BNM Environmental Technical Team.	Sample Reception Form	Receiving of samples at BNM Environmental Laboratory complex by: Laboratory Manager (Secure laboratory complex access to authorised personnel only)
Ms. Kate Tynan	→		→	↓
				Storage of all samples for 1 month period after report issue.
				↓
				Supervised Disposal

APPENDIX 3

USEPA METHOD 524.2 COMPOUND LISTING

USEPA Method 524.2 Compound List

PARAMETER	ACCREDITED	PARAMETER	ACCREDITED
Dichlorodifluoromethane	X	Chloromethane	✓
Vinyl chloride	✓	Bromomethane	✓
Chloroethane	✓	Trichlorofluoromethane	✓
1,1-Dichloroethene	✓	1,1-Dichloroethane	✓
Dichloromethane*	✓	2,2-Dichloropropane	X
trans-1,2-Dichloroethene	✓	Chloroform	✓
cis-1,2-Dichloroethene	✓	1,1-Dichloropropene	✓
Bromochloromethane	✓	1,2-Dichloroethane	X
1,1,1-Trichloroethane	✓	Trichloroethene	✓
Carbon tetrachloride	✓	Dibromomethane	✓
Benzene	✓	cis-1,3-Dichloropropene	✓
1,2-Dichloropropane	✓	trans-1,3-Dichloropropene	✓
Bromodichloromethane	✓	1,3-Dichloropropane	✓
Toluene	✓	Dibromochloromethane	✓
1,1,2-Trichloroethane	✓	Chlorobenzene	✓
Tetrachloroethene	✓	Ethylbenzene	✓
1,2-Dibromoethane	✓	o-Xylene	✓
1,1,1,2–Tetrachloroethane	✓	Bromoform	✓
M,p-Xylene	✓	Bromobenzene	✓
Styrene	✓	2-Chlorotoluene	✓
Isopropylbenzene	✓	4-Chlorotoluene	✓
1,2,3-Trichloropropane	X	1,2,4-Trimethylbenzene	✓
n-propylbenzene	✓	4-Isopropyltoluene	✓
1,3,5-Trimethylbenzene	✓	1,4–Dichlorobenzene	✓
tert-Butylbenzene	✓	1,2-Dichlorobenzene	X
sec-Butylbenzene	✓	1,2,4-Trichlorobenzene	✓
1,3-Dichlorobenzene	✓	n-Butylbenzene	✓
Hexachlorobutadiene	✓	1,2-Dibromo-3-chloropropane	X
Naphthalene	✓	1,2,3 Trichlorobenzene	✓

Notes:

✓ ISO 17025 Accredited Test Method
X Non–Accredited Test Method
* Limit of Detection for DCM is <3µg/l. All other organics have a Limit of Detection of <1µg/l.

