Intel Ireland

Annual Environmental Report 2009

Environmental Department
Intel Ireland

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Abbreviations

BATNEEC	Best Available Technology Not Exceeding Excessive Cost
A	Annum
AAS	Atomic Absorption Spectroscopy
A01-A138	Air Emission Points Identified in the Intel IPCL Application
AER	Annual Environmental Report
AFF	An Foras Forbartha
AHU	Air Handling Unit
AIER	Annual Installation Emission Report (for Greenhouse Gas Emissions)
AQS	Air Quality Standard
Ar	Argon
As	Arsenic
ASI	Area of Scientific Interest
ASW	Ammonium Sulphate Waste
AWN	Acid Waste Neutralisation
BCW	Back-up Loop Chilled Water
BAT	Best Available Technology
BOD	Biochemical Oxygen Demand
BS	British Standards
BCDS	Bulk Chemical Delivery System
BCW	Back-up Cooling Water
CO	Carbon Monoxide
CDO	Catalytic Destruction Oxidiser
CHP	Combined Heat and Power
CMP	Chemical Mechanical Polish

COD	Chemical Oxygen Demand
CCA	Chromated Copper Arsenic
CAP	Community Advisor Panel
CCW	Concentrated Copper Waste
CLW	Concentrated Lead Waste
CMW	Concentrated Metal Waste
C4	Controlled Collapse Chip Connect; (Wafer Finishing Process)
CN	Cyanide
CDS	Cyanide Destruct System
COMAH	Control of major Accidents Hazards
Cond	Conductivity
CPU	Central Processing Unit
Cr	Chromium
CRB	Change Review Board
CRC	Chemical Resistant Coating
CRT	Construction Response Team
CS	Corporate Services
CS Ops	Corporate Services Operations (Site Management Team)
CSS	Contained Storm Sewer
CSW	Corrosive Solvent Waste
Cu	Copper
CUB	Central Utilities Building
CV	Calorific Value
CVD	Chemical Vapour Deposition
d	Day
dB(A)	A-weighted decibels

dB,L_{aeq}	A-weighted equivalent continuous level
DC	Dublin Corporation
DCW	Dilute Copper Waste
DfE	Design for the Environment
DfEHS	Design For Environmental Health & Safety
DGSA	Dangerous Goods Safety Advisor
DLW	Dilute Lead Waste
DMS	Document Management System
DO	Dissolved Oxygen
DoELG	Department of Environment & Local Government
DRO	Diesel Range Organics
EAL	Environmental Assessment Level
EBT	Effluent Balance Tank
EDI	Electro-Deionisation
EEC	European Economic Community
EECA	European Electronic Components Association
EEJ	Tool Set used in C4 area
EEJA	Tool Set used in C4 area
EEP	Ethyl-3-ethoxy proprionate
EEP	Ethyl-3-ethoxy proprionate
EFCA	European Electronics Components
EFYI	Environmental For Your Information
EG	Emergency Generator
EHS	Environmental, Health & Safety
EHSBI	Environmental, Health & Safety Bulletin Incident
EIA	Environmental Impact Assessment

EIS	Environmental Impact Statement
ELV	Emission Limit Value
EMART	Environmental Health and Safety (EHS) Management Action Required (AR) Tracking System
EMEA	Europe, Middle East & Africa, Regional Grouping Of Intel Facilities
EMEAR	Europe, Middle East & Africa Region
EMI	Environmental Management Incident
EMP	Environmental Management Plan
EMR	Environmental Management Representative
EMS	Environmental Management System
EMT	Environmental Management Team
ENV Ops	Environmental Operations Review (Site Management Team)
EPA	Environmental Protection Agency
EPER	European Pollution Emission Register
EPI	Energy Performance Index
EPP	Emergency Preparedness Plan
EPS	External Product Specification
EQO	Environmental Quality Objective
EQS	Environmental Quality Standard
ERFB	Eastern Regional Fisheries Board
ERT	Emergency Response Team
ERU	Environmental Research Unit
ESA	Environmental Self Assessment
ESB	Electricity Supply Board
ESIA	European Semi-Conductor Industry Association
ESSM	European Systems Support Manufacture

ETU	Emissions Trading Unit
EU	European Union
F	Fluoride
f-gas Regulations	Fluorinated Gas Regulations
F10/F14/F24	Fab 10/Fab 14/Fab 24
FAB	Intel name for a semi-conductor fabrication (manufacture) facility.
FAT	Functional Acceptance Team
FID	Flame Ionisation Detector
FMS	Facilities Maintenance System
FTIR	Fourier Transform Infra Red
FWR	Facilities Work Request
GC	Gas Chromatography
GHG	Green House Gas
GPS	Global Positioning System
GSW	General Solvent Waste
GWGs	Global Warming Gases
GWh	Giga Watt hours
GWP	Global Warming Potential
H2SO4	Sulphuric Acid
ha	Hectare
HAPs	Hazardous Air Pollutants
HCL	Hydrochloric Acid
HDP	High Density Plasma
He	Helium
HEPA	High efficiency particulate arrestment
HF	Hydrofluoric acid

HFW	Hydrofluoric Waste
HMDS	Hexamethyldisilazane
$HN0_3$	Nitric acid
HPM	Hazardous Process Material
HSA	Health and Safety Authority
HVAC	House Vacuum
HVM	High Volume Manufacturing
I	Impulsive
IAT	Ireland Assembly Test
IBC	Intermediate Bulk Container
IBEC	Irish Business Employers Confederation
IC	Integrated circuit
ICP	Inductively Coupled Plasma
ICT Ireland	Information and Communication Technology Ireland
ID	Internal diameter
IEMA	Institute of Environmental Management & Assessment
IEN	Improvement Engineering
IES	Irish Environmental Services
IFO	Ireland Fab Operations
IGEE	Index of Gross Eco Efficiency
INEE	Index of Net Eco Efficiency
IPA	Isopropyl alcohol
IPCL	Integrated Pollution Control Licence
IIPCL	Integrated Pollution Prevention and Control Licence
IR1-IR6	Intel Ireland Office Building Nomenclature
IRCS	Ireland Corporate Services

ISO	International Standards Organisation
ISO 14001	Accredited Environmental Management System
IWM	Industrial Water Management
IWW	Industrial Waste Water
IX	Ion Exchange
JIA	Japanese Semi-Conductor Industry Association
KCC	Kildare County Council
Kg	Kilogram
KIA	Korean Semi-Conductor Industry Association
km	Kilometre
KOH	Potassium hydroxide
Kreha Unit	Brand Name for a VOC Abatement Treatment Unit
kV	KiloVolt
kW	KiloWatt
kWh/WS	Kilowatt Hours per Wafer Start
l	Litre
lb	Pound
LOD	Limit of Detection
LPG	Liquid Petroleum Gas
LRW	Lead Reclaim Waste
LSS	Life Safety Support
Ltd	Limited
m	Metre
m^2	Square metre
m^3	Cubic metre
MAC	Maximum Admissible Concentration

MAH	Make-up Air Handlers
MAPP	Major Accident Prevention Policy
Maximo	A task mamagement system that controls maintenace programmes within CS and EHS
MFG	Manufacturing
mg	Milligram
micron	Micron, unit of measurement equal to 10^{-6} meter.
min	Minute
mm	Millimetre
MMTCE	Million Metric Tones Carbon Equivalent
MOA	Memorandum Of Agreement
MS	Mass Spectrometry
MSDS	Material Safety Data Sheet
MVA	MegaVoltAmp
MW	Monitoring Well
N/A	Not Applicable
N/E	Not Emitted
N_2	Nitrogen
Na	Sodium
nm	Nanometer, Unit of measurement equal to 10^{-9} meter
NaOH	Sodium hydroxide
NAP	National Allocation Plan (relating to Greenhouse Gas Emission permits)
NC	Non Compactable
NCP	Noise Control Programme
NH_4OH	Ammonium hydroxide
Ni	Nickel

NIOSH	National institute Of Occupational Safety and Health (USA)
Nm^3	Normal cubic metre
NMP	N-methyl-2-pyrolidone
NO_2	Nitrogen dioxide
NOx	Nitrogen Oxides
O_2	Oxygen
OEM	Original Equipment Manufacturer
Ops	Operations
OPW	Office of Public Works
OSHA	Occupational Safety and Health Administration
P	Phosphorus
P804-P1262	Process 804 - Process 1262; Intel Corp. Production Technology Nomenclature
pa	Per annum
PAS	Percentage Against Schedule
PAW	Phosphoric Acid Waste
Pb	Lead
PER	Pollution Emission Register
PERL	Pollution Emission Register List
PFC	Per Fluorocarbons or Per fluoro-compounds
PFD	Process Flow Diagram
PGMEA	Propylene Glycol Mono Methyl Ether Acetate
PLC	Programmable Logic Controller
POC	Point Of Connection
POCP	Photochemical Ozone Creating Potential
POR	Plan Of Record

POTW	Public Office of Treatment Works
POU	Point Of Use
ppb	Parts per billion
PPE	Personal Protective Equipment
ppm	Parts per million
PRO	Petrol Range Organics
PSB	Process Support Building
PSSS	Process Specific Support Systems; process where gas & chemical support systems are provided for process equipment.
PTD	Portland Technology Development
R	Risk Phrase
RCTO	Rotary Concentrator Thermal oxidiser
RIW	Reuse Industrial Water
RMP	Residual Management Plan
RO	Reverse Osmosis
RODI	Reverse Osmosis De-Ionized
ROI	Return On Investment
s	Second
S.I.	Statutory Instrument
SAC	Special Area Of Conservation
SCW	Slurry Copper Waste
SDS	Sub Atmospheric Distribution System
SECC	Single Edge Contact Cartridge
SIA	Semi- Conductors Association of America
SIT	System Improvement team
SL1/SL2	Safety Level 1/Safety Level 2

Sn	Tin
SO_4	Sulphate
SOP	Standard Operating Procedures
SORT	Electrical Testing Facility
SS	Storm Sewer
SSP	Supplier Service Program
SVOC	Semi-Volatile Organic Carbon
SW	Surface Water Discharge
t	Tonne
T	Tonal
TA	Total Acids
TAL I	TA Luft Inorganics
TAL O	TA Luft Organics
TBC	To Be Confirmed
TBD	To Be Determined
TCDD	Tetrachlorodibenzo Dioxin
TD	Technology Development
TDS	Total dissolved solids
TEDS	Training and Employee Development System
TFS	Trans Frontier Shipment Document
TLV	Threshold limit value
TOC	Total organic carbon
TPH	Total Petroleum Hydrocarbons
TSS	Total Suspended Solids
TTP	Technician Training Package
UCD	University College Dublin

UCG	University College Galway
UKMEAC	United Kingdom Microelectronic Environmental Advisory Committee
ULSD	Ultra Low Sulphur Diesel
UN	United Nations
UPW	Ultra Pure Water
URRO	Ultra Pure Water Recycle with Reverse Osmosis
URW	Ultra Pure Reclaim Water
USEPA	United States Environmental Protection Agency
UV	Ultra Violet
VDF	Vertical Diffusion Furnace
VOC	Volatile Organic Compounds
VSD	Variable Speed Drive
WBT	Web Based Training
WDRI	Winter Demand Reduction Initiative
WHO	World Health Organisation
wk	Week
Workstream	A task management system that controls manufacturing activities in Fab
WP	White Paper
WQMP	Water Quality Management Plan
WSC	World Semiconductor Council
WW	Work Week
WWTP	Waste Water Treatment Plant
YTD	Year To Date

1.0 INTRODUCTION

1.1 SITE DETAILS

Licence Register No:	P0207-03
Licensee Name:	Intel Ireland
Address:	Collinstown Industrial Park, Leixlip, Co. Kildare

1.2 DESCRIPTION OF CAMPUS ACTIVITIES

1.2.1 Intel Ireland – Campus Overview

The Intel Ireland campus is located at Collinstown Industrial Park, Leixlip, County Kildare. It is Intel's fourth largest manufacturing site overall, and the largest outside of the United States.

Intel Ireland first decided to locate a technology campus in Ireland in 1989, and production of motherboards and systems commenced in the following year. Since then over €6.0 billion has been invested in turning the 360 acre former stud farm into the most technologically advanced industrial location in Europe.

This knowledge and capital intensive Leixlip facility employs approximately 4,000 people both directly and indirectly. There are approximately 250 people employed at the Intel Shannon campus located in Co. Clare, which is the Ireland product development arm of our Communications Product Group. It is dedicated to the design and development of advanced broadband technologies for network access devices. Over 75% of our employees have higher level qualifications in the fields of Science, Engineering or Technology.

There are currently two semi-conductor wafer fabrication facilities at the Leixlip campus; Fab 10 and Fab 14, which have merged to form Ireland Fab Operations (IFO), and Fab 24 which is a combination of Fab 24 and Fab 24-2.

IFO is critical to the Intel Fab network and has the highest product mix and most complex operation of Intel worldwide. In 2009, IFO was equipped to run over 65 individual products, three times that of any other Intel 200mm facility worldwide. IFO produced both flash memory and logic devices. The Fab 24 facility combines Fab 24 and Fab 24-2. Fab 24 processes 300mm wafers on both 90 and 65-nanometer process technologies. Fab 24 is one of Intel's most technologically advanced, high-volume manufacturing plants in the world building multi-core microprocessors.

The campus is also home to other Intel Ireland businesses including the Intel® Innovation Centre (IIC). The IIC has global responsibility to research and develop innovative leading-edge IT solutions and technology. It involved a total investment by Intel Ireland of over €12 million. The IIC is at the forefront of demonstrating how Information Technology and Intel products can continue to deliver new competitive advantage through the development of compelling new IT value propositions. The centre, in partnership with NUI Maynooth, has set up the Innovation Value Institute, a multi-disciplinary research and education Institute, which was designed to help achieve sustainable economic value from IT and quantify and understand the true business value of strategic IT investments.

The Technology Research for Independent Living (TRIL) centre is located at the Leixlip campus and is part of our Digital Health initiative. TRIL brings together world-class industry and academic experts who are inventing and testing new technologies with older people and their families to support them in continuing to live healthy and independent lives.

Many other Intel Ireland employees are involved in Research and Development. Intel Ireland funds over 50 PhD's and works closely with the CRANN Nanoscience Research Centre in Trinity College Dublin and the Tyndall National Research Institute in Cork.

Intel Ireland strives to be a trusted, leading corporate citizen. Intel Ireland aims to integrate social responsibility and uncompromising integrity into everything we do, working to advance people and better the planet through active commitment to education, community and environmental sustainability.

Intel Ireland endeavours at all times to be an asset to our communities. This is exemplified through initiatives such as Intel Involved and Community Solutions.

1.2.2 Manufacturing Facilities Overview

Intel Ireland consists of two manufacturing facilities on the site; IFO and Fab 24. Ireland Fab Operations (IFO) consists of two factories, known as Fabrication Plants (or more commonly as "Fabs") which were previously known as Fab 10 and Fab 14.

Both Fabs were amalgamated and operated as one manufacturing organisation. Fab 14 ceased production in late 2009.

IFO manufactured high speed Pentium® 4 support chips using advanced manufacturing technology. There were three processes operating within IFO: 0.13 micron technology used in the production of Flash memory; 0.18 micron technology used in the production of microprocessors; and 0.25 micron technology used in the production of chipsets that optimise a PC's overall performance in handling graphics, 3-D images, video and audio. In lay person's terms, 0.13 micron technology creates millions of transistors on an Integrated Circuit (chip) the size of a finger-nail.

Fab 24 first began producing the industry's most advanced 300mm/12" wafer technology in 2004. The Fab 24 building is 52,000 square metres in size, which includes a 15,000 square metre 'Class 1' clean-room for the manufacture of chips. Moving to 300mm wafers allows over twice the number of chips to be created on each wafer compared with 200mm wafers, leading to a 30 per cent improvement in productivity and costs. The sophistication of the process equipment and the level of automation involved places Fab 24 at the very forefront of semiconductor manufacturing which is widely recognised as the summit of manufacturing technology.

Fab 24 manufactures the latest Intel microprocessors, single and multi-core, that are available from Intel. There are two manufacturing processes, 90nm (nanometre) which is in production since 2004 and 65nm which started in 2006. Fab 24 is a fully automated plant where all material handling is fully automated and computer controlled.

Fab 24-2 is a newer facility, completed at the end of 2005. It is connected to Fab 24 and adds an additional 5,000 square metres of manufacturing 'Class 1' clean-room space, plus the necessary manufacturing equipment to enable the latest 65nm technology. Production commenced in Fab 24-2 in the first quarter of 2006.

1.2.3 Process Steps Overview

Fabrication Plants which produce the silicon-based devices use complex processes involving billions of dollars of equipment and 300-500 operational steps all housed in an ultra-clean environment. The material does not move through the factory in a linear fashion from front to back, but loops back on itself, revisiting some areas sometimes more than twenty times.

