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Industry Sector Task

DECC, The Scottish Government, The Welsh Assembly Government and the Northern Ireland Department of the Environment

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Executive Summary

This research has been commissioned under the UK and DA GHG inventory improvement programme, and aims to research emissions data for a group of source sectors and specific sites where uncertainties have been identified in the scope and accuracy of available source data. Primarily this research aims to review site-specific data and regulatory information, to resolve differences between GHG data reported across different emission reporting mechanisms.

The research has comprised:

1) Data review from different reporting mechanisms (IPPC, EU ETS and EEMS) to identify priority sites (primarily oil & gas terminals, refineries and petrochemicals), i.e. sites where large differences are evident in emissions data reported under different mechanisms, or where the scope of reporting of emissions data is uncertain;
2) Gathering site-specific permits and information from public registers and environmental regulators of IPPC, EU ETS and EEMS;
3) Site visits, meetings and email / phone consultation with industry and regulatory contacts to resolve site-specific issues;
4) Analysis of information to derive revisions to the data used within the UK, DA and Local Authority inventory datasets, including revisions to site allocations;
5) Collation of site-specific information on stack parameters to provide updates to the AEA Pollution Climate Mapping team's stack database for a range of high-emitting sites.

The analysis of information obtained has enabled the following conclusions to be drawn:

Refineries
For refineries, emission estimates are available from IPPC and EU ETS, and also from direct consultation with the UK Petroleum Industries Association (UKPIA). EU ETS and IPPC emission estimates for 11 refineries across the UK were compared, with estimates showing good consistency for the majority of sites. Emission scope clarifications have been achieved for three refinery sites in England (North Tees, South Killingholme and Stanlow). A detailed review of the range of permits and activities across the Grangemouth refinery complex in Scotland has enabled clarification of the emission allocations between different sources; the Grangemouth complex comprises many inter-linked power, refining and petrochemical production facilities, and initial analysis had indicated that data inconsistencies may be evident, but these have now been resolved. The emission totals and allocations for the site within the NAEI programme have been resolved as a result of this work and all improvements will be integrated into the DA and Local Authority CO_2 emission inventories.

Oil and Gas Terminals
Comparison of the CO_2 emission estimates for 24 oil and gas terminals via EU ETS, IPPC and EEMS, indicated that for some sites the emissions data show good consistency, whilst for several sites there are some notable differences and patterns when the three datasets are compared.

The analysis shows that the CO_2 emission estimates for many terminals tend to follow some "typical" trends, as outlined below (although there are several exceptions):

IPPC > EEMS > EU ETS

Not all of the details for data inconsistencies are transparent, due to the lack of a clear scope of reporting (for EEMS, where there is no defined scope of installation) and a lack of detailed reporting (for IPPC, where all emission sources are aggregated in the published data). However, in many cases comparison of the different data sources indicates that differences in emission estimates are the result in the different scopes (emission sources) covered by the reporting mechanisms, notably the narrower scope of the EU ETS.

Sites where uncertainties remain about the reporting differences, and we await further clarifications or confirmation of our analysis findings from regulators include:

- Sullom Voe terminal
- SAGE terminal
- Kinneil terminal
- Theddlethorpe terminal

Sites where we have identified misallocations or data discrepancies within the NAEI point source work that have now been resolved include:

- BP Wytch Farm
- Interconnector Norwich
- Seal Sands terminal
- Teesside Gas Plant
- Innogy Cogen Seal Sands
- Point of Ayr terminal

Petrochemical and Other Sites

In addition to refineries and oil and gas terminals, a number of petrochemical/ chemical sites were identified as a high priority for investigation due to differences in emission estimates reported via the EU ETS and IPPC. Similar to the oil and gas terminals, for some of the petrochemical sites reviewed, the differences in emission estimates are the result in the different scopes (emission sources) covered by the reporting mechanisms, notably the narrower scope of the EU ETS. In addition, the inclusion of Petrochemical 'crackers' as Schedule 1 activities in Phase II of the EU ETS has been identified as accounting for the large increase in emission estimates from a number of organic chemical processing plant between 2007 and 2008.