APPENDIX 9 BUND & SUMP MATRICES 2016 & CCTV SURVEY 2016

RED - REMOVE | DUE ASAP

BUND MATRIX 2016

Bund Number	Bund Ref	Bund Location	Tank/Area	Hydrostatic/Structural	Current Test	Test Date	Due Date	Current Status Pass/Fail/Not Complete	Location & Label Verified (Yes/No)	Bund Retention Volume (L)	Primary Vessel Storage Volume(L)	Actions
1	**B1**	**Tank Farm (MeOH)**	T-960	Hydrostatic	2013	**07.06.2013**	06.06.2016	Pass	Yes	34453	30000	No Action
2	**B2**	**Tank Farm (Waste MeOH)**	T-288	Hydrostatic	2013	**07.06.2013**	06.06.2016	Pass	Yes	35074	22300	No Action
3	**B3**	**Tank Farm (Caustic)**	T-962	Hydrostatic	2013	**03.11.2013**	02.11.2016	Pass	Yes	See Link to Report	60000	New Tank put in Sept 2015 - Test 2016
4	**B4**	**Tank Farm (HCL)**	T-964	Hydrostatic	2013	**07.06.2013**	06.06.2016	Pass	Yes	35700	30200	No Action
5	**B5**	**ASI (High Stength Waste)**	T-940	Hydrostatic	2013	**13.06.2013**	12.06.2016	Pass	Yes	12960	7500	
6	**B6**	**Utility Building (Low Strength Waste)**	T-912	Hydrostatic	2013	**07.06.2013**	06.06.2016	Pass	Yes	12807	5765	No Action
7	**B7**	**ASI (Methanol Recovery)**	T-850	Hydrostatic	2013	**12.06.2013**	11.06.2016	Pass	Yes	20540	4000	No Action
8	**B8**	**ASI (Methanol Recovery)**	T-871	Hydrostatic	2013	**11.06.2013**	10.06.2013	Pass	Yes	19430	500	No Action
9	**B9**	**Tank Farm CAC (Unsuitable for Hydrostatic testing)**	TA-5031	Structural	2013	**01.07.2014**	30.06.2017	Pass	Yes	35700	30,000/ 32795	No Action
10	**B10**	**Tank Farm (DMAC Storage)**	TA-5011	Hydrostatic	2013	**07.06.2013**	06.06.2016	Pass	Yes	103750	37850	No Action
11	**B11**	**Tank Farm (DMAC Virgin)**	TA-5021 (Virgin)	Hydrostatic	2013	**07.06..2013**	06.06.2016	Pass	Yes	103750	37850	No Action
11A	**B11A**	**Tank Farm (DMAC Waste)**	TA-5121 (Waste)	Hydrostatic	2013	**07.06.2013**	06.06.2016	Pass	Yes	103750	37850	No Action
12	**B12**	**Process Building External (West - Scrubber SC 2011)**	SC-2011	Hydrostatic	2013	**10.06.2013**	09.06.2016	Pass	Yes	7735	4000	No Action
13	**B13**	**ASI (Process Sumps)**	Process Pumps under TA-2021	Hydrostatic	2013	**07.06.2013**	06.06.2016	Pass	Yes	18616	8000	No Action
14	**B14**	**ASI (DMAC Recovery)**	DMAC Recovery	Hydrostatic	2013	**07.06.2013**	06.06.2016	Pass	Yes	16836	7400	No Action
15	**B15**	**SC-2051**	Scrubber	Structural	2013	**28.02.2014**	27.02.2017	Pass	Yes	N/A	N/A	No Action
16	**B16**	**West of Process Building (RO Make up Tanks)**	RO Make-Up Tanks	Hydrostatic	2013	**09.08.2013**	08.08.2016	Pass	Yes	35200	30000	No Action
17	**B17**	**Drumstore**	Drumstore Hard Standing	Structural	2013	**18.11.2013**	17.11.2016	Pass	Yes	N/A	N/A	No Action
18	**B18**	**Drumstore**	Drumstore Hard Standing	Structural	2013	**18.11.2013**	17.11.2016	Pass	Yes	N/A	N/A	No Action
19	**B19**	**Rear of Warehouse (Diesel Generator Bund)**	Diesel Generator	Hydrostatic	2013	**07.06.2013**	06.06.2016	Pass	Yes	756	100	No Action
20	**B20**	**CE Charging (Portable)**	Portable Bund	Hydrostatic	2013	**09.08.2013**	08.08.2016	Pass	Yes	200	25	No Action
21	**B21**	**CE Charging**	Internal at scales	Structural	2013	**18.11.2013**	17.11.2016	Pass	Yes	N/A	N/A	No Action
22	**B22**	**Drumstore**	Rack 4	Hydrostatic	2013	18.01.2016	17.01.2019	Pass	Yes	N/A	N/A	No Action
23	**B23**	**Blower/Polymer Room (Fixed Bund - Foamtrol)**	Polymor Room	Hydrostatic	2013	**23.11.2013**	22.11.2016	Pass	Yes	1000	250	No Action
24	**B24**	**Utility Building (Portable Steamate)**	Fixed Bund (Boiler Chemical Dosing)Steamate	Hydrostatic	2013	18.01.2016	17.01.2019	Pass	Yes	412.5	375	No Action
25	**B25**	**Utility Building (Portable - Optisperse)**	Fixed Bund (Boiler Chemical Dosing) Optisperse	Hydrostatic	2013	18.01.2016	17.01.2019	Pass	Yes	412.5	375	No Action