The Fab buildings each contain major areas in which wafers are processed. These areas are referred to as "Functional Areas" and include Diffusion, Lithography, Etch, Thin Films and Planarisation. The general principles of manufacturing microprocessors are that the wafer is passed between the different areas to build up a complex 3-dimensional device on the surface of the wafer. External contacts for the microprocessors are made by what is known as the "Controlled Collapse Chip Connect" process, also known as the “C4" process for short.

The manufacturing activities carried out on site fit into a number of categories. These are:-

Diffusion: Where layers are introduced or ‘grown’ on a semiconductor wafer under high temperature conditions. Implanted chemicals are then introduced to selectively change the electrical properties of sections of the wafer.

Lithography: creation of patterns for the electrical circuits on the wafer surface in a process similar to photography using ultraviolet light passing through apertures in a mask to selectively expose areas of the wafer.

Etch: translates the pattern created by lithography into a three-dimensional structure by selectively etching channels into the surface substrates.

Thin Films: a film of material is introduced to either create conductive interconnects between layers, electrical isolation or protection from the environment.

Planarisation: the surface of the wafer is polished by the use of mechanical and mild chemical abrasives to achieve a uniform flat layer.

Ion Implantation: used to introduce impurities or ‘dope’ the silicon with materials such as phosphorous, boron or arsenic. Implantation changes the electrical characteristics of specific areas of the wafer.

The wafer will pass through each of these functional areas many times before the full three-dimensional structure of each integrated circuit has been built up. Each wafer may contain several hundred integrated circuit, with each die forming the basis of a ‘silicon chip’.

C4 Process: To allow each integrated circuit to be connected to a printed circuit board for installation into computers, connections must be created to connect the circuit to other electrical components on the board. For some product types, these connections are produced in the "C4" process. During this step, lead and tin solder (or copper in the case of the more advanced technology) connects are introduced onto the circuit by an electrolytic process. C4 operations in IFO ceased production over the course of 2009.

Sort: Each chip is then electrically tested in a quality assurance step known as SORT and then distributed to other Intel plants outside Ireland for final packaging.

1.2.4 Environmental Abatement

Each fabrication building essentially carries out a similar manufacturing process with progressive refinements for improved technology as smaller dimension technology is introduced. Some variations do, however, occur in the treatment of waste generated from certain processes. The major environmentally significant differences in technology employed in Fab 24 from that in IFO include the following:-

Copper: The introduction of copper metal layers into the planarisation, thin films and C4 processes and the treatment of copper wastes arising.

VOC Abatement: Rotary concentrator / thermal oxidiser (RCTO) units have been included in Fab 24 (and also retrofitted into Fab 10) to treat the concentrated solvent exhausts from wafer manufacturing operations resulting in 95 per cent reduction of Volatile Organic Compounds (VOC's) which would otherwise have been emitted from Fab 10/Fab 24.

POU Scrubbers and Hydrofluoric/Phosphoric Acid Waste Treatment: Additional Point of Use (POU) scrubber systems were introduced to reduce emissions of Perfluorinated Compounds (PFC's) and provide enhanced fluoride removal from air emissions. Additional treatments of Hydrofluoric/Phosphoric Acid were also provided whereby fluoride/phosphate containing wastewaters (including the additional POU systems) are converted to a benign solid waste as per existing practice.

Ammonia Exhaust System: The introduction of an ammonia exhaust system has segregated ammonia emissions from the main acid gas scrubber systems and optimised the removal efficiency of both treatment systems. This has resulted in a reduction in overall emissions.

Ammonia Wastewater Treatment System: In order to reduce the amount of ammonia based compounds being discharged to the Leixlip Wastewater Treatment Plant (WWTP), an Ammonia Wastewater Treatment System has been installed at Fab 24. A proportion of ammonia based compounds are segregated at a number of tools and collected separately. This waste (consisting mainly of water, ammonium hydroxide and hydrogen peroxide) is then treated in a number of strippers where the ammonia is transferred from the liquid phase to the gas phase. This ammonia laden air is then fed to a number of scrubber units where the ammonia is reacted with sulphuric acid. Liquid ammonium sulphate is formed which is collected and stored on site until such time as it is sent off-site for recycle. The treated wastewater, which now has a much reduced concentration of ammonia, is then discharged to Leixlip WWTP. The only other discharge from the Treatment System is a vent which is classified as a minor emission point.

1.2.5 Support Activities

To support manufacturing operations, a number of on-site utilities including chemical storage and handling facilities, ultra pure water treatment plant, bulk gas plants, boilers and chillers along with wastewater treatment plants are required. These provide the raw materials, conditions and services necessary for the manufacturing process.

1.3 ENVIRONMENTAL POLICY

Intel Ireland operates a rigorous Environmental Management System (EMS), which is independently certified to the international environmental standard ISO 14001:2004. An EMS is a requirement of our Integrated Pollution Prevention and Control (IPPC) licence. Having a certified EMS creates additional confidence in the standard of our environmental controls.

The aspects of energy management are embedded in our Environmental Systems and Policy. Hence, the site's Energy Policy is incorporated into the overall Environmental Policy. The Ireland site was accredited to the Irish Energy Management Standard (IS 393:2005) in December 2007.

In line with ISO 14001 and IS 393 requirements, and to demonstrate the sites commitment to Environmental Management, Intel Ireland has developed an Environmental Policy. This policy is reviewed, updated and then signed by the site managers on an annual basis. A copy of the 2010 Environmental Policy is outlined below.

Intel Ireland Environmental Policy 2010

Intel Ireland Limited comprises of the semiconductor integrated circuit manufacturing facilities – Ireland Fab Operations (IFO) and Fab24.
Intel Ireland is committed to achieving a high standard of environmental performance. To fulfil this commitment, Intel will:

- Comply, as a minimum, with all applicable regulatory requirements.
- Maintain focus on our ISO14001 Environmental Management System (EMS) and our IS393 / EN 16001 Energy Management System and continually improve our environmental and energy performance by regular auditing of our systems and by working towards the Objectives and Targets set down in our Environmental Management Plan (EMP).
- Promote pollution prevention technology to conserve natural resources and minimise emission loads to air, land and water.
- Proactively engage in early research and development to incorporate energy efficiency, materials elimination, substitution, minimisation and to continue reducing our waste by maximising recycling on site.
- Ensure that the operational controls we have in place to manage our environmental and energy systems are safe, effective and robust and, by minimisation of energy use, reduce greenhouse gas emissions in line with our Corporate Goals.
- Develop environmental responsibility across all levels of our organisation through awareness and training programs, and encourage all our employees to act as advocates for Intel Ireland's commitment to the environment and energy efficiency.
- Require on-site contractors, sub-contractors and designers engaged with Intel to apply environmental and energy standards compatible with our own.
- Work with regulatory agencies, the local community and our employees to ensure that we identify and address emerging areas of environmental concern.
- Allow this policy to be readily available to customers and to members of the public.

Jim OHara	Eamonn Sinnott	Joe Foley	Philip Moynagh	Shane Maccarvill
General Manager Intel Irl IFO Plant Manager & Vice President TMG	F24 Plant Manager	IFO Factory Manager	F24 Factory Manager	Corporate Services Manager

Caring for our Environment

Environmental Department
Intel Ireland

Environmental Department
Intel Ireland

1.4 ENVIRONMENTAL MANAGEMENT ORGANISATIONAL STRUCTURE

This section details the roles, responsibilities and interrelations of key staff responsible for environmental activities. The Environmental management structure is represented below.

Intel Ireland General Manager

The Intel Ireland General Manger has overall responsibility for Environmental Management on the site. He/She is responsible for the assessment of the site's Environmental performance against its stated targets and objectives. The General Manager also sets direction during the annual review and facilitates the achievement of these targets and objectives by attending Environmental Operations (Environmental Ops) meeting which occur on a formal basis at least once per year.

IFO/Fab 24 Plant Managers

The IFO/Fab 24 Plant Managers have overall responsibility for Environmental Management in their specific plant. He/She participates in the assessment of the site and, in particular, their plant's Environmental performance against its stated targets and objectives. The Plant Manager sets direction and ensures that the targets and objectives are met.

Ireland Corporate Services (IRCS) Manager

The IRCS Manager reports to the CS FSM TD Worldwide Manager and has overall responsibility for Environmental Management in the IRCS area. He/She participates in the assessment of the site and, in particular, Corporate Services' (CS) Environmental Performance against its stated goals and objectives. The CS Manager sets direction during the annual review and ensures that the CS targets and objectives are met.

Environmental Health and Safety (EHS) Manager

The Intel Ireland EHS Manager reports to the IRCS Manager and is responsible for the day-to-day management of the Environmental Health and Safety Department within the site. He/She have responsibility to ensure that stated Environmental targets and objectives are met. He/She sets direction on Environmental matters and gives direction. The EHS manager advises the CS Manager of requirements to ensure sufficient resources are in place to run the EMS.

Operationally, the EHS Manager has overall responsibility for Environmental Management across the site and for achieving stated Environmental targets and objectives. Together with the IRCS Manager and business unit operations managers, the EHS Manager sets direction on environmental matters and ensures that Intel Ireland remain in compliance with relevant licences. The EHS Manager ensures that the IRCS Manager is informed of resources needed to run the EMS. The EHS Manager is responsible for the operational running of Environmental Operations (Environmental Ops) meetings. He / She is responsible for the EHSBI (Environment, Health & Safety Bulletin System) incident management system.

The EHS Manager has a team of approximately six individuals who drive the Intel Ireland environmental programme on a planned basis.

Emergency Response Team (ERT)

The Site Emergency Response Team is responsible for the facility during an emergency. An ERT leader, who directs operations during an emergency, leads the team. ERT have specialised training to deal with a range of potential incidents.

Environmental Department

The Environmental Department currently comprises of six engineering or environmental science graduates whose work is subdivided to deal with many aspects of environmental programme management including:

- Integrated Pollution Prevention and Control Licence (IPPC)
- Greenhouse Gas (GHG) Emissions Permit
- Environmental Management System (EMS)
- Environmental excellence programme
- Community and internal environmental awareness

Essentially, the objective is that the operation of the activity complies with all applicable environmental regulations and policies, and that the site's environmental management system is managed in a sustainable fashion for social, environmental and economic purposes.

2.0 SUMMARY INFORMATION

2.1 SELF-MONITORING DATA

2.1.1 Emissions to Waters/Sewer

Wastewater parameters are monitored as per requirements under Schedule C.3.2 of Intel Ireland's IPPC licence on the basis of daily flow-proportional composite sampling. Flow, pH and temperature are measured on a continuous basis before being discharged from the site.

Licensed effluent mass emissions to the Kildare County Council Wastewater Treatment Plant (WWTP) in Leixlip for 2009 were compared with 2008 licensed emissions data (Table 2.1).

Table 2.1 – Summary of Licensed Effluent Emissions to Sewer for 2009 compared with 2008.

Parameter	Volumetric Emissions (m^3) 2008	Volumetric Emissions (m^3) 2009	Licensed Volumetric Emissions (m^3)
Flow (m^3)	3,775,569	4,230,095	6,022,500

Parameter	*Mass Emissions (Kg) 2008	*Mass Emissions (Kg) 2009	Licensed Mass Emissions (Kg)
BOD	***113,497***	***92,409***	492,750
COD	***190,625***	85,349	985,500
Suspended Solids	***104,546***	***42,700***	985,500
Total Dissolved Solids	3,629,459	***2,859,953***	22,108,050
Total Phosphorus (as P)	4,668	4,249	24,638
Total Nitrogen	68,224	70,981	197,100
Fluoride	15,161	16,900	58,400

Cyanide	***0.431***	**-**	493
Tin	***8.98***	***17.0***	1,971
Lead	***6.77***	***3.14***	584
Chromium	***2.27***	***6.33***	493
Nickel	***10.76***	***13.6***	986
Copper	***178***	***177***	1,478
Arsenic	***1.49***	***1.75***	493
Total Heavy Metals Note 1	***236***	***219***	4,928
Cobalt	***5.54***	***1.57***	N/A
Sulphates	1,582,459	1,520,000	N/A
Ammonia	45,080	52,300	N/A
Nitrates	14,508	8,340	N/A

* For the purposes of the 2009 Annual Environmental Report and Pollutants Release and Transfer Register (PRTR), Intel Ireland has calculated the annual average wastewater mass emissions of the incoming 'City Water' and subtracted this from the annual Intel Ireland wastewater mass emissions. A submission to the Agency regarding the modification to the mass calculation method was submitted on the 15th of March 2005.

Items in Bold and Italic format indicate "Less Then" Value

Note 1: Total Heavy Metals is the sum of Arsenic, Tin, Lead, Chromium, Nickel and Copper

Where the concentrations of parameters measured during 2009 were reported as below the limit of detection, the parameter has been assumed to be equal to the detection limit to enable average concentrations and annual emission rates to be calculated. The reported concentrations and emission rates are thus reported as 'less than' the calculated values.

A detailed summary of all wastewater emissions to Leixlip WWTP is included in the PRTR found in Appendix A.

2.2.2 Emissions to Atmosphere

This section identifies the annual emissions to atmosphere from licensed emission points identified in Intel's IPPC Licence. Emissions are derived from five main sources including:

- boiler and generator emission sources (NO_x and CO);
- acid scrubber exhausts (acid gases);

- specialty exhausts (arsenic and total dusts);
- solvent exhausts (volatile organic compounds, VOC);
- RCTO / KREHA Emissions (volatile organic compounds, VOC, NO_x and CO).

Table 2.2 Total Annual Emissions to Atmosphere for 2009 (Fab 10, Fab 14 & Fab 24)

Parameter	**Annual Emission Kg 2009**
NOx (as NO_2)	17,514
CO	8,072
Total Acids (as HCl)	950
Gaseous HF	182
Total Fluorides	384
Class I, II & III VOC's From Stack Monitoring	4,582
Class I, II & III inorganic dusts	9
Total Dusts	61

Many of the monitored components have been identified to be below the limit of sampling and analytical detection. Where the concentrations of parameters measured during 2009 were reported as below the limit of detection, the parameter has been assumed to be equal to the detection limit to enable average concentrations and annual emission rates to be calculated. The average emission concentrations are detailed for each emission point in the following tables. A detailed summary of the air emissions from Intel Ireland is included in the PRTR found in Appendix A.

Nitrogen Oxides (NO_x) and Carbon Monoxide (CO) Emissions

Fab 10 Boilers: A01, A03, A04, A05, A06

Monitoring Frequency: Annually

Parameter	Average Emission Concentration (mg/Nm3)	IPPCL ELV (mg/Nm3)	Percentage Compliance
NOx (as NO2)	108	180	100%
CO	2	100	100%

Fab 14 Boilers: A101, A102, A103, A104

Monitoring Frequency: Annually

Parameter	Average Emission Concentration (mg/Nm3)	IPPCL ELV (mg/Nm3)	Percentage Compliance
NOx (as NO2)	92	170	100%
CO	1.7	100	100%

Fab 24 Boilers: A201, A202, A203, A204, A205, A248, A253

Monitoring Frequency: Annually

Parameter	Average Emission Concentration (mg/Nm3)	IPPCL ELV (mg/Nm3)	Percentage Compliance
NOx (as NO2)	120.5	150	100%
CO	1.4	100	100%

Acid Gas Emissions

Fab 10 Scrubbers: A07, A08, A10, A14, A15, A16, A20, A22, A23

Monitoring Frequency: Quarterly

Parameter	Average Emission Concentration	IPPCL ELV	Annual Mass Emission (Kg)	Percentage Compliance
Total Fluoride	1.79 g/hr	27.5 g/hr	142	100%
Hydrofluoric Acid (as HF) (Gaseous)	0.034 mg/m3	0.27 mg/m3	57	100%
Total Acids (as HCl)	0.041 mg/m3	4 mg/m3	105	100%

Fab 14 Scrubbers: A105, A106, A107, A108, A109, A110, A111

Monitoring Frequency: Quarterly

Parameter	Average Emission Concentration	IPPCL ELV	Annual Mass Emission (Kg)	Percentage Compliance
Total Fluoride	0.49 g/hr	30.3 g/hr	43	100%
Hydrofluoric Acid (as HF) (Gaseous)	0.037 mg/m3	0.27 mg/m3	36	100%
Total Acids (as HCl)	0.104 mg/m3	4 mg/m3	523	100%

<u>Fab 24 Scrubbers</u>: A206, A207, A208, A209, A210, A211, A212, A213

Monitoring Frequency: Quarterly

Parameter	Average Emission Concentration	IPPCL ELV	Annual Mass Emission (Kg)	Percentage Compliance
Total Fluoride	2.76 g/hr	19.3 g/hr	194	100%
Hydrofluoric Acid (as HF) (Gaseous)	0.037 mg/m3	0.27 mg/m3	71	100%
Total Acids (as HCl)	0.334 mg/m3	4 mg/m3	345	100%