Data discrepancies have also been resolved at two chemical sites in England (Tioxide Europe and Ineos Silica), whilst further information is awaited from Site Inspectors to resolve uncertainties at a further 5 chemical sites, all in England.

Summary

The research has enabled the AEA inventory team to resolve data discrepancies for a number of sites, and to conduct a wide-ranging quality check of several sectors where high uncertainties were evident in the GHGI datasets from different reporting mechanisms. For the majority of sites studied, the work has led to an improved understanding of site activities, design, and scope of reporting to different mechanisms. Gaps and inconsistencies in data have been resolved for a number of high emitting sites, and this will improve the accuracy of GHGI data at all spatial scales.

The research has also enabled essential updates and improvements to IPPC permit information and Pollution Climate Mapping (PCM) stack information resources to improve the air emissions modelling outputs to DECC and Defra. Notably the site information for all Northern Ireland sites regulated under IPPC and EU ETS have been obtained; these new site details will enable improved analysis of point source emissions and will provide a useful reference resource for future emissions inventory work.

In addition, through consultation with the DECC Oil & Gas regulatory team in Aberdeen, all upstream[1] oil and gas sites have been allocated to either the upstream oil or the upstream gas industries. These allocations will enable future development of the detail of GHG inventory reporting in order to meet the requirements of IPCC 2006 Guidelines for national inventory reporting, and will also enable more detailed analysis of End User GHG inventories.

The difficulty in obtaining site-specific information from some sources has highlighted the need for Data Supply Agreements to be established with environmental regulators of IPPC and EU ETS in order that the UK GHGI compilation team can access permits and data more readily in future. In particular, access to the Environment Agency's (IPPC) Permit Administration System (PAS) and the DECC EU ETS site information from the National Allocation Plans would enable further improvements to research into energy and emissions data, which in turn would facilitate improved analysis of policy options, drawing upon site-specific information.

[1] The term "upstream" is used to indicate those installations that operate in the exploration and production sector of crude oil and gas, and includes oil and gas terminals where initial fuel processing is conducted prior to secondary fuel processing at oil refineries or gas network injection facilities.

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1 Introduction

This research has been commissioned under the UK and Devolved Administration (DA) Greenhouse Gas (GHG) inventory improvement programme, and aims to research emissions data for a group of source sectors and specific sites where uncertainties have been identified in the scope and accuracy of available source data. Primarily this research aims to review site-specific data and regulatory information, to resolve differences between GHG data reported across different emission reporting mechanisms.

The compilation of UK, DA and Local Authority (LA) GHG emissions inventories utilises a range of available data sources on energy and emissions from different industries and sites:

- Site-specific annual CO_2 emission estimates are reported by operators under the EU Emissions Trading Scheme (EU ETS), regulated by the Environment Agency, Scottish Environment Protection Agency (SEPA), Northern Ireland Environment Agency (NIEA) and the Department of Energy and Climate Change (DECC) Oil & Gas team. EU ETS submissions also include details of fuel-specific quantities and qualities used on each site on an annual basis; whilst these data are not publicly available, they are used in UK and DA GHG Inventory compilation;

- Site-specific annual emission estimates of a wide range of pollutants including CO_2, other Greenhouse Gases (GHGs) and air quality pollutants are reported to regulators under Integrated Pollution Prevention and Control regulations (IPPC)[2], and data are publicly available from the regulator inventories such as the Pollution Inventory (PI), Scottish Pollutant Release Inventory (SPRI) and Northern Irish Inventory of Sources and Releases (ISR). For each site, an annual estimate of total emissions (i.e. from all sources and activities cited within the installation IPPC authorisation permit) for each pollutant is submitted to the environmental regulator inventories. Where a site permit may cover a range of combustion, process and other emission sources, the IPPC data are not transparent as to the split of emissions from different sources on site;

- Site-specific, source-specific annual emission estimates of CO_2, CH_4, N_2O, NO_X, CO, NMVOC, SO_2 and F-gases are available from the Environmental Emissions Monitoring System (EEMS) for oil and gas installations, regulated by the DECC Oil & Gas team. This system covers emissions from offshore and onshore installations, although the onshore oil and gas terminal only report voluntarily under EEMS, as they are also regulated under IPPC and hence report their annual emissions (aggregated by site rather than by source) to the PI, SPRI and ISR;

- Further details of emission estimates used within the NAEI/GHGI are compiled through direct consultation with specific process operators and trade associations, where greater detail is needed to allocate emissions to a specific source within an installation;

- Annual energy consumption statistics are available from the EU ETS (by site, as noted above, and not in the public domain), and from national energy statistics, published in DUKES (aggregated by economic sector).