26	**B26**	**Utility Building (Portable)**	Fixed Bund (Boiler Chemical Dosing) Cortrol	Hydrostatic	2013	18.01.2016	17.01.2019	Pass	Yes	412.5	375	No Action
27	**B27**	**Utility Building**	NaOH Day Tank Bund T-939	Structural	2013	**Due Date**	01.03.2016 Remove	Pass	Yes	449	1000	Remove - Redundant
28	**B28**	**Utility Building**	HCl Day Tank Bund T-938	Structural	2013	**Due Date**	01.03.2016 Remove	Pass	Yes	449	1000	Remove - Redundant
29	B29	**Drumstore**	Rack 1 - Waste Oil Blue Bund	Hydrostatic	2013	2016	DUE	Due	Yes			testing Due ASAP
30	**B30**	**Blower Room**	Polymor Room - Foamtrol	Hydrostatic	2012	**23.11.2013**	22.11.2016	Pass	Yes	500	1000	No Action
31	**B31**	**Drumstore**	Rack 4	Hydrostatic	2013	18.01.2016	17.01.2019	Pass	Yes	N/A	N/A	No Action
32	**B32**	**Drumstore**	Rack 4	Hydrostatic	2013	18.01.2016	17.01.2019	Pass	Yes	N/A	N/A	No Action
33	B33	**ASI**	Transformer	Structural		**18.11.2013**	17.11.2016	Pass	Yes	200	23	No Action
34	**B34**	**Drumstore**	Rack 4	Hydrostatic	2013	18.01.2016	17.01.2019	Pass	Yes	N/A	N/A	No Action
35	**B35**	**Tanker Unloading Polychannel**	Tank Farm	Structural	2013	**18.11.2013**	17.11.2016	Pass	Yes	N/A	N/A	No Action
36	B36	**Drumstore**	Rack 4	Hydrostatic	2013	18.01.2016	17.01.2019	Pass	Yes	N/A	N/A	No Action
37	B37	**Drumstore**	Rack 4	Hydrostatic	Compliance Reports\Bu	18.01.2016	17.01.2019	Pass	Yes	N/A	N/A	No Action
38	B38	**Drumstore**	Rack 4	Hydrostatic	2013	18.01.2016	17.01.2019	Pass	Yes	N/A	N/A	No Action
39	B39	**Drumstore**	Rack 4	Hydrostatic	2013	18.01.2016	17.01.2019	Pass	Yes	N/A	N/A	No Action
40	B40	**Drumstore**	Rack 4	Hydrostatic	2013	18.01.2016	17.01.2019	Pass	Yes	N/A	N/A	No Action
41	B41	**Drumstore**	Rack 4	Hydrostatic	2013	18.01.2016	17.01.2019	Pass	Yes	N/A	N/A	No Action
42	B42	**Drumstore**	Rack 4	Hydrostatic	2013	18.01.2016	17.01.2019	Pass	Yes	N/A	N/A	No Action
43	B43	**Drumstore**	Rack 4	Hydrostatic	2013	18.01.2016	17.01.2019	Pass	Yes	N/A	N/A	No Action
44	B44	**Drumstore**	Rack 4	Hydrostatic	2013	18.01.2016	17.01.2019	Pass	Yes	N/A	N/A	No Action