<u>Fab 24-2 Scrubbers</u>: A249, A250, A251

Monitoring Frequency: Quarterly

Parameter	Average Emission Concentration	IPPCL ELV	Annual Mass Emission (Kg)	Percentage Compliance
Total Fluoride	0.62 g/hr	26 g/hr	5	100%
Hydrofluoric Acid (as HF) (Gaseous)	0.018 mg/m3	0.27 mg/m3	18	100%
Total Acids (as HCl)	0.085 mg/m3	4 mg/m3	82	100%

TA Luft Classified Inorganic Dusts and Total Dusts Emissions

Fab 10 Speciality Exhaust:

Monitoring Frequency: Quarterly

Parameter	Average Emission Concentration (mg/Nm3)	IPPCL ELV	Annual Mass Emission (Kg)	Percentage Compliance
TALI Dusts Class 1	0.009	0.2 mg/Nm3	0.04	100%
TALI Dusts Class 2	0.009	0.2 mg/Nm3	0.04	100%
TALI Dusts Class 3	0.020	0.2 mg/Nm3	0.1	100%
Total Dusts	0.200	20 mg/Nm3	1.0	100%

Fab 14 Speciality Exhaust:

Monitoring Frequency: Quarterly

Parameter	Average Emission Concentration (mg/Nm3)	IPPCL ELV	Annual Mass Emission (Kg)	Percentage Compliance
TALI Dusts Class 1	0.007	0.2 mg/Nm3	0.6	100%
TALI Dusts Class 2	0.007	0.2 mg/Nm3	0.6	100%
TALI Dusts Class 3	0.020	0.2 mg/Nm3	1.7	100%
Total Dusts	0.317	20 mg/Nm3	37.5	100%

Fab 24 Speciality Exhaust:

Monitoring Frequency: Quarterly

Parameter	Average Emission Concentration (mg/Nm3)	IPPCL ELV	Annual Mass Emission (Kg)	Percentage Compliance
TALI Dusts Class 1	0.010	0.05 mg/Nm3	1.2	100%
TALI Dusts Class 2	0.020	0.2 mg/Nm3	2.3	100%
TALI Dusts Class 3	0.020	0.2 mg/Nm3	2.3	100%
Total Dusts	0.200	20 mg/Nm3	23.4	100%

Emissions of Class I, II and III Organic Compounds

Fab 10 RCTO: A56, A57

Monitoring Frequency: Quarterly

Parameter	Average Emission Concentration (mg/Nm3)	IPPCL ELV	Annual Mass Emission (Kg)	Percentage Compliance
TALO 1	0.58	5 mg/Nm3	45.62	100%
TALO 2	0.36	20 mg/Nm3	30.72	100%
TALO 3	4.17	50 mg/Nm3	76.30	100%
TOC	6.17	50 mg/Nm3	68.35	100%

Fab 14 Kreha: A112

Monitoring Frequency: Quarterly

Parameter	Average Emission Concentration (mg/Nm3)	IPPCL ELV	Annual Mass Emission (Kg)	Percentage Compliance
TALO 1	0.30	20 mg/Nm3	77.17	100%
TALO 2	0.30	100 mg/Nm3	70.66	100%
TALO 3	3.72	150 mg/Nm3	3230.25	100%
TOC	3.38	75 mg/Nm3	3265.26	100%

Fab 24 RCTO: A214, A215, A216, A217

Monitoring Frequency: Quarterly

Parameter	Average Emission Concentration (mg/Nm3)	IPPCL ELV	Annual Mass Emission (Kg)	Percentage Compliance
TALO 1	0.68	5 mg/Nm3	208.17	100%
TALO 2	0.47	20 mg/Nm3	144.10	100%
TALO 3	2.27	50 mg/Nm3	698.80	100%
TOC	4.51	50 mg/Nm3	2421.22	100%

Emissions of Ammonia

Parameter	Average Emission Concentration (mg/Nm3)	IPPCL ELV	Annual Mass Emission (Kg)	Percentage Compliance
Ammonia	1.37	30 mg/Nm3	376.5	100%

2.1.3 Summary of Waste Data

A summary of the waste data is outlined in Tables 2.3 to 2.5.

Table 2.3 – Summary of Total Waste for 2009 (Tonnes)

Total Waste	8255.28
Total Waste Disposed of	1496.63
Total Waste Recovered	6758.65

Table 2.4 – Summary of Hazardous Waste for 2009 (Tonnes)

Waste Description	***2006***	***2007***	***2008***	***2009***
Corrosive Lead	5.01	3.75	*Note 1	*Note 1
Corrosive Arsenic	12.69	14.97	*Note 1	*Note 1
Flammable Arsenic	22.68	10.07	*Note 2	*Note 2
Flammable Debris	96.31	70.41	86.57	73.41
Corrosive Debris	176.07	167.02	150.30	289.43
General Solvent	1575.09	1814.26	1728.84	1380.83
Lead Reclaim Waste	1.16	9.91	0.00	14.14
Reclaim Metal Waste	151.81	53.26	18.78	16.42
Lead/Metal Waste-	1646.52	774.21	689.24	648.66

Waste Description	***2006***	***2007***	***2008***	***2009***
concentrated				
Copper Waste-concentrated	1328.87	64.95	71.80	72.06
Phosphoric Acid Waste	345.19	479.42	599.38	510.84
Ammonium Sulphate Waste	289.07	627.74	711.30	700.30
Slurry Copper Waste	52.94	0.00	0.00	0.00
Fluorescent Lamps	3.82	1.96	2.77	2.40
Batteries	4.66	10.08	58.03	44.19
Clinical Waste	0.21	0.19	0.16	0.14
Waste Refrigerants	0.00	0.00	0.00	0.13
Used Oil	0.00	2.50	4.75	3.00
Resin	20.68	40.55	43.40	21.00
KD100	0.00	8.10	0.00	32.58
Copper Chromate Arsenic Treated Timber	0.00	0.00	0.00	2.40
SVG – Polimide recovery waste	1.04	0.27	0.43	0.00
Arsenic Filters	0.62	0.56	0.00	0.00
Arsenic Slurry Waste	4.85	2.92	6.74	3.01
Labpacks [* Note 3]	71.03	31.91	28.29	88.30
Contaminated Soil	0.72	1.00	0.00	0.00
Hydrofluoric acid	0.00	127.81	0.00	0.00
Copper with residual sulphuric acid	0.00	6.50	7.58	9.91
Total Recovered	3327.24	3790.19	3829.01	3395.72

Waste Description	*2006*	*2007*	*2008*	*2009*
Total Disposed	2324.44	537.11	379.35	517.43
Total Haz Waste	5651.68	4327.30	4208.36	3913.15
% of Total Haz Waste Recovered	58.87	87.59	90.99	86.78

*Note 1- The Corrosive Lead and Corrosive Arsenic debris numbers was incorporated into the Corrosive debris Number

*Note 2 - The Flammable Arsenic debris number was incorporated into the Flammable debris Number for 2008

*Note 3 – The definition of lab packs is used to describe the disposal of Expired Chemicals

Overall the amount of hazardous waste generated in 2009 decreased. This is predominantly related to the reduced production. Fab 14 also ceased production in October. The amount of waste disposed increased in 2009 with an increase in Q4 as a result of the deinstall of equipment and facilities associated with Fab 14. The increase in corrosive debris is as a result of the deinstall of Fab 14. Similarly, the increase in labpacks (expired chemicals) can be attributed to chemicals which were remaining following the cessation of production in Fab 14 and also the achievement of an environmental objective and target set in 2009 for the removal of historical expired chemicals at the site which did not have a waste disposal outlet. Copper chromate arsenic timber was disposed of in 2009 achieving another objective and target to remove this historical waste at the site. KD100 waste waters were generated during the decontamination of KD100 collection and storage treatment system at the site. The overall site recycling rate for hazardous waste slightly decreased due to the increase in waste for disposal which could not be recovered.

Table 2.5 – Summary of Non-Hazardous Waste (Tonnes)

Waste Description	*2005*	*2006*	*2007*	*2008*	*2009*
All Paper Recycled	32.89	20.64	10.26	2.99	3.14
Cardboard Recycled	107.18	141.64	57.68	66.43	36.46
Metal Recycled	115.92	445.47	291.56	281.58	1065.36
Plastic Recycled	29.78	37.9	8.32	1.52	79.98
Wood Recycled	203.34	502.22	239.28	206.14	112.59

Other Recycled [Note 2]	1094.9	960.26	2466.90	783.3	2065.40
General Non-hazardous	562.29	1078.39	274.23	264.92	319.38
General Non-hazardous C&I	287.53	327.34	409.02	291.41	189.4
General Non-hazardous C&D	0	0	15.08	0	0
Calcium Fluoride Cake	761.86	966.8	900	845.42	470.42
Non-Hazardous Aqueous Waste	193.5	0	0	0	0
Total Recovered	**1584.01**	**2435.47**	**3074.4**	**1341.95**	**3362.93**
Total Disposed	**1805.18**	**1840.25**	**1598.32**	**1401.75**	**979.2**
Total Non- Haz Waste	**3389.19**	**4275.72**	**4672.72**	**2743.71**	**4342.13**
% of Total Non- Haz Waste Recovered [Note 1]	**46.74**	**56.96**	**65.79**	**48.91**	**77.45**

Note 1:The above recycling figure for non-hazardous waste includes calcium fluoride cake which is a non hazardous waste.

Note 2: 'Other Recycled' includes; Cables, WEEE, Glass, Clothing, Compost, Mixed Packaging, Sludge, Resin, Municipal Mixed Waste, C&I Mixed and C&D mixed waste

In 2009, there was a significant increase in the volumes of non-hazardous waste generated from site primarily due to equipment de-install in the F14 facility. The tonnage of waste to recovery increased in 2009, while waste volumes to landfill decreased from 2008 (primarily due to a decrease in Calcium Filter cake.) Overall, the percentage of non hazardous waste recovered increased to 77.5% in 2009 as a result of an increase in generation of recoverable waste from the F14 de-install project and timber pallet re-use.

A detailed summary of all waste streams sent off-site from Intel Ireland for disposal is included in the PRTR found in Appendix A.

2.2 AGENCY MONITORING AND ENFORCEMENT

The AER Guidance Note requires that any significant differences between monitoring carried out by Intel Ireland and that of the Agency is highlighted in this section.

2.2.1 Agency Monitoring Visits

The various monitoring visits made by the Agency during 2009 are outlined in Table 2.6 below.

Table 2.6 – Agency Monitoring Visits

Date of Visit	*Purpose of Visit*
22-Jan-09	*Water SW / WW
16-Apr-09	*Water SW / WW
10-Jul-09	Air Sampling Visit
17-Aug-09	*Water SW / WW
29-Oct-09	*Water SW / WW

*SW refers to Surface Water Discharges and WW refers to Wastewater Discharges

2.2.2 Agency Inspections

There were five (5) Agency Inspections during 2009.

EPA Inspectors Audit (21st January 2009)

The Agency visited the Intel site to conduct an audit of compliance with the site IPPC Licence. The Agency noted that Intel had informed the Agency of two non-compliances in 2008 relating to elevated Carbon Monoxide from the A216 (RCTO) and elevated BOD, COD and Suspended Solids from SE1. The Agency also made several observations which were quickly addressed.

EPA Inspectors Audit (10th July 2009)

The Agency visited the Intel site to verify the situation in relation to five notifications of continuous monitoring equipment going offline. The inspection was also conducted to acquaint the new Inspector with the operations and environmental management/IPPC licence compliance at the facility. The Agency noted Intel's overall high level of compliance with the requirements of their IPPC licence and the high standard of housekeeping observed on the day of Inspection. An observation was raised to investigate elevated concentrations of conductivity, ammonium, chloride and fluoride in groundwater and submit a report to the Agency.

EPA Visit to Inspect Safe Access for Air Monitoring (23rd March 2009)

On behalf of the EPA, Euro Environmental Services carried out a Reconnaissance Survey of the suitability of the Intel site for safe air monitoring access as specified in the IPPC licence. Intel was found to be in full compliance.

EPA Visit for ODS and F-Gas Regulations (20th October 2009)

The Agency visited the Intel site to check compliance with the ODS and F-Gas Regulations. The Agency reviewed the site refrigerant inventory, ODS gas stockpile, training and qualifications and record keeping.

EPA Inspectors Visit to Inspect Caustic Day-tank Incident (9th December 2009)

Intel notified the Agency by telephone and fax that a minor chemical spillage incident had occurred from the Fab 24 Bridge Caustic Day Tank Bund. The volume of NaOH spilt was estimated to be 5-litres. The Inspector noted that the environment was not impacted as a result of this incident. Corrective action arising from this visit included the submission of a full incident report to the Agency.

2.3 RESOURCE MANAGEMENT

2.3.1 Introduction

This section identifies resource and energy use on site and outlines reduction measures used by the company.

The management systems in place for design of wafer fabrication facilities and the associated processes ensure that raw material usage and energy use arising from site activities are further reduced at source per unit produced for successive generations of technologies where possible. The environmental goals of minimisation, substitution and recycling are employed to ensure resource use is minimised and resources are used efficiently.

Raw material conservation, emission and waste reduction are achieved through a combination of:-

- Cleaner and more efficient process technology to reduce raw material inputs and produce lower emissions and wastes
- Material substitution with lower toxicity alternatives or those that generate lower emissions such as low volatility chemicals
- Recycling or recovery of raw materials and waste products

In addition to chemical and gas consumption minimisation, resource conservation is focused on the efficient use of electricity, gas and water on the site.

Details of the methods employed and results are described in sections 2.3.2 to 2.3.3 below.

2.3.2 Design for the Environment

Technology Goals

Intel Corporation develops and delivers a new chip manufacturing technology approximately every two years. The development cycle starts typically with 6 years external research in universities and government labs, followed by approximately 4 years joint research and development between Intel and suppliers followed by 2 years process development to produce a fully functional technology before transfer to high volume manufacturing (Figure 2.1). Intel has recognised that there is an opportunity for early engagement to effect change for environmental benefit during external and joint research, in addition to when the process is in high volume manufacturing mode. However, the optimum time to effect change for environmental design of the process is during the 2 years of final process development. The Intel Environmental Technology Development (TD) group is involved throughout this timeframe and has input into manufacturing process development, chemical selection, waste management, facility systems design and manufacturing equipment selection.

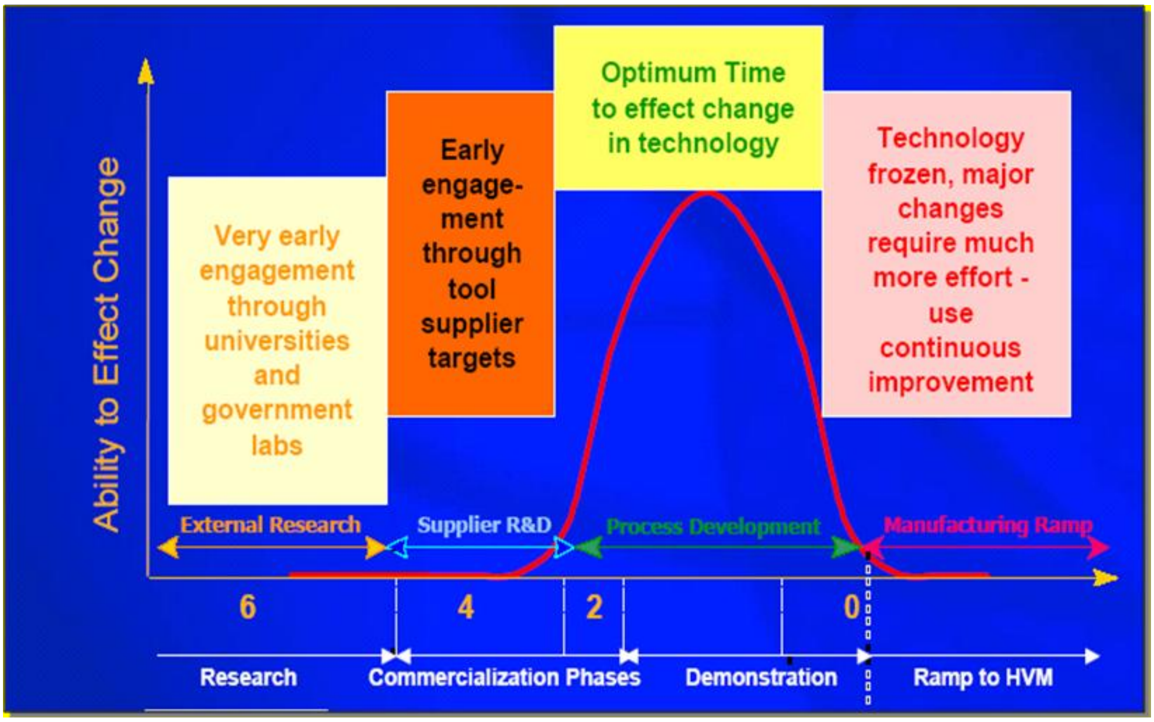

Figure 2.1 Effecting change during Intel process technology development

For each technology, goals are set for specific types of emissions, for example:- mass of VOC's or copper emitted per wafer produced. The methodology used for the setting of these goals is to first evaluate the receiving environment at each of the High Volume Manufacturing (HVM) sites. Items considered during this review would include existing site permits, local area regulations, wastewater treatment Plant capacity, air and water quality standards and demographic growth projections. Against this data is set projected wafer manufacturing capacities at each of the HVM's for each of the technologies. From this are derived acceptable emissions/wafer figures for each of the HVM sites. To set the corporate goal, the lowest emission/wafer figure so calculated is used. Once the goals have been ratified at the appropriate management level, measures are put in place during the development cycle to ensure the targets are met. Measures include material selection, material substitution, recipe optimisation, emissions treatment and waste segregation. In this way, the Corporation aims to ensure that the transfer of technologies to the HVM's can be successfully transferred without detrimental effect on the local environment.