Inconsistencies are evident in emissions data reported to these different mechanisms for some industry sectors and specific sites, but the reasons for these inconsistencies are not fully understood. There is currently an uncertainty, especially regarding any overlaps or gaps in energy and emissions data reported under the different reporting mechanisms. These

[2] The IPPC Regulations are for many sites in the process of being superseded by the Environmental Permitting Regulations (EPR). In this report we have predominantly referred to "IPPC" as most of the existing permits that we have accessed are based on the IPPC regulations.

uncertainties in scope of the reported data impair the accurate compilation of point source emissions data which is used to underpin DA and LA inventories; these data uncertainties for some high-emitting industrial sites will primarily affect the Scottish and English GHG inventories, and the Local Authority CO_2 data where the sites are located.

Since the inception of the EU ETS in 2005, the AEA inventory team has conducted limited research into the data consistency between IPPC and EU ETS, and good progress has been made to improve the understanding and inventory application of data from the iron and steel and power industries. However, for other industries such as oil and gas production, oil refining, and petrochemicals additional work is required[3]. This research aims to collate the necessary information to enable improvements in inventory data quality to be achieved, focusing on the oil & gas terminals and related refinery and petrochemical industry sites. IPPC permit information and energy and emissions data at the installation level from the different mechanisms of IPPC, EU ETS and EEMS has been analysed to improve the accuracy of emission estimates within UK, DA and LA emission inventories.

1.1 Note on Data Disclosure

The fuel-specific data reported by EU ETS operators and the EU ETS site scope details are not publicly available. However, this information is made available for use in the compilation of both UK energy statistics (i.e. the compilation of the Digest of UK Energy Statistics by DECC) and the UK GHG inventory (compiled by AEA under contract to DECC). There are legal mechanisms in place to secure and control the use of EU ETS data within these systems.

Due to issues of commercial confidentiality, the site-specific details from analysis of the EU ETS data cannot be presented in this report.

[3] For a summary of data uncertainties, see Section 2 of the "Report on point source fuel use estimates" at http://decc.gov.uk/en/content/cms/statistics/climate_change/climate_change.aspx

2 Research Approach and Information Summary

This chapter summarises the information sources that have been collected and analysed, together with an overview of the consultation activities.

2.1 Research Approach

The study team has collected and analysed information pertinent to sites that report under the IPPC, EU ETS and EEMS mechanisms, to explore the available information on reporting scope and plant design.

The study team consulted with:

- DECC Oil & Gas, regulators for the EEMS reporting system;
- Oil & Gas UK, the trade association representing the oil and gas exploration and production industry;
- DECC EU ETS
- Environment Agency, SEPA and NIEA contacts (industry sector leads, registry staff, permit administrators for IPPC and EU ETS)
- UK Petroleum Industries Association (UKPIA) for refinery data clarifications;
- Individual site Process Engineers and Site Inspectors, to clarify specific data reporting scope details

A large part of the work has involved communication with environmental regulators, most notably the IPPC permit registry teams within local offices of the Environment Agency, SEPA and NIEA to obtain permit and application documentation through a combination of emailed electronic files and site visits to registry offices to view and scan/copy available files for specific sites.

An initial scoping analysis compared the available site CO_2 emissions data between IPPC, EU ETS and EEMS (for sites reporting to EEMS) to identify the priority sites where greatest data discrepancies were evident. This review of the AEA point source database helped to identify priority sites within the refinery, oil & gas terminal and co-located petrochemical sites, as well as a handful of other sites in the chemical and non-ferrous metal industries.