45	B45	**Drumstore**	Rack 4	Hydrostatic	2013	18.01.2016	17.01.2019	Pass	Yes	N/A	N/A	No Action
46	B46	**Drumstore**	Rack 4	Hydrostatic	2013	18.01.2016	17.01.2019	Pass	Yes	N/A	N/A	No Action
47	B47	**Drumstore**	Rack 4	Hydrostatic	2013	18.01.2016	17.01.2019	Pass	Yes	N/A	N/A	No Action
48	B48	**Drumstore**	Rack 4	Hydrostatic	Compliance	18.01.2016	17.01.2019	Pass	Yes	N/A	N/A	No Action
49	B49	**Drumstore**	Rack 4	Hydrostatic	2013	18.01.2016	17.01.2019	Pass	Yes	N/A	N/A	No Action
50	B50	**Drumstore**	Rack 4	Hydrostatic	2013	18.01.2016	17.01.2019	Pass	Yes	N/A	N/A	No Action
51	B51	**Drumstore**	Rack 4	Hydrostatic	2013	18.01.2016	17.01.2019	Pass	Yes	N/A	N/A	No Action
52	B52	**Drumstore**	Rack 2	Hydrostatic	Compliance	18.01.2016	17.01.2019	Pass	Yes	N/A	N/A	No Action
53	B53	**Drumstore**	Rack 2	Hydrostatic	2013	18.01.2016	17.01.2019	Pass	Yes	N/A	N/A	No Action
54	B54	**Drumstore**	Rack 2	Hydrostatic	2013	18.01.2016	17.01.2019	Pass	Yes	N/A	N/A	No Action
55	B55	**Drumstore**	Rack 2	Hydrostatic	2013	18.01.2016	17.01.2019	Pass	Yes	N/A	N/A	No Action
56	B56	**Drumstore**	Rack 2	Hydrostatic	2013	18.01.2016	17.01.2019	Pass	Yes	N/A	N/A	No Action
57	B57	**Drumstore**	Rack 2	Hydrostatic	2013	18.01.2016	17.01.2019	Pass	Yes	N/A	N/A	No Action
58	B58	**Drumstore**	Rack 2	Hydrostatic	2013	22.02.2016	21.02.2019	New - Feb 2016	Yes	N/A	N/A	No Action
59	B59	**Drumstore**	Rack 2	Hydrostatic	2013	22.02.2016	21.02.2019	New - Feb 2016	Yes	N/A	N/A	No Action
60	B60	**Drumstore**	Rack 2	Hydrostatic	2013	18.01.2016	21.02.2019	Pass	Yes	N/A	N/A	No Action
61	B61	**Drumstore**	Rack 2	Hydrostatic	2013	22.02.2016	21.02.2019	New - Feb 2016	Yes	N/A	N/A	No Action
62	B62	**Drumstore**	Rack 2	Hydrostatic	2013	18.01.2016	17.01.2019	Pass	Yes	N/A	N/A	No Action
63	B63	**Drumstore**	Rack 2	Hydrostatic	2013	18.01.2016	17.01.2019	Pass	Yes	N/A	N/A	No Action
64	B64	**Drumstore**	Rack 2	Hydrostatic	2013	18.01.2016	17.01.2019	Pass	Yes	N/A	N/A	No Action
65	B65	**Drumstore**	Rack 2	Hydrostatic	2013	18.01.2016	17.01.2019	Pass	Yes	N/A	N/A	No Action
66	B66	**Drumstore**	Rack 2	Hydrostatic	2013	22.02.2016	21.02.2019	New - Feb 2016	Yes	N/A	N/A	No Action