Once the technology is transferred to a receiving HVM site, such as Intel Ireland, actual emissions per unit of product for each parameter are sampled and reported to development and receiving factory site management to confirm that, when the technology is run in high volume manufacturing conditions, it performs to the goals that the Technology Development (TD) group is required to deliver.

Table 2.7 Progress on Emissions Reduction 0.35 to 0.065 Micron Technology

Parameter	Mass % Reduction per normalised unit produced from 0.35 to 0.065 micron technology
PFCs	90%
VOCs	70%
[1]HAPs	67%

(Note:- 0.065 Micron = 65 nanometres)

[1]HAPs (Hazardous Air Pollutants) is a US term to describe emissions such as hydrofluoric acid, hydrochloric acid, chlorine and methanol.

By way of comparison, a technology which was being manufactured at the Ireland site in the late 1990's and early 2000's was the 0.35 micron technology which was developed in 1995. The latest technology (0.065 micron or 65 nanometre) started manufacture at Intel Ireland in 2006. The table above demonstrated the improvements in environmental performance which has been achieved within that time-frame.

Since the inception of the environmental technology goals process, a number of additional parameters have been included in the more recent years. Currently Intel has technology goals for reducing emissions and waste per wafer produced including the following parameters:

- Emissions to Atmosphere:
    - PFC

- VOC
- HAPs

- Emissions to Waste Water
    - CMP Solids
    - Ammonia
    - Copper
    - Lead
    - Nickel
    - Fluoride
    - Cobalt
    - Tin
- Waste
    - Mass of chemical waste

2.3.3 Supplier Environmental Performance Targets

Equipment or 'tool' design is a significant area of research for Intel and Intel's equipment suppliers. Intel requires that equipment suppliers design tools to minimise environmental emissions and resource consumption by including specific target emission levels on a per wafer processed basis in the equipment contractual purchase specifications. This practice ensures environmental considerations are designed into the process tools from the conceptual phase. Tool vendors are required to select gases and chemicals that can meet the target and must then carry out emissions characterisation on exhaust and waste streams. Since Intel introduced environmental emission targets to equipment vendor purchase specifications, the vendors have become more aware of the environmental considerations arising from their tools and are often in a more appropriate position than Intel to address any issues. The practice has resulted in dramatic reductions in emissions to air, water conservation and more recently to electricity consumption and has contributed to the overall reductions seen in PFC's and VOC's emissions and water consumption.

2.3.4 Water Consumption and Minimisation

The usage of water is a function of several variables including production levels and water conservation measures in place. There is a base loading on the factories that is independent of production levels arising from systems such as cooling towers and exhaust air treatment systems. Therefore, when a facility is operating at lower production rates, water usage expressed in terms of volume per unit produced can be adversely affected.

Tables 2.8 and 2.9 compare water consumption in relation to production levels for 2008 and 2009.

Table 2.8 provides these figures for IFO (Fab 10 and Fab 14). In IFO, annualised productions levels over the course of 2009 were at a level of approximately 168,000 wafers, which represents a decrease of 52% in relation to IFO production figures for 2008. Despite this fall in production, water consumption decreased by only about 4% relative to 2008 at 1,446,101 cubic metres. Hence, the water consumption in IFO normalised to production doubled relative to 2008. This can be explained by two factors; the inherent inefficiency of running a factory at a lower production rate and the use of significant amounts of water to decontaminate the Fab 14 factory which took place in the latter part of 2009.

Fab 24 water consumption figures are provided in Table 2.9. Fab 24 produces 12 inch wafers compared with the 8 inch wafers produced by IFO. A 12 inch wafer has approximately 2.25 times the surface area of an 8 inch wafer. To facilitate ease of comparison between Fab 24 and IFO, we have provided water usage per 12 inch wafer in Fab 24 and also per equivalent 8 inch wafer. Over the course of 2009, the volume of water consumed in Fab 24 remained approximately constant with 2008 with a total consumption 2,793,350 cubic metres. There was a reduction of approximately 10% in the number of wafers processed in Fab 24 in 2009 relative to 2008. This led to an increase in water consumption, normalised to production of approximately 13%. In the case of Fab 24, this normalised increase can be explained by the inherent inefficiency of running a factory at lower production rate.

A summary of improvement measures taken over 2009 are included in the 2009 EMP Report and further proposals are included in the 2010 EMP Proposal.

Table 2.8 IFO Annualised Water consumption as a function of production levels for 2008 and 2009

Parameter	2008	2009
Total Water Usage (m^3)	1,510,128	1,446,101
Total Wafer Production	352,725	167,755
m^3/1,000 8" Wafers	4,281	8,620

Table 2.9 Fab 24 Annualised Water consumption as a function of production levels for 2008 and 2009

Parameter	2008	2009
Total Water Usage (m^3)	2,758,824	2,793,350
Total Wafer Production(12")	331,269	296,502
m^3/1,000 12" Wafers	8,328	9,421
m^3/1,000 8" Wafers (equivalent)	3,701	4,187

2.3.5 Energy Consumption

Consumption of energy (electricity, natural gas and oil) for 2008 and 2009 are detailed in the tables below, and is followed by a discussion of results.

Table 2.10 Annual Electricity Usage

Parameter	*2008*	*2009*
Total (MWh)	**521,140**	**471,460**
Total Annual Wafer Starts (8" Equivalent)	**1,098,080**	**834,900**
Electricity Used per 1,000 Wafer Start (MWh/1,000 8" wafers)	**475**	**565**

Table 2.11 Annual Natural Gas Usage

Parameter	*2008*	*2009*
Total (MWh)	**164,095**	**168,420**
Total Annual Wafer Starts (8" Equivalent)	**1,098,080**	**834,900**
Gas Used per 1,000 Wafer Start (MWh/1,000 8" wafers)	**149**	**201**

Table 2.12 Oil Usage at Site

Parameter	*2008*	*2009*
Oil Usage (MWh)	1,472	1,494
Total Annual Wafer Starts (8" Equivalent)	**1,098,080**	**834,900**
Oil Used per 1,000 Wafer Start (MWh/1,000 8" Wafers)	**1.3**	**1.8**

Note: To calculate Total Wafers, each 12" wafer is considered as 2.25 times an 8" Wafer.

Discussion of Results

Utility consumption trends were reviewed against wafer production, however it should be noted that there is no direct relationship between natural gas consumption and wafer starts as a constant cleanroom environment has to be maintained irrespective of wafer loading. Natural Gas usage is dependent on heat load. Increased heat load comes about from outside air conditions and increased tool exhaust load. Outside air affects the cleanroom on cold days whereby the make-up air to the clean room requires more heating than usual and so heat load increases on the boilers.

In 2009, consumption of electricity decreased by 10% in absolute terms but there was an increase of approximately 19% in normalised terms. The consumption of natural gas increased by 3% in absolute terms and by approximately 35% in normalised terms. The fact that Natural Gas usage increased in 2009 despite the reduction in the number of wafers produced and there was ongoing de-installation of equipment from the Fab 14 production facility can be explained by the following facts;- the Heat Recover system was taken off-line for a period to allow for the installation of additional coils in the Fab 24, an on-site warehouse (IR3) was brought back into use and the re-commissioning of the Fab 10 UPW plant entailed additional heating requirements for the pre-heating of incoming UPW.

A list of the Energy Saving projects implemented in 2009 is included in the EMP Report for 2009 and a list of options under evaluation for 2010 are included in the 2010 EMP Proposal.

2.3.6 Material Efficiency

Process Optimisation for Material Efficiency

Due to the very minute dimensions that are patterned onto a wafer during manufacture, process chemical and gas flow set points need to be very exact.

Process optimisation through the statistical ‘Design of Experiments’ methodology is a practice used extensively throughout the process to determine the wafer processing recipe set points such as gas and chemical flows and power during technology development.

Using this method, tests are carried out by varying equipment recipe set points and measuring the result on the wafer. For example, in a dry etch process; set-point variables for an etchant gas may be tested at flow rates of 10, 12, 14 and 16 sccm. The flow that provides optimum results on the surface of the wafer is selected. Process optimisation ensures that excess chemicals, gases or energy are not consumed which conserves resources.

The move from 8 inch to 12 inch wafers has meant significant efficiencies are achieved in relation to raw materials used per number of product units manufactured. The 12 inch (or 300mm) wafer carries more than twice the number of dies that can be produced on an 8 inch wafer. This economy of scale has given rise to an increase in production without a proportional increase in consumption of raw materials.

Yield Improvements

In all the manufacturing technologies operated on site, yield improvement is a focus area. This covers the line yield, (the number of wafers that are not scrapped in line), as well as die yield (which is the number of functioning die per wafer at end of line). The continuous effort to improve yield gives rise to more efficient use of raw material, thereby conserving resources.

For example; certain compounds reduces the number of defects on the product which can cause failures in circuits and reducing die yield. Failed circuits are discarded at end of process and require replacements. Use of these chemicals reduces these process losses and makes the manufacturing process more efficient, thereby reducing overall emissions and resource use per unit of production.

2.4 ENVIRONMENTAL INCIDENTS AND COMPLAINTS

2.4.1 Environmental Incidents

Introduction

This section details the Environmental Incidents that occurred in 2009. Condition 11.7 of the Intel Ireland IPPC Licence required that -

> The licensee shall submit to the Agency, by the 31st March of each year, an AER covering the previous calendar year. This report, which shall be to the satisfaction of the Agency, shall include as a minimum the information specified in Schedule D and shall be prepared in accordance with any relevant guidelines issued by the Agency.

Environmental Incidents

There was one (1) environmental incident in 2009.

Fab 24 Bridge Caustic Day Tank Containment Breach (30th November 2009)

At approximately 6 a.m. on the 30th November 2009, a leak was detected on a high level valve from the sodium hydroxide (caustic) pump recirculation line to the bridge scrubbers. The valve was contained within a bunded area and resulted in a leak of sodium hydroxide into the bund. The bunded area is surrounded by a Perspex screen for the prevention of high-level sprays breaching the bunded area. In this particular instance, because the valve was at a high level, a small amount of the leak sprayed outside of the bunded area (5-litres). The bund was emptied and the caustic was neutralised. The chemical did not enter any storm drains.

There was no negative impact on the environment but the regulatory agency (EPA) was notified of the incident on the 30th November as the containment area had been breached.

In addition to the event above, we also reported the following events relating to monitoring equipment during 2009 (Table 2.13). None of these events led to loss of control of the abatement systems.

Table 2.13 – Monitoring equipment downtime during 2009

Date of Downtime	Equipment
28th February 2009	Fab 14 Kreha TOC Analyser (Stack A112)
24th March 2009	Fab 10 RCTO TOC Analyser (Stack A57)
30th March 2009	Fab 10 RCTO TOC Analyser (Stack A57)
23rd May 2009	Fab 14 Kreha TOC Analyser (Stack A112)
4th June 2009	Fab 10 RCTO TOC Analyser (Stack A57)
26th June 2009	Fab 14 Kreha TOC Analyser (Stack A112)
11th July 2009	Fab 14 Kreha TOC Analyser (Stack A112)
4th August 2009	Fab 14 Kreha TOC Analyser (Stack A112)
4th August 2009	Fab 10 RCTO TOC Analyser (Stack A57)
4th August 2009	Fab 10 RCTO TOC Analyser (Stack A57)
6th August 2009	Fab 14 Kreha TOC Analyser (Stack A112)
7th August 2009	Fab 10 RCTO TOC Analyser (Stack A57)
12th August 2009	Fab 14 Kreha TOC Analyser (Stack A112)
17th August 2009	Fab 14 Kreha TOC Analyser (Stack A112)

2.4.2 Complaints

The Corporate Affairs department deals with any complaint received from the public with support from the environmental department.

Corporate Affairs maintains a log of all environmental complaints received from the public. This log contains information regarding the complainant and the nature of the complaint. Each complaint is communicated to the environmental department, the complaint is investigated and an appropriate response is determined. Details of the response are held in the complaints log. However, during the course of 2009, there were no complaints of an environmental nature received.

3.0 Management of the Activity

3.1 ENVIRONMENTAL MANAGEMENT PROGRAMME 2009

3.1.1 Schedule of Environmental Objectives and Targets 2009

The 2009 Intel Ireland Objectives and Targets were made up of 9 strategic objectives. Objectives and Targets were chosen in order to establish realistic and meaningful improvements for that projected period. A summary of these targets and objectives is given in the table below.

Table 3.1 Summary of Environmental Objectives and Targets for 2009

Topic	Objective	Target	Key Date
Water	Wastewater Management and Surfacewater / Groundwater Protection	Ensure 100% Compliance with IPPCL Condition 3.6.6	Q1'2009
		Ensure 100% Compliance with IPPCL Condition 3.6.2	Q2'2009
		Ensure 100% Compliance with IPPCL Condition 6.14.2	Q3'2009
		Ensure 100% Compliance with IPPCL Condition 6.6	Q2'2009
		Ensure 100% Compliance with IPPCL Condition 5.1	Q4'2009
Hazardous waste Management	Removal of legacy hazardous wastes from site to ensure compliance	Set up disposal outlets for 5 legacy waste on-site to remove current amounts and ensure disposal outlet for future	Q4'2009
Hazardous waste Management	Reduce environmental impact of hazardous waste generated by IR SITE operations.	Achieve a measurable target to align with corporate goal of 10% reduction by 2012 based on 2007 levels.	Q4'2009

	Recycle 80% of chemical waste generated per year	80% recycling rate for chemical waste (haz waste and non-haz filter cake)	Market dependen t timeframe
Non-Hazardous Waste	Recycle 90% of solid waste (non-haz waste) generated per year	90% recycling rate for solid waste (non-haz waste) Carry out four waste awareness stands in 2009	Q4'2009
Air Quality	Ensure Air Quality	Quantify emissions and impact of fluoride on vegetation	Q1-Q2 '2009
Global Warming Gases	Drive international semi-conductor PFC reduction agreement with industries and governments that levels the playing field and is consistent with Intel's capability. Continue to investigate PFC substitutions which reduce emissions	As a member of the ESIA/EECA, Intel Ireland will deliver its contribution to the target of reducing all member companies total annual absolute PFC emissions to 10 percent (on a MMTCE basis) below the 1995 baseline PFC emissions by 2010	Q1-Q4'2009
Legislation	Develop environmental requirements for implementation of REACH	Understand site's and suppliers requirements in relation to REACH and develop/implement systems to ensure compliance.	2008-2010
Energy	Reduce energy and electricity consumption on site	The updated Corporate Goal is to reduce normalised energy use by 5% per year from 2007 through 2012. As a site we strive to match the Corporate Goal	2012
Water Conservation	Reduce water use	The updated Corporate Goal is to reduce normalised water use by 2012 from 2007 levels. As a site, we strive to match Corporate	2008-2010

		Goal.	

3.1.2 EMP REPORT FOR 2009

Water

Topic	Objective	Target	Project	Key Date
Water	Wastewater Management and Ground/Surface water Protection	Ensure 100% Compliance with IPPCL (Condition 3.6.6)	Review of all bunds to assess type of testing required (visual or hydrostatic) in line with EPA Guidance Note on Chemical Storage & Transportation	Q1'2009
		Ensure 100% Compliance with IPPCL (Condition 3.6.2)	Install signage to display maximum storage allocation on loading bay areas.	Q2'2009
		Ensure 100% Compliance with IPPCL (Condition 6.14.2)	Review maintenance programme for bunds.	Q3'2009
		Ensure 100% Compliance with IPPCL (Condition 6.6)	Re-line or replace F14 AWN line to EBT	By 2010
		Ensure 100% Compliance with IPPCL (Condition 5.1)	Investigation report to be issued to the EPA. Approval for increase in SS limit and filtration of samples for BOD and COD to be sought from KCC. Seek	Q2'2009

			technical amendment of the IPPCL with the EPA.	
		Ensure 100% Compliance with IPPCL (Condition 5.1)	Carry out a risk assessment for F24 bunds to determine recommended sequence of operation for sumps	Q4'2009

A Ensure 100% Compliance with IPPCL (Condition 3.6.6)

Project: Review of all bunds to assess type of testing required (visual or hydrostatic) in line with EPA Guidance Note on Chemical Storage & Transportation

Intel Ireland commissioned Project Management Ltd. to assess the site's bunds in line with the Agency's Guidance Note on Chemical Storage and Transportation. A detailed review of all bunds was carried out including visual inspections by a structural engineer and an assessment of the type of testing required in future based on risk assessment criteria. The bund assessment report is included in Appendix C.