67	B67	**Drumstore**	Rack 2	Hydrostatic	2013	18.01.2016	17.01.2019	Pass	Yes	N/A	N/A	No Action
68	B68	**Drumstore**	Rack 2	Hydrostatic	2013	18.01.2016	17.01.2019	Pass	Yes	N/A	N/A	No Action
69	B69	**Drumstore**	Rack 2	Hydrostatic	2013	18.01.2016	17.01.2019	Pass	Yes	N/A	N/A	No Action
70	B70	**Drumstore**	Rack 2	Hydrostatic	2013	2016	DUE	Due	Yes	N/A	N/A	Testing Due ASAP
71	B71	**Drumstore**	Rack 2	Hydrostatic	2013	18.01.2016	17.01.2019	Pass	Yes	N/A	N/A	No Action
72	B72	**Drumstore**	Rack 1	Hydrostatic	2013	2016	DUE	Due	Yes	N/A	N/A	Testing Due ASAP
73	B73	**Drumstore**	Rack 1	Hydrostatic	2013	18.01.2016	17.01.2019	Pass	Yes	N/A	N/A	No Action
74	B74	**Drumstore**	Rack 1	Hydrostatic	2013	18.01.2016	17.01.2019	Pass	Yes	N/A	N/A	No Action
75	B75	**Drumstore**	Rack 1	Hydrostatic	2013	18.01.2016	17.01.2019	Pass	Yes	N/A	N/A	No Action
76	B76	**Drumstore**	Rack 1	Hydrostatic	2013	18.01.2016	17.01.2019	Pass	Yes	N/A	N/A	No Action
77	B77	**Drumstore**	Rack 1	Hydrostatic	2013	18.01.2016	17.01.2019	Pass	Yes	N/A	N/A	No Action
78	B78	**Drumstore**	Rack 1	Hydrostatic	2013	18.01.2016	17.01.2019	Pass	Yes	N/A	N/A	No Action
79	B79	**Drumstore**	Rack 1	Hydrostatic	2013	18.01.2016	17.01.2019	Pass	Yes	N/A	N/A	No Action
80	B80	**Drumstore**	Rack 1	Hydrostatic	2013	18.01.2016	17.01.2019	Pass	Yes	N/A	N/A	No Action
17	B81	**Drumstore**	Rack 1	Hydrostatic	2013	18.01.2016	17.01.2019	Pass	Yes	N/A	N/A	No Action
82	B82	**Drumstore (oil)**	Rack 1 - Waste Oil Orange Bund	Hydrostatic	2013	2016	DUE	Due	Yes	N/A	N/A	Testing Due ASAP
83	B83	**Fire pump house**	Portable Bund - Spectrus	Hydrostatic	2013	18.01.2016	17.01.2019	Pass	Yes	220	245	No Action
84	B84	**Fire pump house**	Portable Bund - Gengaard	Hydrostatic	2013	18.01.2016	17.01.2019	Pass	Yes	220	245	No Action
85	B85	**Fire pump house**	Portable Bund - Biomate	Hydrostatic	2013	18.01.2016	17.01.2019	Pass	Yes	220	245	No Action
86	B86	**Fire pump house**	Portable Bund - Slimicide	Hydrostatic	2013	18.01.2016	17.01.2019	Pass	Yes	220	245	No Action
87	B87	**Fire pump house**	Plastic portable - Alcoseal	Hydrostatic	2013	18.01.2016	17.01.2019	Pass	Yes	N/A	N/A	No Action
88	B88	**Fire pump house**	Plastic portable - Fluofoam	Hydrostatic	2013	18.01.2016	17.01.2019	Pass	Yes	N/A	N/A	No Action
89	B89	**Polymor Room**	Nutrifeed Bund	Hydrostatic	2013	18.01.2016	17.01.2019	Pass	Yes	3000	3500	No Action
90	B90	**Utility Building**	Fixed Bund (Boiler Chemical Dosing)	Hydrostatic	2013	20.11.2013	19.11.2016	Pass	Yes	449	1000	No Action
91	B91	**South side of development Lab.**	2 IBCs Methanol and Water	Hydrostatic	2014	26.06.2014	25.06.2017	Pass	Yes	1100	1000	Bunds Redundant Maximo Work order raised - MK 15.10.15
92	B92	**SW TOC Hut**	Mobile Pallet	Hydrostatic		18.01.2016	17.01.2019	Pass	No			Label Required
93	B93	**SW TOC Hut**	Mobile Pallet	Hydrostatic		18.01.2016	17.01.2019	Pass	No			Label Required
94	B94	**Spare in Drumstore**	Mobile Spare -Blue	Hydrostatic		18.01.2016	17.01.2019	Pass	No			Label Required

Sump Testing Period

SUMP MATRIX 2016

Sump Ref	Sump Location	Previous Test	Hydrostatic/Structural	Current Test	Due Date	Current Status Pass/Fail/Not Complete	Location & Label Verified (Yes/No)	Sump Capacity (m3)	Actions
S1	QC Laboratory East	2010	Hydrostatic	2013	2016	Pass	Yes	2.9	No Action Required
S2	Process-Process Building-West	2011	Structural	2015	2018	Pass	Yes	13.5	Repairs carried out by CPRS during september shutdown in 2015
S3	ASI North	2011	Structural	2015	2018	Pass	Yes	5	Visual inspection carried out in shutdown 2015. sump vacuumed dry and no ingress of water recorded over a 10 hour period
S4	Utility Building South	2009	Hydrostatic	2015	2018	Pass	Yes	18	Hydrostatically tested september 2015 shutdown no issuesd reported, refer to trend
S5	Tank Farm West	2011	Hydrostatic	2013	2016	Pass	Yes	5.2	Sump Lined in 2013
S6	Warehouse - Recycling Area-North	2009	Structural	2015	2018	Pass	Yes	1.7	Repairs required , reinspect following repairs
S7	Confluence Tank-WWTP-East	2008	Structural	2011	2016	Pass	Yes	10.2	Integrity test not required due to low risk classification of contents. Inspection only
S8	Oil / Water Interceptor - Utility Building - South.	2011	Hydrostatic	2015	2018	Fail	Yes	n/a	Further repair required
S9	Diverter Valve-Administration Building-South	2011	Structural	2013	2016	Pass	Yes	n/a	No Action Required
S10	Scrubber-Process Building-West	2010	Structural	2013	2016	Pass	Yes	5	Integrity test not required due to low risk classification of contents. Inspection only
S11	CE Charging-Process Building-West	2010	Hydrostatic	2013	2016	Pass	Yes	1.2	No Action Required
S12	Front Lawn Weir-Administration Building-South	2008	Structural	2015	2018	Pass	Yes	n/a	No follow on actions required
S13	Reactor Extension-TA-2082-ASI North	2011	Structural	2014	2017	Pass	Yes	4	Perform Repairs of the liner of the sump still to be done need water table to drop can preferom the hot air welding
S14	Oil / Water Interceptor - Front of Facility-Adjacent of Security Building-South	n/a	Structural	new	2016	Pass	Yes		No Action Required
S15	Eastern Drainage Ditch - HSW Tanks-East	n/a	Structural	new	2016	Pass	Yes		No Action Required
S16	South side of Process Development Laboratory	n/a	Structural	new	2017	NEW	No	4	No Action Required

USA Ltd
Underground Surveying & Analysis
Unit 33, Airton Terrace,
Airton Road, Tallaght,
Dublin 24.
Telephone; 01-4564991
Fax: 01-4564828

Summary Report

TO: Mallinckrodt Pharmaceuticals

JOB NO: USA7413

ATTENTION: Mercedes Kavanagh

FROM: Linda Murphy

DATE: 22nd January 2016

REF: Mallinckrodt Pharmaceuticals CCTV survey

Please find enclosed following our sewer condition inspection survey carried out at Mallinckrodt Pharmaceuticals

- CCTV report
- A USB contains the WinCan Viewer to view the CCTV footage

There was 1682.93m of drainage surveyed in total with foul drainage accounting for 521.88m and storm drainage 1161.04m.