B. Ensure 100% Compliance with IPPCL (Condition 3.6.2)

Project: Install signage to display maximum storage allocation on loading bay areas.

The signage has been installed on all loading bay areas.

C. Ensure 100% Compliance with IPPCL (Condition 6.14.2)

Project: Review maintenance programme for bunds

The maintenance programme for bunds was reviewed. Currently, some bunds are included in the preventive maintenance programme and others are maintained on an as-needed basis. The waste treatment system chemical bunds are monitored by means of preventive maintenance and Safety Management by Walkabout (SMBWA).

D. Ensure 100% Compliance with IPPCL (Condition 6.6)

Project: Re-line or replace F14 AWN line to EBT

The damaged sections of the inner lining of the F10 AWN and F14 AWN process effluent pipes were remediated and re-surveyed and found to be in a satisfactory condition. The process effluent pipe remediation and survey report is included in Appendix E.

E. Ensure 100% Compliance with IPPCL (Condition 5.1)

Project: Carry out a risk assessment for F24 bunds to determine recommended sequence of operation for sumps

A risk assessment was carried out on the F24 wastewater treatment system and waste collection bunds. In the event of a failure, the highest risk system was found to be the HFW lift station bund due to the potential of this bund to overflow to the AWN pit and therefore to the AWN wastewater treatment system resulting in a potential breach in Intel's IPPCL limit for fluoride emissions to sewer. The operating level of the tanks in this bund has been reduced to remediate this risk. In addition, the development of a protocol for emptying all sumps will be included in the 2010 objectives and targets programme.

Hazardous Waste

Topic	Objective	Target	Key Date
Hazardous waste Management	Removal of legacy hazardous wastes from site to ensure compliance	Set up disposal outlets for 5 legacy waste on-site to remove current amounts and ensure disposal outlet for future	Q4'2009
Hazardous waste Management	Reduce environmental impact of hazardous waste generated by IR SITE operations.	Achieve a measurable target to align with corporate goal of 10% reduction by 2012 based on 2007 levels.	Q4'2009

Hazardous waste Management	Recycle 80% of chemical waste generated per year	80% recycling rate for chemical waste (haz waste and non-haz filter cake)	Market dependent timeframe

A Removal of legacy hazardous wastes from site to ensure compliance

Four out of five legacy waste items were removed from site in 2009. These included Copper chromate arsenic treated timber, expired chemicals, construction materials, waste refrigerants. Some waste cylinders were removed in 2009 with a few remaining in TMM warehouse on-site which require a disposal outlet. The remaining cylinders will be addressed in 2010 in order to secure a disposal solution for these.

B. Reduce environmental impact of hazardous waste generated by IR SITE operations.

The Ireland site implemented a project to change the plumbing on tools to divert Concentrated Metal Waste (CMW) from tools in Fab 24 to the Copper Concentrated Waste (CCW) treatment system on-site to reduce the volume of CMW waste shipped off-site for treatment. This was completed by Corporate Services Engineering in WW15 of 2009.

C. Recycle 80% of chemical (hazardous) waste generated per year

The site recycled 87% of its hazardous waste in 2009. Please note this figure does not include calcium fluoride filter cake which is a non-hazardous waste. The Ireland site has for the last ten years proactively engaged with waste companies and cement kilns in order to send its calcium fluoride filter cake for recovery. Unfortunately this objective is very market related at although Intel has made some progress with cement kilns in taking this waste this was not achieved. This is still an objective which Intel will pursue as other facilities within the corporation are fuel blending this material at cement kilns.

Non- Hazardous Waste

Topic	Objective	Target	Key Date
Non- Hazardous Waste	Recycle 90% of solid waste (non-haz waste) generated per year	90% recycling rate for solid waste (non-haz waste)	Q4'2009

A Recycle 90% of solid waste (non-haz waste) generated per year

Seven out of Nine project relating to the recycling of non-hazardous waste were completed in 2009. Four awareness events occurred in 2009 relating to waste recycling and reduction (2 awareness stands and 2 Intel TV communications).

A review of C&I skips and segregation practices was carried out. This review looked at the collection of waste as C&I and improved segregation was implemented where practicable for example the IR3 warehouse.

A review of the packaging materials in the canteen was carried out. Opportunities for the use of biodegradable packaging were investigated by Intel's contract catering company but no change was made to packaging as this was deemed cost prohibitive. The catering company changed from using sugar sachets to using sugar dispensers to reduce packaging. Similarly, they order in bulk items where possible to reduce packaging volumes.

The contractors compound waste procedure was reviewed and updated in 2009. Similarly, communications were issued to the contractors on segregation of waste materials to improve recycling.

An ad hoc skip ordering process was devised by Intel and its non-hazardous waste contractor Greenstar in 2009. The purpose was to further control wastes generated at the site where skips were requested by groups to ensure that the person placing the order was aware of the segregation practices required to ensure recycling.

A system check sheet for Lord of the Bins (Intel's employee's recycling stations) was implemented in 2009. This check sheet is used to monitor segregation practices in this area so improvements can be made where possible.

Two projects were not completed in 2009. One was the extension of the composting scheme to other areas on-site including the cleaning company. This project was not completed as Intel was contracting out an Integrated Facilities Management contract to manage front of house services which became higher priority than the project set in terms of environmental compliance. The other project was to find a disposal outlet for recycling of anti-static bags, gloves, hairnets and booties. In 2009, Thorndales waste company in Northern Ireland were identified as a possible outlet but they did not have the necessary permitting. Greenstar continue to work on finding an available outlet for this in 2010.

Air Emissions

Topic	Objective	Target	Key Date
Air Quality	Ensure Air Quality	Quantify emissions and impact of fluoride on vegetation	Q1-Q2 2009

A Ensure Air Quality

RSK EHS, in collaboration with Newcastle University, were commissioned by Intel Ireland Ltd to produce a comprehensive report detailing fluoride sampling in vegetation in the vicinity of Intel's manufacturing facility.

Fluoride levels in vegetation have been monitored since 2002 at locations upwind and downwind of the Intel facility. Analysis of the long-term measurement trends reveals that the highest measured levels of fluoride in vegetation occur at locations that are downwind of Intel facility, though seasonal variation was observed and concentrations in vegetation would appear to falls rapidly with distance from the production facilities.

A long-term trend of gradually rising levels of fluoride in vegetation is evident in line with increased production from the Intel site. Such concentrations however are well below recognised thresholds designed to protect vegetation.

The existing monitoring strategy has been reviewed and recommendations were included in the report regarding increasing the frequency of monitoring and enhancing both vegetative and airborne concentration monitoring to correlate ambient air concentrations (and process emissions) with fluoride levels in vegetation. Some of these recommendations have been put in place in 2009 as part of an integrated fluoride monitoring programme and the rest will be carried out as part of the 2010 EMP.

Global Warming Gases

Topic	Objective	Target	Key Date
Global Warming Gases	Drive international semi-conductor PFC reduction agreement with industries and governments that levels the playing field and is consistent with Intel's capability. Continue to investigate PFC substitutions which reduce emissions	As a member of the ESIA/EECA, Intel Ireland will deliver its contribution to the target of reducing all member companies total annual absolute PFC emissions to 10 percent (on a MMTCE basis) below the 1995 baseline PFC emissions by 2010	Q1-Q4'2009

A Drive international semi-conductor PFC reduction agreement with industries and governments that levels the playing field and is consistent with Intel's capability. Continue to investigate PFC substitutions which reduce emissions

During the course of 2009, Intel continued to participate in the European industry's programme to manage its emissions of PFC's and achieve its goal to reduce its PFC emissions below its 1995 emissions by 10% by 2010. Data for the period 1995 to 2008 was released over the course of 2009 and shows that PFC emissions from the industry in Europe has reduced its emissions by 26% below emission in 1995, showing that the industry it very likely to reach its 2010 goal.

Discussions have already commenced within the European Semiconductor Industry Association (ESIA) and the World Semiconductor Council (WSC) to agree a replacement for the current agreement which concludes in 2010. The WSC PFC Working Group is co-chaired by an Intel Corporate Engineer.

As detailed in Section 4.6 of this AER, Intel Ireland also completed its long term project to reduce its emissions of PFC from the older plant (IFO) on site. This project involved using a substitute gas for CF4 and C2F6 with a higher utilisation rate which reduces overall emissions. This project combined with the de-installation of equipment in Fab 14 and the consolidation of equipment into Fab 10 means that emissions from this part of the site has now fallen below emissions from Fab 24.

Legislation

Topic	Objective	Target	Key Date
Legislation	Develop environmental requirements for implementation of REACH	Understand site's and suppliers requirements in relation to REACH and develop/implement systems to ensure compliance.	2008-2010

A Develop environmental requirements for implementation of REACH

Intel Ireland is positioned as a Downstream User under REACH. To secure our supply chain, we are required to ensure that the substances (within chemicals) that we use are pre-registered and on-track for registration under REACH. During 2009, Intel developed a compliance database of chemicals, detailing tonnage band, SVHC content, pre-registration status and exposure assessment details.

Energy

Topic	Objective	Target	Key Date
Energy	Reduce energy and electricity consumption on site	The updated Corporate Goal is to reduce normalised energy use by 5% per year from 2007 through 2012. As a	Q2'2009

		site, we strive to match the Corporate Goal	

A Reduce energy and electricity consumption on site

Over the course of 2009, Intel Ireland completed a number of projects with the aim of reducing energy consumption. The target of this programme for 2009 was to reduce annualised consumption by 1.6% against H2'2007-H1'2008 usage. In fact, this programme was successful in reducing annualised energy consumption by 4% over the course of 2009.

Please find below a listing of the energy conservation projects implemented over the course of 2009.

Completed Projects	**Electricity Saving (kWh/annum)**
F24 Scrubber Packing change	46,919
F24 South Fan deck. Switch off one MAH	43,800
F24 CPCW false load reduction	171,696
F24 SCW: Turn off O2 Fans	13,400
F24 EPI Eco mode	839,160
F24 Allocation of F10 N2 Plant	7,315,410
F10 MAH Evap Hum Pilot	192,600
IR5 MAH Humidification Skid overhaul	35,461
F10 Compressors v's F14	2,607,142
Reduce electrical load on F14 Make-up Booster HX control	113,168
Lighting Reduction (Watt Watch) IR1 Ground floor office	22,391
Lighting Reduction (Watt Watch) F14 Subfab Corridor	26,175

Lighting Reduction (Watt Watch) IR5 Sort Floor Main	97,762
Lighting Reduction (Watt Watch) IR5 Office Second Floor Office	48,881
Lighting Reduction (Watt Watch) IR1 Sort Floor	84,031
IR4 Office Lighting 1st Floor, Timeclock control.	198,846
IFO Allocation of F10 N2 Plant	4,483,638

Water Conservation

Topic	Objective	Target	Key Date
Water Conservation	Reduce water use	The updated Corporate Goal is to reduce normalised water use by 2012 from 2007 levels. As a site, we strive to match the Corporate Goal	2008- 2010

A Reduce water use

Water usage remained approximately level between 2008-2009, despite the reduction in production on site.

A project was carried out over the course of 2009 which involved routing wastewater from Acid Wet Benches (AWBs) to the Concentrated Lead Waste (CLW) System instead of the Re-use Industrial Water (RIW) System, thereby preventing the contamination of water in the RIW system with acid residues. This project has a projected annualized saving of 18,400m^3/year of water.

Also over the course of 2009, plant "robusting" exercises were carried out to optimise water usage and reduce waste. These exercises are estimated to have savings of approximately 100,000m3/annum.

The project to install a High Efficiency Reverse Osmosis (HERO) system on site is currently subject to a management decision on future site developments.

The project to By-pass the Fab 24 EDI Systems has been progressed with the completion of the 20 week pilot phase of the project. The design has been completed and the project is now at the costing stage. Once that is completed, a "White Paper" will be drafted outlining the impact on water quality, the risk to factory operations and the associated costs and water savings. The White Paper will then be submitted to management for approval and it is expected that the White Paper will be submitted by the early Q2'2010. It is expected that a management decision will be made over the course of Q2'2010. Then subject to management approval, the project will be implemented over the course of 2010 and 2011.

3.2 ENVIRONMENTAL MANAGEMENT PROGRAMME 2010

3.2.1 Schedule of Environmental Objectives and Targets 2010

The 2010 Intel Ireland Objectives and Targets are made up of 11 objectives. Objectives and Targets were chosen in order to establish realistic and meaningful improvements for that projected period. A summary of these targets and objectives is given in table 3.2.

Table 3.2 Summary of EMP for 2010

Topic	Objective	Target	Key Date
Water	Surface Water/Groundwater Protection	Ensure 100% Compliance with IPPCL (Condition 3.6.6)	Q4 2010
		Ensure 100% Compliance with IPPCL (Condition 3.6)	Q1 2010
Hazardous Waste	Reduce environmental impact of hazardous waste generated by IR SITE operations.	Achieve a measurable target to align with corporate goal of 10% reduction by 2012 based on 2007 levels.	Q4'2010
	Recycle 80% of chemical waste generated per year	80% recycling rate for chemical waste (haz waste and non-haz filter cake)	Market dependent timeframe

Non-hazardous Waste	Recycle 80% of our solid waste (non-Haz) generated per year	80% recycling rate for solid waste (non-haz waste hairnet and booties)	Q4 '10 Market Dependant
	Seamless Implementation of IFM contract for non-haz waste	0 non-compliances with IPPCL during implementation	Q3 '10
Air Quality	Ensure Air Quality	Integrated fluoride monitoring programme	Q4 2010
Legislation	Ensure compliance with the REACH regulation	Ensure that all chemical products used by Intel are pre-registered by a Supplier or OR.	Q4 2010
	Ensure compliance with the revised ODS Regulations and the Irish F-Gas Regulations	Implementation of Management Systems to ensure compliance with all aspects of the Regulations	Q4 2010
Energy	Implement Energy Reduction Projects and contribute to the Corporate Goal of 5% normalised energy consumption reduction	Implement Energy Reduction Projects that provide annualised energy reduction of 1% relative to H'2008 and H1'2009 energy usage	Q4'2010
Water Conservation	Implement Water Conservation Projects and contribute to the Corporate	Implement Projects to reduce demand on incoming water	Q4'2010

	Goal of reducing normalised water use by 2012 from 2007 levels	by at least 30m3/hr	
Environmental Management System	Continuously improve our environmental and energy management systems to provide improved performance	Completion of 7 environmental management projects.	Q4'2010

3.2.2 Assessment of EMP 2010

Objective 1

Surface Water / Groundwater Protection

Overall Target

100% Compliance with IPPCL Conditions

Project	Key Date	Owner
Repair outstanding bunds and test in accordance with bund assessment findings carried out in 2009.	Q4 2010	Env Dept
Install apron to prevent sprays from escaping bunded area for sodium hydroxide bridge scrubber day tank bund.	Q1 2010	Env Dept
Review protocol and update procedures for emptying bunds and sumps.	Q4 2010	Env Dept

Objective 2

Reduce environmental impact of hazardous waste generated by IR SITE operations.

Overall Target

Achieve a measurable target to align with corporate goal of 10% reduction by 2012 based on 2007 levels.

Project	Key Date	Owner
Implement corporate driven projects associated with waste minimization	Q4'2010	Env Dept

Objective 3

Recycle 80% of chemical waste generated per year.

Overall Target

80% recycling rate for chemical waste (hazardous waste and non-hazardous filter cake).

Project	Key Date	Owner
Find recycling outlet for filter cake - potentially could boast recycling rate by 16%	Market dependent timeframe	Env Dept

<u>Objective 4</u>

Recycle 80% of our solid waste (non-hazardous) generated per year.

Overall Target

80% recycling rate for solid waste (non-hazardous waste, hairnets and booties).

Project	Key Date	Owner
Implement recycling of hairnets, booties and latex gloves	Q4 '10 Market Dependant	Env Dept

<u>Objective 5</u>

Seamless Implementation of IFM contract for non-hazardous waste.

Overall Target

Zero non-compliances with IPPCL during implementation.

Project	Key Date	Owner
Sustained operational control during Integrated Facilities Management (IFM) transition	Q3 '10	Env Dept

Objective 8

Ensure Air Quality.

Overall Target

Develop and implement an integrated fluoride sampling programme.

Project	Key Date	Owner
Develop an integrated sampling protocol for vegetation, HF diffusion tubes and filter paper.	Q4 2010	Env Dept.

Objective 7

Ensure compliance with the REACH regulation.

Overall Target

Ensure that all chemical products used by Intel are pre-registered by a Supplier or Only Representative.

Reason

The REACH regulation is an extensive new chemical regulation which is applicable to Intel. Intel Ireland has a role under REACH as a Downstream User of chemicals and as a manufacture of articles. The company's role as a Downstream User of chemical is covered in the EMP. Its role as a manufacturer of articles is covered as a global compliance program and is not within the scope of the AER.