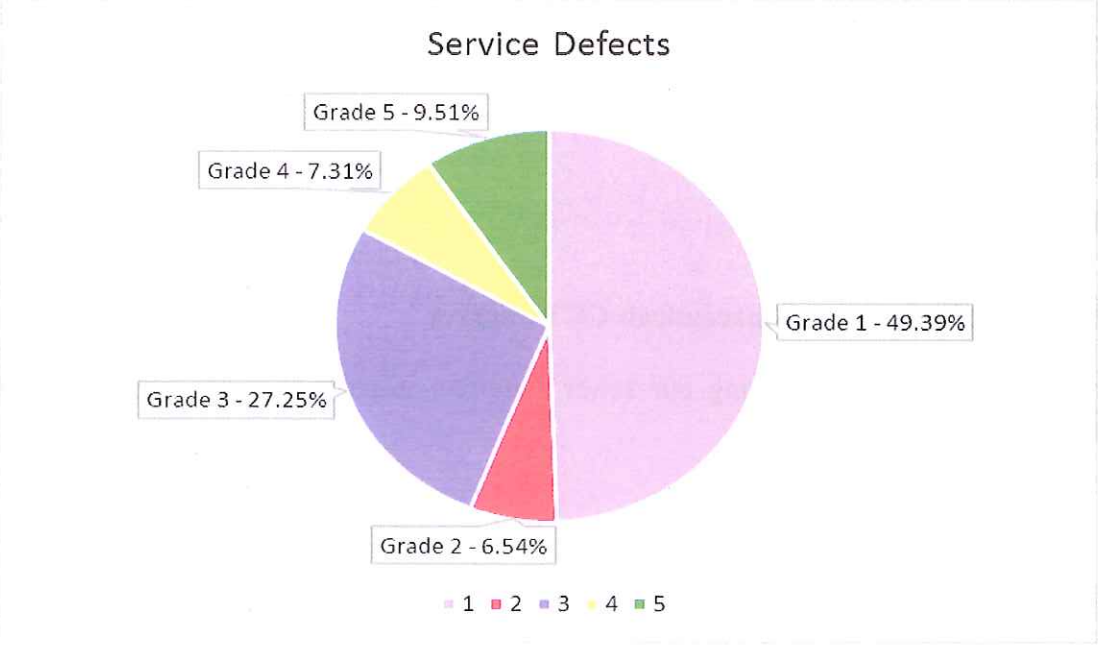
Please see below the breakdown of pipe diameters. 45% of the total drainage survey was 225mm.

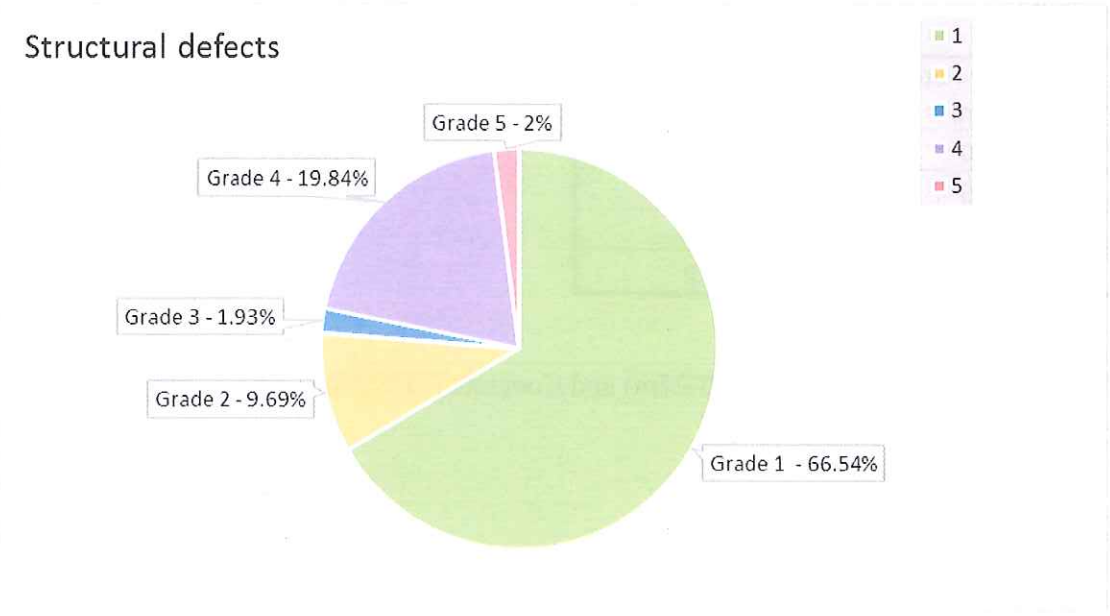
Pipe Diameter (mm)	Length Surveyed (m)
150	384.74
225	757.7
300	272.9
450	268.2

The pipe material was PVC (433.27m) and Concrete (1249.66m).

USA Ltd
Underground Surveying & Analysis
Unit 33, Airton Terrace,
Airton Road, Tallaght,
Dublin 24.
Telephone; 01-4564991
Fax: 01-4564828

Please find below the breakdown of the structural and service grades of the pipe length surveyed.





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Service grades are less serious in the most part and are indicative of a restriction to the flow in the pipe. The lines of most concern are any that have structural grades 3,4 and 5. See page 6 of the report for more details on the grade explanation.

Structural Grade Summery

Structural Grade 5 Summery:

Section Number	U/S Manhole Reference	D/S Manhole Reference	Defect	Comment
34	FW12	FW9C	Deformation	15% deformed, pipe material however is PVC. This is generally not a cause for concern. Although in future surveys this should be observed to ensure it does not deteriorate.

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Structural Grade 4 Summery:

Section Number	U/S Manhole Reference	D/S Manhole Reference	Defect	Comment
6	SW17	SW6	Broken Sewer	This line has previously been repaired with 3 partliners. This would be recommended for this defect also. Several connections to lines which are all in good condition.
7	SW15	SW15A	Broken Sewer	Repair is recommended for the broken sewer @23.54m and 23.87m. Also there are cracks and a fracture at .5m which requires a repair.
17	SW1a	SW1	Broken Sewer	Repair is recommended for the broken sewer @31.32m. The intruding connection @ 3.19m is intruding by 20mm on a 450mm pipe. There is a significant amount of silt in the pipe up to 15% in places.
18	SW1	Ex MH	Broken Sewer	Repair is recommended for the broken sewer @.50m. Also there is a crack at the same position. Debris up to 20% in places.
32	FW11	FW12	Broken Sewer	Repair is recommended for the broken sewer @23.93m.

Structural Grade 3 Summery:

Section Number	U/S Manhole Reference	D/S Manhole Reference	Defect	Comment
36	FW1a	FW1	Fracture	Repair of fracture is recommended. 5% grease visible from 24m to manhole FW1.

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Structural Grade 2 Summery:

Section Number	U/S Manhole Reference	D/S Manhole Reference	Defect	Comment
16	SW2	PI	Crack	Crack (longitudinal & circumferential) @ 10.30m, repair recommended.
19	SWHH	Outfall	Crack	Crack (longitudinal & circumferential) @ 2.77m repair recommended.
38	FW 9d	FW9b	Deformation	5 % deformation on uPVC pipe – no action required.
39	FW9b	FW9c	Deformation	5 % deformation on uPVC pipe – no action required. Noted that MH FW9c has a backdrop.
48	SW19	SW20	Deformation	5 % deformation on uPVC pipe – no action required.
56	S5	S4	Crack	Crack (longitudinal) @ 37.46m repair recommended. Infiltration noted @ 14.15m at a defective connection. Line has previously been repaired.

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Structural Grade 1 Summery:

The lines that have a structural grade 1 are in good condition. Many have been previously repaired - Sections 1,2,3, 4,5, 8, 10, 11, 12, 13, 21, 22, 23, 24,25 ,26, 27, 29, 31, 37, 41, 42, 43, 46, 53 and 54.

Other items to note in the Structural Grade 1's are

Section Number	Comment
9	SW5 has backdrop
15	Survey abandoned at 24.95m due to valve in pipe
14	Survey abandoned at 35.78m due to bend in pipe
20	Infiltration noted at .5m
24	High water levels noted for length of survey
26	High water levels noted for length of survey
27	High water levels noted for length of survey
28	High water levels noted for length of survey – Survey abandoned
33	High water levels noted for length of survey
45	Survey abandoned at 2.33m due to bend in pipe
46	High water levels noted for length of survey
50	SW14C has backdrop

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Service Grade Summery

As mentioned before service grade defects are for the most part less serious that structural grade defects. However there are a few items that should be highlighted. These are generally roots and obstructions. These may cause debris to get caught and restrict the flow. In particulate if they occur in foul lines action should be taken to rectify the situation. Cutting the roots/obstruction using a robotic cutter is the usual course of action taken

Please see below the sections where these present.

Section Number	Comment
17	Obstruction at .50m Rubber seal exposed.
25	Roots Mass, 25% cross sectional area
33	Obstruction at .50m Rubber seal exposed.
40	Obstruction at .50m liner foil exposed