Project	Key Date	Owner
Develop a compliance database of site chemicals, pre-registration communications, restrictions and registration deadlines.	Q4 2010	Env Dept.
Prepare site MSDS's for the MREP IT System launch.	Q4 2010	Env Dept.

Objective 8

Ensure compliance with the revised ODS Regulations and the Irish F-Gas Regulations.

Overall Target

Implementation of management systems to ensure compliance with all aspects of the Regulations.

Project	Key Date	Owner
Specify a Software System for the management of all refrigerants on site.	Q4 2010	Env Dept.

Objective 9

Implement Energy Reduction Projects and contribute to the Corporate Goal of 5% normalised energy consumption reduction.

Overall Target

Implement Energy Reduction Projects that provide annualised energy reduction of 1% relative to H'2008 and H1'2009 energy usage.

Project	Key Date	Owner
Implement 2010 Energy Reduction Roadmap Projects listed below:-	Q4'2010	CS (K.G.)
IR5 Further Reduction to support F10		
F10 Facility Load Opportunities		
F10 Chiller with IR5 Sort Reduction		
Compressor Efficiency Improvements		
DSUM ION EEM		
IR1 York Air Cooled Chiller Optimisation		
IR6 HVAC Improvement		
Reduction of F24 RCTO's to N Units		
Fab 24 Tool Cost by CEID		

Objective 10

Implement Water Conservation Projects and contribute to the Corporate Goal of reducing normalised water use by 2012 from 2007 levels.

Overall Target

Implement Projects to reduce demand on incoming water by at least 30m3/hr.

Project	Key Date	Owner
Complete costing for the EDI By-	Q1'2010	CS (A.G.)

Pass Project		
Draft White Paper and submit to site management for approval of EDI By-Pass Project.	Q2'2010	
Obtain Management Approval for EDI By-Pass Project.	Q2'2010	
Implement EDI By-Pass Project (subject to Management Approval)	Q4'2011	

Objective 11

Continuously improve our environmental and energy management systems to provide improved performance.

Overall Target

Completion of 7 environmental management projects.

Project	Key Date	Owner
Gain successful certification of the Energy Management System to ISO16001	Q4'2010	Env Dept & ENG
Review and Update of Environmental Training Classes	Q4'2010	Env Dept
Review of internal environmental auditing process to provide improvements	Q4'2010	Env Dept
Review of ICM document management system files	Q4'2010	Env Dept
Review of Maximo Preventative Maintenance Orders for Env and	Q4'2010	Env Dept

Update where necessary		
Review of process for corrective and preventative actions	Q4'2010	Env Dept
Review Communications within EHS group to revise and improve	Q4'2010	Env Dept

3.3 POLLUTION EMISSION REGISTER

3.31 Introduction

This section includes an introduction to Intel's PER, a summary of the methodology used to assess these pollutants and a pollution emission register table.

The Pollution Emission Register (PER) is a requirement of the Integrated Pollution Control Licence (Register No. P0207-03), as issued to Intel Ireland Ltd. Specifically, under Condition 6.16.1 of the Integrated Pollution Control Licence, the following is noted:

> *6.16.1 The licensee shall prepare and maintain a PER for the site. The substances to be included in the PER shall be agreed by the Agency each year by reference to the list specified in the Agency's AER Guidance Note. The PER shall be prepared in accordance with any relevant guidelines issued by the Agency and shall be submitted as part of the AER.*

As per Condition 6.16.1, Intel Ireland submitted a proposal for the 2009 PER in the Annual Environmental Report for 2008. This PER includes fluoride, and copper and the rationale for including these parameters has been outlined in the proposal.

3.3.2 Summary of Methodology for Substances Requiring A Full PER

3.3.2.1 Copper

Intel Ireland uses electroplated copper interconnects in the fabrication of wafers in the 300 mm fabrication facility in F24.

Electroplating facilitates the deposition of a metal film by using current to provide electrons to convert metal ions to metal atoms at a conductive interface. A thin copper seed layer is deposited on the silicon wafer prior to electro-deposition (to provide a conductive layer for the deposition process). The wafer is then immersed in an electrolytic solution containing copper ions where deposition of a copper film is accurately controlled by the application of an electric current. The current is passed between the anode (copper disc) and the cathode (wafer) where copper metal is deposited on the conductive seed layer. A copper anode replenishes the electrolytic solution with copper ions as they are consumed at the cathode.

Two tools sets are employed in the thin films process in F24 to facilitate the electroplating process. These are AMAT (EPA) and Novellus (EPN). After passing through the electroplating tool set the wafers proceed to copper polish where the deposited copper films are polished down. A number of metal layers are deposited on each production wafer. Copper is also used in the copper bump plating tools in the C4 process.

The Fab 24 electroplating and planarisation process produces copper contaminated waste. These waste types include concentrated copper waste (CCW), dilute metal waste (DMW), slurry copper waste (SCW) and spent copper anodes. The majority of the CCW waste is treated on-site by electro-winning and copper balls are produced during this process. Both SCW and DMW waste streams are dilute copper effluent which is treated by ion-exchange prior to discharge to process wastewater.

The following table summarises the inputs and outputs that are considered in the copper pollution emission register for 2009.

Table 3.4 Summary Table of Copper Inputs/Outputs

Inputs	Outputs
Copper Make-up Solutions	CCW Waste Copper Balls
Copper Anodes	Concentrated Copper Waste (CCW) Liquid Waste
Copper Media for CCW	Dilute Metal Waste (DMW) Waste
	Slurry Copper Waste (SCW) Waste
	Used/Recovered Copper Anodes
	Copper deposited onto the wafer/product

3.3.2.2 Fluoride

Intel uses compounds containing fluoride in a number of process steps in the manufacture of semiconductors. During the process, the wafers pass through each of the functional areas a number of times to build up a complex 3-D device on the surface of the wafer. Fluoride is used in its different forms in the following steps:

- Diffusion (Hydrogen Fluoride in gaseous and acid form).
- Etch (PFC gases and Hydrogen Fluoride acids).
- Thin Films (PFC gases).

Fluoride-containing wastewater is treated on-site by precipitation with calcium hydroxide to form calcium fluoride as a solid waste.

The following potential inputs/outputs are considered in the fluoride mass balance analysis for 2009.

Table 3.6 Summary Table of Fluoride Inputs/Outputs

Inputs	Outputs
PFC's and other fluorinated gases	Fluorine, HF and PFCs in atmospheric emissions
Fluorinated liquid chemicals	Fluoride in wastewater emissions
	Fluoride in solid waste

3.3.2 Pollution Emission Register

Facility Identification

Facility Name	Intel Ireland Ltd.
Register No.	P0207-03
National/Grid Reference	2370(N), 2985(E)
Reporting Period	Jan 2009 to Dec 2009
Production units	Silicon wafers
Employee No.	4,000

Pollutants Summary														
				Outputs										
Pollutant Name	CAS No.	Input	Gross Usage	Air	MOM	Liquid Effluent	MOM	Waste	MOM	Product	MOM	Recovery	Treated	Unaccounted
Copper	7440-50-8	13,166	8,509	-	-	184	M	6,876	M	2,960	E	3,516	-	370
Fluoride	7782-41-4	131,919	138,170	10,00 5	M	16,911	M	98,788	E	-	-	3,748	-	2,465

3.3.4 Pollution Emission Register (PER) Proposal for 2010

Section 6.16.1 of Intel Ireland's IPPC licence number P0207-03 detailed below, specifies that an agreed PER list shall be included in the AER.

> *6.16 Pollution Emission Register (PER)*
>
> *6.16.1 The licensee shall prepare and maintain a PER for the site. The substances to be included in the PER shall be agreed by the Agency each year by reference to the list specified in the Agency's AER Guidance Note. The PER shall be prepared in accordance with any relevant guidelines issued by the Agency and shall be submitted as part of the AER.*

For the year 2010, we propose the following substances for a full Pollution Emission Register (PER) mass balance.

- *Total Fluoride*
- *Copper*

These substances have been included due to their potential environmental toxicity.

3.4 Environmental Management System (EMS) Activities for 2009

The team of dedicated environmental engineers, along with employees across the site, maintained the focus on EMS during 2009.

The first item reviewed was the Site Environmental Policy. This was updated, reviewed, ratified and signed by the Site Committee (Senior Business Unit Managers on site). The updated copy was then posted at specified locations on the site and uploaded on our internal web-site and a summary copy posted to the external website.

During 2009, a focused activity remained the compilation and submission of reports as required by the site Integrated Pollution Prevention and Control Licence and the site Greenhouse Gas Emissions permit.

Regular environmental updates were presented to the Site Committee and these covered various topics including compliance performance, media programme updates (air, water, waste noise etc.) legislative updates, system improvements, reviews etc.

On the training front, all new employees coming on site undergo orientation training which includes an environmental section. For employees working in specific areas of the site, there is also a requirement to complete other environmental related classes, for example; Environmental Awareness, Hazardous Waste Management or Decontamination. In relation to these classes, 32 sessions in total were conducted. All of this training is tracked as part of employee's certification training. In addition, Corporate Service Technicians have environmental training included as part of their system training and this is also tracked. The training materials for the technicians training packages were reviewed and updated. For the team of environmental engineers continuing professional development and environmental training continued in order to ensure that they remain abreast of current developments.

In order to ensure that the systems and the EMS in general are operating successfully, audits take place on a regular basis. Two ISO 14001 audits were conducted by external registrars in 2009. On the 22nd to 24th of September, a Corporate ISO 14001 recertification audit was conducted and the local ISO 14001 surveillance audit was conducted on 11th of November. There were no major findings as a result of the audits. Suggestions for further improvements were given and a plan is in place for implementation.

In addition audits of selected external facilities that process waste, both hazardous and non hazardous from the site were conducted. The selection of facilities is based on an audit rota for all facilities that is maintained by the environmental department.

In addition to training, communications to employees on the environment is primarily through updates at regular dept / group meetings, through posters and the internal web site. Any significant changes to the site EMS have to be approved by the Site Committee.

Key Environmental Projects and Events with an Internal / External Community Focus

The key environmental projects and events with an internal/ external/ community focus that occurred in 2009 were as follows:

1. **Awards**

Environmental Excellence Awards

Every year Intel award employees who have achieved Environmental excellence though out their course of work in Intel worldwide. In 2009 the Intel Ireland site achieved 2 awards from Intel Corporation

A Gold award was awarded to F24 manufacturing Electroplating Module for their project "Orange goes Green" for implementing a design to recycle Copper waste that was previously being disposed of as Hazardous waste. A Bronze award was also awarded to Intel Ireland, for the project "Green Country, not Green House- Reducing PFC's from a legacy factory". Michael Cullen from the Environmental Department was a member of this team who contributed to the PFC reduction in absolute emissions to 10% below 1995 emission levels in line with the ESIA voluntary agreement.

Gold Award: F24 Electroplating Module: Orange Goes Green!

F24 Electroplating team, Michael Hennessy Olivier Beyaert, Alan Thomas, Frank Hogan, Laura Hanley and Brian Fanning (Missing from Photograph:- Laura Hanley and Brian Fanning)

Bronze Award: Green Country Not Green House - Reducing PFC's from a Legacy Factory

IFO Team (Kevin Gallagher missing from photo)
Team Members: Michael Cullen, Dara O' Donovan, Greg Nolan, John Corcoran, Tom O'Malley, Kevin Gallagher (Missing from Photograph:- Kevin Gallagher)

2. Events

Intel Ireland 20th Anniversary

Friday, November 27th marked a special a day for Intel as they celebrated the 20th Anniversary of operations in Ireland.

The event was attended by a number of special guests who have been a part of Intel Ireland's remarkable journey. These guests along with Intel Ireland employees at the Leixlip campus met to commemorate this significant day and reflect upon the milestones and memories of the past 2 decades

An Taoiseach Brian Cowen who said, "*I would like to acknowledge and congratulate the wonderful achievements of Intel throughout its 20 year history in Ireland. Building on one of the nations greatest resources – our intellectual capital, Intel Ireland has* *consistently surpassed expectations and gone beyond its core mandate. The employees at Intel Ireland are a great example of what can be achieved when the Irish put their minds to it*".

Taoiseach Brian Cowen speaking to Intel Irealnd and inivted guests at an event to celebrate Intel Ireland 20th anniversary in Ireland.

Intel celebrates 20 years in Ireland.

<u>3. Environmental Awareness</u>

<u>*Environmental Awareness Stand*</u>

In February 2009, the Environmental department held an Environmental Awareness week at the site. The purpose of this awareness stand was part of EHS's plans to raise Environmental Awareness within the Ireland site. Currently Ireland's main focus is on external/public environmental awareness.

There were numerous stands giving information to the employees. The first stand was focused on recycling in the home, how to reduce your household waste and make your home greener. As well as this, there was information on local County Council Waste Facilities. Also available was information on recycling rates and targets for non-hazardous waste within Intel with recycling and disposal rates for Q4 2008. Feedback questionnaires were provided as well as free reusable bags to participants.

Hannah Daly and Rachael Ramsey from EHS host the stand in Intel's canteen

Energy Awareness Stand

In April 2009, the Environmental department in conjunction with the Energy Manager held an Energy Awareness stand. Employees were given useful tips on how to reduce their Electricity/Energy bills at both home and at work. Indicators were also given on how Intel Ireland was performing over the last 5 years in relation to Electricity, Energy and Natural Gas Usage

4.0 LICENCE-SPECIFIC REPORTS

4.1 GROUNDWATER MONITORING SUMMARY REPORT

Condition 6.1 of the IPPC licence requires that:

> *The licensee shall carry out such sampling, analyses, measurements, examinations, maintenance and calibrations as set out below and as in accordance with Schedule C of this licence.*

The required monitoring as specified in Schedule C.6.3 is outlined below:

Table 4.1: IPPC Licence Monitoring Schedule C.6.3

Parameter	Monitoring Frequency	Analysis method/Technique
pH	Biannually	pH electrode/meter
COD	Biannually	Standard Method
Nitrate	Biannually	Standard Method
Total Ammonia	Biannually	Standard Method
Total Nitrogen	Biannually	Standard Method
Conductivity	Biannually	Standard Method
Chloride	Biannually	Standard Method
Fluoride	Biannually	Standard Method
Organohalogens	Biannually	GC-MS

Note 1: Screening for priority pollutant list substances (such as US EPA volatile and/or semi-volatile compounds.

Intel Ireland commissioned TMS Environmental Ltd. to carry out the groundwater sampling and analysis and a summary report for both biannual monitoring events is detailed below:

EXECUTIVE SUMMARY

Biannual groundwater sampling was carried out on 10th, 12th, 17th and 26th February and on 5th, 6th, 10th, 11th, 12th and 13th August and 1st September 2009 to satisfy the IPPC Licence requirements of Intel Ireland Ltd. Re-sampling of MW15 was carried out on 1st September 2009. Tables A & B below provide a summary of the results compared to the EPA Interim Guideline Values (IGV) and the Drinking Water Limits (S.I. No. 278 of 2007) for those parameters where available. Results which exceed the EPA IGV are shown in bold text.

All results reported were below the Drinking Water Limits set out in S.I. No. 278 of 2007 for the first biannual monitoring carried out in February 2009. During this monitoring round Chloride levels in MW16 were seen to decrease when compared to 2008. The Total Ammonia exceedance to the Drinking Water Limit reported for MW12 during October 2008 was no longer an issue as the result was <0.01 mg/L N during the first biannual monitoring event of 2009.

All results for the second biannual monitoring event were below the drinking water limits with the exception of pH in MW12 and Total Ammonia in MW7. The EPA IGV pH limits match the drinking water limit for pH of >6.5 and <9.5 in the second monitoring round of 2009, the pH of MW12 was found to be just below the limits at a pH of 6.4 (historically the pH at MW12 has varied from 6.96 to 7.66). This well will continue to be monitored.

During the second biannual monitoring event, it was found that elevated Conductivity, Chloride, and Total Ammonia levels historically detected in groundwater at the Intel site are likely to originate from off site and are the subject of a separate report to the EPA.

On comparison of results with the EPA's IGVs, some wells exceeded the IGV for conductivity during the first monitoring event (MW4, MW13, MW14, MW15 and MW16) and the second monitoring event (MW1, MW4, MW13, MW14, MW15 and MW16). It is likely that the source of elevated conductivity originates from off-site due to the fact that MW1 and MW13 are control wells

(on site boundary) and MW14, MW15 and MW16 are downstream of these wells. In addition, there are no Intel operations between the site boundary and MW14 and MW15. MW4 has shown historically to have a high conductivity value above the EPA IGV. There has been little change in the background levels for these wells over the past number of sampling events. The fact that Electrical Conductivity is elevated both up-gradient and down-gradient of the site immediately suggests an ***off-site source*** *for the elevated concentrations observed. EC concentrations are not uniformly elevated in groundwater across the site, suggesting that it is* ***not a single point source*** *up-gradient of the site. Also, concentrations at individual monitoring points vary with time, suggesting a* ***discontinuous source*** *with pollution of groundwater occurring at varying rates (e.g. like a leaking sewer).*

The concentration for chloride recorded in a number of wells exceeded the EPA IGV of 30mg/l in the first monitoring event (MW1, MW2, MW5, MW13, MW14, MW15, MW16 and MW19) and the second biannual monitoring event (MW1, MW2, MW5, MW8, MW12, MW14, MW16 and MW20). Chloride has been historically elevated above the EPA IGV in MW1, MW2, MW5, MW13, MW14, MW16 and MW19. It can be demonstrated that the source of elevated chloride is likely to originate from off-site due to the fact that MW1 and MW13 are control wells (on site boundary) and MW14, MW15 and MW16 are downstream of these well. In addition, there are no Intel operations between the site boundary and MW14 and MW15. Concentrations above the EPA IGV in MW8, MW12 and MW20 are not historically as consistently elevated. On examination of the historical chloride results for all the wells on site, there is a background level of approximately 25-30mg/l, as would be expected for this area of Ireland. Chloride concentrations are consistently elevated in monitoring wells MW1 up-gradient of the site and MW14 at the eastern perimeter of the site. Sampling of other wells shows occasionally elevated concentrations above background, however the elevated concentrations are not sustained.

Fluoride in MW12 exceeded the EPA's IGV of 1.0 mg/l F during the first biannual monitoring event of 2009, with a result of 1.26mg/l. The concentration of fluoride in the background groundwater quality has been measured to date up to 0.7 mg/l. These concentrations are similar to the *concentrations detected down-gradient of the site, therefore we believe the concentrations down-gradient are naturally occurring. We therefore do not recommend further action. The fluoride level in MW12 has returned to below the EPA IGV in the second biannual monitoring event of 2009 and therefore no action is recommended. A observation report on the occurrence of fluoride in groundwater at the Intel Ireland Ltd. site was completed by TMS Environment Ltd. and submitted to the Agency.*

Total Ammonia was found to exceed the EPA IGV of 0.15 mg/l (as NH_4) in one well during the first biannual monitoring event (MW5, 0.16 mg/l as NH_4) and in three wells on site during the second biannual monitoring event (MW7 (0.59 mg/l as NH_4), MW15 (0.193mg/l as NH_4) and MW18 (0.154 mg/l as NH_4). The presence of Total Ammonia in groundwater in the up-gradient well (MW7) suggests an off-site source of organic pollution. The two possible off-site sources up-gradient of the site are the Local Authority sewer running along the Maynooth - Leixlip road and agricultural activity up-gradient of the site. Given that the agricultural land up-gradient of Intel does not appear to be intensively grazed, the likely source is the Local Authority sewer. MW5, MW15 and MW18 are situated to the north and north-east of MW7 and as the groundwater flow direction is in a north north-easterly direction it is suggested that the rise in Total Ammonia at these locations is due to external factors.

No Volatile Organic Compounds (VOCs) were detected above the laboratory detection limit in any groundwater samples tested during 2009.

Table 4.2 - First Biannual Monitoring Results (February 2009) Summary Table

Parameter	Units	MW1	MW2	MW3	MW4	MW5	MW7	MW8	MW9	MW10	EPA Interim Guideline Value (IGV)	Drinking Water Limits (S.I. No. 278 of 2007)
pH		7.2	7.4	7.3	7.4	7.3	7.5	7.4	7.34	7.04	>6.5 and <9.5	>6.5 and <9.5
Conductivity	µS/cm	998	527	632	**1164**	906	363	700	527	667	1000 µS/cm	2500 µS/cm
COD	mg/l O_2	<5	<5	<5	<5	<5	<5	25	<5	<5	-	-
Nitrate	mg/l NO_3	<3	<3	<3	<3	<3	9.3	3.52	3.77	<3	25 mg/l NO_3	50 mg/l NO_3
Total Ammonia	mg/l (as NH_4)	0.013	0.013	0.013	0.013	**0.156**	0.013	0.013	0.013	0.013	0.15 mg/l as NH_4	0.3 mg/l as NH_4
Total Nitrogen	mg/l N	0.7	1.1	0.1	<0.5	0.2	1.3	2.8	0.5	0.8	-	-
Chloride	mg/l Cl	**160**	**43**	27	21	**35**	8	30	17	25	30 mg/l Cl	250 mg/l Cl
Fluoride	mg/l F	0.22	0.3	0.19	0.41	0.6	0.08	0.09	0.14	0.15	1 mg/l F	1.5 mg/l F

Parameter	**Units**	**MW11**	**MW12**	**MW13**	**MW14**	**MW15**	**MW16**	**MW17**	**MW18**	**MW19**	**MW20**	**EPA Interim Guideline Value (IGV)**	**Drinking Water Limits (S.I. No. 278 of 2007)**
pH		7.20	7.20	7.20	7.80	7.40	7.40	7.30	7.30	7.30	7.30	>6.5 and <9.5	>6.5 and <9.5
Conductivity	µS/cm	624	611	**1058**	**1189**	**1011**	**1174**	779	402	613	690	1000 µS/cm	2500 µS/cm
COD	mg/l O2	98	<5	<5	<5	<5	<5	<5	441	<5	16.5	-	-
Nitrate	mg/l NO3	<3	<3	<3	3.34	<3	7.38	<3	<3	11	16.5	25 mg/l NO_3	50 mg/l NO_3
Total Ammonia	mg/l (as NH_4)	0.013	0.013	0.023	0.013	0.062	0.024	0.013	0.013	0.013	0.013	0.15 mg/l as NH_4	0.3 mg/l as NH_4
Total Nitrogen	mg/l N	0.2	1.1	1.1	0.2	1.2	1.5	0.3	0.4	1.5	3.6	-	-
Chloride	mg/l Cl	26	28	**40**	**235**	**35**	**53**	25	10	**35**	25	30 mg/l Cl	250 mg/l Cl
Fluoride	mg/l F	0.2	**1.26**	0.14	0.49	0.14	0.17	0.31	0.36	0.46	0.12	1 mg/l F	1.5 mg/l F

Table 4.3 Second Biannual Monitoring Results (August 2009) Summary Table

Parameter	Units	MW1	MW2	MW3	MW4	MW5	MW7	MW8	MW9	MW10	EPA Interim Guideline Value (IGV)	Drinking Water Limits (S.I. No. 278 of 2007)
pH		7.4	7.6	8.0	7.7	7.5	7.5	7.3	7.0	7.6	>6.5 and <9.5	>6.5 and <9.5
Conductivity	µS/cm	**1053**	645	716	**1141**	958	681	841	666	710	1000 µS/cm	2500 µS/cm
COD	mg/l O_2	8	9	6	<5	<5	7	7	11	<5	-	-
Nitrate	mg/l NO_3	<1	<1	<1	<1	<1	<1	1.49	<1	<1	25 mg/l NO_3	50 mg/l NO_3
Total Ammonia	mg/l (as NH_4)	0.026	0.026	0.052	0.013	0.09	**0.59**	0.103	0.039	0.013	0.15 mg/l as NH_4	0.3 mg/l as NH_4
Total Nitrogen	mg/l N	1.3	1.8	1.3	<1.2	2	1.8	<1.2	<1.2	2.5	-	-
Chloride	mg/l Cl	**95**	**47**	27	22	**31**	17	**32**	22	26	30 mg/l Cl	250 mg/l Cl
Fluoride	mg/l F	0.24	0.31	0.2	0.43	0.67	0.23	0.11	0.16	0.2	1 mg/l F	1.5 mg/l F

Parameter	**Units**	**MW11**	**MW12**	**MW13**	**MW14**	**MW15**	**MW16**	**MW17**	**MW18**	**MW19**	**MW20**	**EPA Interim Guideline Value (IGV)**	**Drinking Water Limits (S.I. No. 278 of 2007**
pH		7.7	**6.4**	7.1	7.4	7.6	7.5	7.5	7.4	7.4	7.2	>6.5 and <9.5	>6.5 and <9.5
Conductivity	µS/cm	794	793	**1130**	**1338**	**1138**	**1219**	985	525	684	771	1000 µS/cm	2500 µS/cm
COD	mg/l O2	8	<5	6	<5	25	36	7	84	48	39	-	-
Nitrate	mg/l NO3	<1	1.12	<1	1.14	1.74	1.23	<1	<1	1.5	3.42	25 mg/l NO_3	50 mg/l NO_3
Total Ammonia	mg/l (as NH_4)	0.013	0.013	0.013	0.013	**0.206**	0.013	0.077	**0.155**	0.052	0.013	0.15 mg/l as NH_4	0.3 mg/l as NH_4
Total Nitrogen	mg/l N	3	<1.2	<1.2	<1.2	<1.2	<1.2	3.0	<1.2	<1.2	<1.2	-	-
Chloride	mg/l Cl	18	**31**	27	**220**	23	**35**	23	18	27	**31**	30 mg/l Cl	250 mg/l Cl
Fluoride	mg/l F	0.38	0.6	0.21	0.54	0.117	0.16	0.31	0.35	0.37	0.14	1 mg/l F	1.5 mg/l F

4.2 RIVER RYE WATER MONITORING REPORT

As per Condition 6.1 and Schedule C.6.4 of the IPPC Licence the River Rye water was sampled for the following range of parameters:

C.6.4 Receiving Water Monitoring

Location: RW1, RW2, RW3, RW4, RW5

Parameter	Monitoring Frequency	Analysis Method/Technique
pH	Bi-annually	pH electrode/meter
Conductivity	Bi-annually	Conductivity meter
Temperature	Bi-annually	Thermometer
DO	Bi-annually	Standard Method
BOD	Bi-annually	Standard Method
Suspended solids	Bi-annually	Standard Method
Nitrate	Bi-annually	Standard Method
Nitrite	Bi-annually	Standard Method
Ammonium	Bi-annually	Standard Method
Chloride	Bi-annually	Standard Method
Fluoride	Bi-annually	Ion-selective electrode
Total Phosphorous	Bi-annually	Standard Method
Heavy metals [Note 1]	Bi-annually	Atomic absorption/ICP

Note 1: The sum of arsenic, chromium, copper, nickel, lead, tin and cobalt.

Intel Ireland commissioned Bord na Móna Environmental Ltd to carry out an assessment of the quality of surface waters at a number of locations along the River Rye, upstream and downstream of the surface water retention pond outlet (i.e. discharge point to the river). Locations RW-1, RW-2 and RW-3 are upstream and locations RW-4 and RW-5 are downstream of the discharge point from the Intel Ireland site. The executive summary from the second biannual report is detailed below along with sample results from the biannual analyses. The results of the analysis are included in tables 4.4 and 4.5.

Executive Summary

Intel (Ireland) Ltd. is required to carry out an assessment on a bi-annual basis, at its site in Leixlip, Co. Kildare, of the water quality of the River Rye to comply with Schedule C.6.4. (Receiving Water Monitoring) of its Integrated Pollution Prevention and Control Licence, Reg. No. P0207-03. Bord na Móna Technical Services was contracted to assess the quality of surface waters at a number of *points along the river, including upstream and downstream of the surface water retention outlet (i.e. discharge point to the river).*

The site was visited by Bord na Móna Environmental Scientists on the 13th of May and the 12th of August 2009 to conduct the first and second bi-annual assessments, respectively. A total of five surface water samples were returned to the laboratory for analysis for each monitoring event. Results obtained were compared with the European Communities "Quality of Surface Water Intended for the Abstraction of Drinking Water Regulations, 1989."

The surface water samples taken from the River Rye, both upstream and downstream of the Intel facility, are of good quality; and there are no exceedences of the legislative limits for any of the parameters measured.

Based on the results obtained, there is no difference in the water quality of the River Rye between the sampling points located upstream and downstream of the Intel (Ireland) Ltd. site, indicating that the surface water discharges from this site are not resulting in any environmental impacts on the receiving waters.

The results of the investigation carried out by Bord na Móna Technical Services are presented in Tables 4.4 and 4.5 below.

Table 4.4 Monitoring Results for River Rye Water – May 2009

Surface Water Sampling Locations						
Parameter	**RW-1**	**RW-2**	**RW-3**	**RW-4**	**RW-5**	**WQS S.I. 294 of 1989**
pH (pH units)	8.0	8.2	8.0	8.0	8.1	*5.5 – 8.5*
Temperature (°C)	12.1	12.3	12.4	12.0	12.0	*25*
Dissolved Oxygen (%)	115.03	112.85	125.93	123.15	114.82	*>60%*[1]
Ammonia-N (mg/l)	0.03	0.03	0.05	0.05	0.02	*0.15**
B.O.D. (mg/l)	<2	<2	<2	<2	<2	*5*
Conductivity (µS/cm @	656	647	646	636	635	*1000*
Suspended Solids (mg/l)	<5	<5	<5	<5	<5	-

Chloride (mg/l)	24	25	24	24	25	*250*
Fluoride (mg/l)	0.11	0.14	0.12	0.12	0.14	*1.0*
Nitrate-N (mg/l)	1.43	1.27	1.31	1.24	0.84	*11.29**
Nitrite-N (mg/l)	<0.02	<0.02	<0.02	<0.02	<0.02	-
Total Phosphorus (mg/l)	<0.05	<0.05	<0.05	<0.05	<0.05	-
Arsenic (µg/l)	<2	<2	<2	<2	<2	*50*
Cobalt (µg/l)	<2	<2	<2	<2	<2	-
Copper (µg/l)	10	10	4	7	10	*50*
Lead (µg/l)	<2	<2	<2	<2	<2	*50*
Nickel (µg/l)	4	3	3	3	3	-
Tin (µg/l)	<2	<2	<2	<2	<2	-
Chromium (µg/l)	<2	<2	<2	<2	<2	*50*

Note: River Rye sampling points located upstream of the Intel surface water discharge point are shaded in blue.

WQS = Water Quality Standard

S.I. 294 of 1989: Water Quality Standard = Water Quality Standards set in the European Communities (Quality of Surface Water Intended for the Abstraction of Drinking Water) Regulations, 1989. Limit values for A1 waters are shown.

* Converted Water Quality Standard for Nitrite, Nitrate and Ammonia as N (mg/l).

Table 4.5 Monitoring Results for River Rye Water – August 2009

Surface Water Sampling Locations						
Parameter	**RW-1**	**RW-2**	**RW-3**	**RW-4**	**RW-5**	**WQS S.I. 294 of 1989**
pH (pH units)	7.9	7.9	8.1	8.2	8.2	*5.5 – 8.5*
Temperature (°C)	13.6	14.2	13.3	13.7	13.9	*25*
Dissolved Oxygen (%)	100.1	90.4	114.8	110.5	115.2	*>60%[1]*
Ammonia-N (mg/l)	0.03	0.07	<0.02	<0.02	<0.02	*0.15**
B.O.D. (mg/l)	<2	<2	<2	<2	<2	*5*
Conductivity (µS/cm @	656	540	656	650	640	*1000*
Suspended Solids (mg/l)	<5	<5	<5	<5	<5	-
Chloride (mg/l)	<0.02	0.05	<0.02	<0.02	0.02	*250*
Fluoride (mg/l)	<0.10	0.22	0.10	<0.10	<0.10	*1.0*
Nitrate-N (mg/l)	0.68	0.43	0.77	0.77	0.74	*11.29**
Nitrite-N (mg/l)	<0.03	<0.03	<0.03	<0.03	<0.03	-

Total Phosphorus (mg/l)	<0.05	<0.05	<0.05	<0.05	<0.05	-
Arsenic (µg/l)	<2	<2	<2	<2	<2	*50*
Cobalt (µg/l)	<2	<2	<2	<2	<2	-
Copper (µg/l)	<2	4	<2	<2	<2	*50*
Lead (µg/l)	<2	<2	<2	<2	<2	*50*
Nickel (µg/l)	<2	<2	<2	<2	<2	-
Tin (µg/l)	<2	<2	<2	<2	<2	-
Chromium (µg/l)	<2	<2	<2	<2	<2	*50*

Note: River Rye sampling points located upstream of the Intel surface water discharge point are shaded in blue.

WQS = Water Quality Standard

S.I. 294 of 1989: Water Quality Standard = Water Quality Standards set in the European Communities (Quality of Surface Water Intended for the Abstraction of Drinking Water) Regulations, 1989. Limit values for A1 waters are shown.

* Converted Water Quality Standard for Nitrite, Nitrate and Ammonia as N (mg/l).

4.3 LOUISA SPA WATER QUALITY MONITORING REPORT

Introduction

As per Schedule C.6.5 of the site IPPC licence, the following monitoring is required:

Location: Mineral spring at Louisa Bridge

Parameter	Monitoring Frequency	Analysis Method/Technique
pH	Annually	pH electrode/meter
Conductivity	Annually	Conductivity meter
Temperature	Annually	Thermometer
TOC	Annually	Standard Method
Major anions: nitrate, nitrite, chloride, sulphate, fluoride	Annually	Standard Method
Major cations: calcium, magnesium, sodium, potassium, ammonia	Annually	Standard Method
Heavy metals: iron, manganese, copper, tin, chromium, lead, nickel, cobalt	Annually	Atomic absorption/ICP

The services of TMS Environment Ltd. were employed to carry out the sampling and analysis of this well and their report is summarised below. The Louisa Spa is located outside the Intel Ireland site boundary.

EXECUTIVE SUMMARY

A sample of water was collected was from the Louisa Spa Spring at Louisa Bridge, which is east of the Intel Campus buildings. Sampling was conducted to comply with the annual monitoring requirements as specified in the sites IPPC Licence Reg No. P0207-03.

The water sample was analysed for the following parameters;

- Conductivity,
- pH,
- Temperature,
- Total Ammonia,
- Chloride,
- Sulphate,
- Nitrate,

- Nitrite,
- Fluoride,
- Calcium,
- Magnesium,
- Sodium,
- Potassium,
- TOC and,
- Trace Metals.
- Temperature and Conductivity were measured *in situ*.

The results recorded were compared to the Irish Drinking Water Limits (S.I. No. 278 of 2007) and were found to be within accepted norms with the exception of Chloride (535 mg/l) and Sodium (229 mg/l) however these concentrations are similar to the results detected during previous monitoring events as can be seen from Table 4.6 below.

It may be noted that the limit values are for comparison purposes, and the spa water is not used as a drinking water source. There has been no significant change in the monitored water quality to date.

Table 4.6 - Summary Table of Annual Results

Parameter	**Unit**	**April 2003**	**April 2004**	**April 2005**	**Oct 2006**	**April 2007**	**July 2008**	**Aug 2009**	**Drinking Water Limit (S.I. No. 278 of 2007)**
pH		7.36	7.28	7.41	7.01	7.3	8	8.03	>6.5 and <9.5
Conductivity	µS/cm @ 20 °C	1670	1746	1711	1634	987	1602	1856	2500 µS/cm
Temperature	°C	15.8	16.5	17.2	17.1	15	22.8	18.5	-
Total Organic Carbon	mg/l C	8.4	-	<0.5	1.4	2.8	2.8	3	No abnormal change

Nitrate	mg/l NO_3	<1	<5	<1	14	4.3	6.33	1.53	50 mg/l
Nitrite	mg/l N	<0.005	<0.005	<0.005	0.005	<0.005	<0.005	<0.02	0.5 mg/l
Chloride	mg/l	471	350	31	550	485	435	535	250 mg/l
Sulphate	mg/l SO_4^{2-}	65	55	56	105	58	44	50.5	250 mg/l
Fluoride	mg/l F	0.49	0.08	0.44	0.19	0.43	0.50	0.39	1.5 mg/l
Calcium	mg/l	215	169	119	114	65	125	115	-
Magnesium	mg/l	56	50	30	32	23	31	29	-
Sodium	mg/l	180	282	222	21	90	210	229	200 mg/l
Potassium	mg/l	34.5	8.2	8.8	8	8.1	13	8.4	-
Total Ammonia	mg/l N	0.5	<0.02	0.08	0.152	0.14	<0.01	0.012	0.23 mg/l
Copper	µg/l	2	<50	<10	-	<10	<50	< 50	2000 µg/l
Tin	µg/l	<2	<50	<10	110	<10	<10	< 10	-
Chromium	µg/l	3	<50	<10	<5	<5	<5	< 5	50 µg/l
Cobalt	µg/l	<0.1	<50	<10	<5	<10	<10	< 10	-
Lead	µg/l	<0.5	<50	<5	<10	<10	<10	<10	25 µg/l
Nickel	µg/l	<0.6	<50	<10	<10	<20	<20	< 20	20 µg/l
Iron	µg/l	3	<50	370	450	320	<5	< 5	200 µg/l
Manganese	µg/l	48	<50	54	50	70	<5	< 5	50 µg/l

Shaded cells indicate results exceeding the Drinking Water Limits

< Denotes less than the laboratory detection limit

4.4 SURFACE WATER DISCHARGE SUMMARY REPORT

Under Condition 6.1 of the IPPC licence, we are required to carry out the monitoring as detailed in Schedule C.2.3. A summary of the analysis results is detailed in the following table.

Table 4.7 - Summary of Monitoring Results SW1 (Storm Water Emissions), 2008 and 2009.

Parameter	Monitoring Frequency	Units	Average Emission 2008	Average Emission 2009
pH	Continuous	pH	8.2	8.0
Conductivity	Weekly	µS/cm	570.5	520.9
COD	Weekly	mg/l	<16.0	<15.6
TOC	Weekly	mg/l	<5.4	<5.0
Arsenic	Biannual	µg/L	<2	<2
Chromium	Biannual	µg/L	<2	<2
Cobalt	Biannual	µg/L	<3	<2
Copper	Biannual	µg/L	12	8.5
Nickel	Biannual	µg/L	3	<2
Tin	Biannual	µg/L	<2	<2
Lead	Biannual	µg/L	<2	<2

4.5 RESIDUAL MANAGEMENT PLAN

As per Condition 10 of the site's IPPC licence, a Residuals Management Plan (RMP) is maintained for the Intel Ireland site. The 2007 update of the RMP (which takes into account changes in site operations, the increase of costs associated with waste removal and decontamination) was completed and a copy was provided to the EPA during a site visit on 21st January 2009. This plan will be update over the course of 2010 to take account of the decommissioning of Fab 14 in 2009.

4.6 PER FLUORINATED CARBON (PFC) EMISSIONS REPORT

Following correspondence between the EPA and Intel Ireland during 1999, the following programme was agreed on 17th May 1999 under EPA reference M207/GC/11 in relation to substances that have a significant global warming potential:

> *In view of the company's argument that details of gas usage would place the company at a competitive disadvantage, details of inputs and outputs need not be given in any written report to the Agency, but individual annual tonnage figures for Emissions of C_2F_6, CF_4, and SF_6 must be reported separately. A full record of how the figures were calculated must be available on-site at Intel Ireland Ltd to authorised persons of the Agency at all times.*

The tables at the end of this section give individual annual tonnage figures for emissions of the three gases required by the Agency (C_2F_6, CF_4, and SF_6) and a consolidated figure for three other fluorinated gases (CHF_3, NF_3 and C_4F_8). For ease of comparison between each of the gases and to allow for comparison from year to year, the emissions have also been expressed as Million Metric Tonnes Carbon Equivalent (MMTCE) which is a standard way for expressing emissions of PFC's.

The 2009 data was compiled and computed in the following manner:-

Several companies such as Air Products, Praxair, and BOC etc. supply Intel Ireland with speciality gases for their manufacturing process. These gases are issued on a periodic basis from Intel Ireland's chemical and gas warehouses to the fabrication manufacturing plant. Intel Ireland then produces a report detailing the number and size of gas cylinders issued to the wafer fabrication operations.

In calculating emissions, a constantly improved method is periodically agreed between all European semiconductor-manufacturing facilities. These companies are members of European Semiconductors Industry Association (ESIA). The data from each company is then collated for this association on an aggregate basis annually to give one emission data point notated in MMTCE units. (Million Metric Tonnes Carbon Equivalent – an universally accepted metric for global warming impact). The collation of the Intel Ireland data is kept by the Environmental Engineer on a shared drive within the department's EMS data retention system.

For methodical calculations, the assumption currently adopted within the industry and ratified by the world semiconductor council (WSC) is that an agreed documented % of each gas is consumed efficiently during manufacturing and conversely a fixed % of gas is emitted to atmosphere (Tier 2a). Such generic assumptions are being refined across the industry globally under the remit of the WSC (World Semiconductor Council). A new calculation methodology has been adopted by ESIA which takes into account the efficiency of removal of GWP gases from point of use (POU) abatement devices deployed between the tool and the large on-site gas scrubbers. In calculating the Metric Tonnes Carbon Equivalent (MTCE) emission data, there are also assumptions taken on the global warming potential of each gas and the fact that some gases such as C_2F_6 after use can also form other by-products such as CF_4. All this information is managed within the ESIA excel spreadsheets and is summarized in terms of emissions as MMTCE in the table below. The Global Warming Potential (GWP_{100}) for each of the Gases is taken from the Intergovernmental Panel on Climate Change (IPCC) 4th Assessment Report. The GWP_{100} values have been presented below for information purposes.

GWP_{100} Values from 4th IPCC Assessment Report

C_2F_6 GWP = 12,200 CHF_3 GWP = 14,800

SF_6 GWP = 22,800 NF_3 GWP = 17,200

CF_4 GWP = 7,390 C_4F_8 GWP = 10,300

Intel Ireland Ireland's Emissions of PFC's

The tables below give details of emissions of PFCs for 2008 and 2009.

Table 4.8 - 2008 Emissions using 4th IPPC Assessment Report GWP_{100} Values (Tier 2a Methodology)

Parameter	Emissions (Metric Tonnes)	MMTCE
C_2F_6	8.48	0.0282
CF_4	2.84	0.0057
SF_6	0.77*	0.0048*
CHF_3, NF_3, C_4F_8	3.78	0.0161

Total PFC's	**15.77**	**0.0548**

* These figures do not include an accidental venting of one cylinder of SF_6 in late 2008. This venting was equivalent to 0.0032 MMTCE. If this venting is included in the table above, the Total Emissions would equate to 0.0574 MMTC (i.e. an increase of 6%).

Table 4.9 - 2009 Emissions using 4th IPPC Assessment Report GWP_{100} Values (Tier 2a Methodology)

Parameter	Emissions (Metric Tonnes)	MMTCE
C_2F_6	4.77	0.016
CF_4	0.81	0.002
SF_6	0.66	0.004
CHF_3, NF_3, C_4F_8	2.57	0.011
Total PFC's	**8.81**	**0.0326**

During 2009, Intel Ireland also calculated its emissions using a more precise method known as "Tier 3". This uses process specific emissions factors for each of the process gases. This method gives a result which is higher than that calculated by Tier 2a. Table 4.10 provides this data for 2009.

Table 4.10 - 2009 Emissions using 4th IPPC Assessment Report GWP_{100} Values (Tier 3 Methodology)

Parameter	Emissions (Metric Tonnes)	MMTCE
C_2F_6	5.03	0.017
CF_4	2.21	0.004
SF_6	1.56	0.010
CHF_3, NF_3, C_4F_8	2.55	0.011
Total PFC's	**11.35**	**0.0420**

For a number of years, Intel Ireland has been pursuing various reduction initiatives such as gas usage reduction with the introduction of each new process technology, gas substitution for example by the replacement of C_2F_6, in certain recipes, with alternative gases. During 2009, Intel Ireland completed its project to replace C_2F_6 on some tools in IFO with a gas which has a greater utilization rate. This means that the quantity of gas used and PFC emissions (expressed as MMTCE) are lowered.

Finally, it should be noted that emission calculation methodologies may well change in the coming years as improved calculation systems are formally adopted and verified by analytical methods across the semiconductor associations such as SIA (Semiconductor Industry Association of America), ESIA (European Semiconductor Industry Association), KIA (Korean Semiconductor Industry Association), JIA (Japanese Semiconductor Industry Association), to accommodate for example for the introduction of new gases, or alternate point of use abatement technologies.

4.7 AMBIENT AIR MONITORING SUMMARY

Ambient Air Monitoring was carried out at the Intel Ireland facilities in accordance with Schedule C.6.1. of the IPPC Licence.

The parameters to be measured were Oxides of Nitrogen (Continuous), Nitrogen Dioxide (Bi-annual), Total Fluoride (Bi-annual) and Total Acidity (Bi-annual).

A continuous monitor measuring Oxides of Nitrogen is installed at the on-site weather station and the results are trended on a monthly basis.

Nitrogen Dioxide diffusion tubes are placed at five locations surrounding the site. Results from May 2009 show a range of 5 to 19 ug/m^3 while results from December 2009 show a range of 11 to 16 ug/m^3.

In addition, ambient air monitoring surveys were carried for the following periods:-

- 22nd – 28th May 2009
- 14th – 21st December 2009

These surveys were conducted at two sampling locations, A1 and A2. A1 is located close to the on-site sports centre (to the south west of the facility) while A2 is located in the field to the north of the facility.

The monitoring was carried out by Site Right Environmental Ltd. and TMS Environmental Ltd. Below is an extract from the TMS report on this monitoring:-

> *There is no significant difference in levels of the pollutants found at these two locations which would indicate the client's site had an impact on ambient air quality. All ambient total fluoride concentrations measured during the course of the survey were below or close to the limit of detection at both monitoring locations. Total acidity levels were below the limit of detection at both monitoring locations during the course of the survey.*

4.8 FUGITIVE EMISSIONS PROGRAMME

The company is required under Condition 6.7.2 of the IPPC Licence to maintain a fugitive emissions program in order to achieve the limits specified in Condition 6.7.1. That condition specifies that fugitive emission losses shall not exceed 15% of total solvent input.

Fugitive emissions from Intel Ireland are minor and well controlled. They primarily arise from the use of Isopropyl Alcohol (IPA) used for cleaning of equipment and surfaces within the cleanrooms. This IPA is used either as saturated wipes or as a liquid in combination with dry wipes.

On a quarterly basis, "VOC Indicators" are calculated. These calculate the total quantity of solvents used as well as the fugitive emissions. These calculations confirm that fugitive losses are well below the limit of 15% (as a percentage of total solvent use) set in Condition 6.7.1. The company intends to keep in place current controls on the use of IPA to continue to remain in compliance with this limit.

Furthermore, the company submitted a proposal to the EPA in May 2006 in relation to draft criteria for shutting down production processes in the event of non-compliance, equipment failure and/or by-pass. The Agency approved this proposal by letter dated 13th June 2006 subject to a number of conditions including the requirement that "All by-passes (of the VOC abatement equipment) shall be recorded and included in the fugitive emissions reduction programme".

All such by-passes (>1 hour duration) are recorded (and communicated to the Agency) and these by-passes are included in the calculation of the quarterly VOC Indicators. Every effort is made to bring the Abatement Equipment back on line in the shortest possible time.

During 2009, there were only 3 periods when VOC abatement equipment was offline across the site – two for preventative maintenance and one due to failure of a unit. These occurrences were all less than 2 days.

Furthermore, the company retains in place the protocol which was introduced in 2007 to ensure that by-passes of abatement units are minimised and any by-passes which last for longer than one week are communicated to and approved by senior site management.

4.9 NOISE MONITORING REPORT

A copy of the 2008Annual Noise Monitoring Report is included in Appendix B of this Report.

4.10 BUND TESTING REPORT

Under Condition 3.6.6 of Intel Ireland's IPPC licence (Register No. P0207-03), Intel Ireland is required to carry out bund integrity testing at least every three years. Intel Ireland commissioned Project Management Ltd. to carry out visual bund inspections by a qualified structural engineer in 2009. In addition, all bunds were assessed to determine whether it was necessary, safe and practicable to conduct hydrostatic testing in line with the EPA's Guidance Note on Storage and Transfer of Materials for Scheduled Activities. The bund integrity assessment report is included in Appendix C of the report. A number of bunds require repair and/or hydrostatic testing and Intel will repair and hydrostatically test the identified bunds and submit an integrity test report on these in the 2010 AER.

4.11 UNDERGOUND PIPE AND TANK INTEGRITY TESTING SUMMARY

Under Condition 6.6 of Intel's IPPC licence (Register No. P0207-03), Intel Ireland is required to ensure that:

> *6.6 The integrity and water tightness of all underground pipes and tanks and their resistance to penetration by water or other materials carried or stored therein shall be tested and demonstrated by the licensee at least once every three years and reported to the Agency on each occasion. A written record of all integrity tests and any maintenance or remedial work arising from them shall be maintained by the licensee.*

The Fab 10 and Fab 14 process effluent pipe integrity testing was completed in 2008 and the survey found that the Fab 10 and Fab 14 pipe's inner lining was damaged in sections. The F10 and F14 process effluent pipes were relined and resurveyed in 2009 and found to be in satisfactory condition. Please refer to Appendix D for full report.

In relation to underground tank testing, Intel commissioned AD Analytical Ltd. to conduct hydrostatic testing of the F10 upper and lower yard tanks and the site Effluent Balancing Tank (EBT). Both the F10 lower yard tank and the EBT tanks passed the integrity tests and the report is included in Appendix E. However, the Fab 10 upper yard tank had failed prior to the test taking place and therefore was not included in the report. An investigation is ongoing into the cause of the failure and this tank will be repaired and re-tested by the end of 2010. An integrity test report will be included in the 2010 AER.

4.13 FIREWATER RETENTION SUMMARY

A firewater risk assessment was carried out in March 2003 to determine if the firewater retention facilities on site were adequate to contain contaminated firewater. This assessment took FAB 10, FAB 14, and FAB 24 into consideration, but it did not include the FAB 24-2 expansion.

Intel Ireland commissioned Jacobs Engineering Ltd. to revise the firewater risk assessment to include the FAB 24-2 expansion and the potential for a future FAB 24-3 expansion which are both included in the scope of the current IPPC licence (Register No. P0207-03). The revised firewater risk assessment report in included in Appendix F.