The AEA inventory team has used old copies of IPC and early IPPC permits as installation reference sources for a number of years, and the access to updated site records (via current IPPC permits) was necessary to enable site-specific analysis and inventory improvement to progress. The site visit to NIEA offices in Belfast enabled a comprehensive collection of the available IPPC and EU ETS permits and site records, regardless of the economic sector; within this study we have only reviewed and summarised the permits from the highest-emitting sites in Northern Ireland such as the power stations and cement kilns.

The analysis has involved site-by-site comparison of reported emissions together with review of the available permits and information on emission reporting scope under IPPC, EU ETS and (for oil and gas terminals) EEMS. The use of these different data in compiling the AEA point source database has previously been based on limited information and “expert judgement”; this work has enabled the assessment of the scope of emissions data, relationships between different data reporting mechanisms and allocation of emissions to inventory sources to be based on much more detailed understanding of activities on each site.

Where data discrepancies could not be resolved through direct comparison of the available information, the study team has consulted with the environmental regulators for IPPC, EU ETS and EEMS to seek clarifications on correct interpretation of the data, to resolve inconsistencies and determine accurate emission allocations by site.

The aim of the analysis was to ensure that each site is correctly assigned to IPCC source sectors within the AEA point source database, understand where emissions from different sources are aggregated (e.g. where waste water treatment emissions are included within emission estimates) and minimise the risks of gaps and double-counts within emission inventories.

The information collected under this task will continue to be useful across several different areas of work under the NAEI work programme; the data gathering phase has enabled us to cost-effectively collate information that has applications across other inventory outputs such as the UK Air Accounts, mapping of emissions, energy and heat, and the Pollution and Climate Mapping research for DECC and Defra.

2.2 Overview of Emission Reporting Mechanisms

High emitting industrial sites in the UK are regulated under a range of mechanisms; annual pollutant emission estimates from such installations may be reported under Integrated Pollution Prevention and Control (IPPC) and the EU Emissions Trading Scheme (EU ETS). In addition, sites in the oil and gas exploration and production industry sector also report annual emission estimates under the Environmental Emissions Monitoring System (EEMS).

A summary of these different reporting mechanisms is shown below.

Table 2.2 Overview of IPPC, EU ETS and EEMS Emission Reporting Mechanisms

	IPPC (SPRI/PI/ISR)	EU ETS	EEMS
Legal basis	IPPC Directive enabled by The Pollution Prevention and Control (PPC) Act 1999 and the Pollution Prevention and Control (Scotland) Regulations 2000. The Regulations specify the types of activities covered by the Regulations and the procedures that must be applied when regulating these activities.	UK regulations require all installations carrying out any activity listed in Schedule 1 to hold a greenhouse gas emissions permit. The conditions of the permit require installations to monitor and report emissions in accordance with the monitoring plan approved by the regulator agencies (EA, SEPA, NIEA, DECC).	No legal basis. The onshore terminals report to EEMS on a voluntary basis, using a reporting system that has been developed and used by the industry over many years. (Note that for offshore installations, the EEMS system is a mandatory reporting obligation, used by DECC to fulfil reporting obligations under the European Pollutant Release and Transfer Register (E-PRTR.)
Air Emissions (reportable substances)	Dependant on permit conditions, but may include a very wide range of pollutants, often including: CO_2, NO_X, SO_2, CO, PM_{10}, NH_3, CH_4, NMVOCs, N_2O, heavy metals, speciated VOCs, fluorinated gases, PAHs, dioxins and furans, HF, HCl	CO_2 (the scheme may be expanded in future to include emissions of other GHGs)	CO_2; CO; NO_x; SO_x; CH_4; NMVOCs; CFCs; HCFCs; Halons; HFCs; PFCs; and SF_6.

	IPPC (SPRI/PI/ISR)	EU ETS	EEMS
Other information reported	Hydrocarbons flared Hydrocarbons vented.	Emissions are reported to regulators on a fuel-by-fuel and source-by-source basis for each site, with full details of fuel use, emission factors, calorific values and oxidation factors presented. However, these details are not publicly available.	Activity data: Gas consumption; Diesel consumption; Fuel oil consumption; Gas flaring; Gas venting; Direct process emissions; Oil loading; Storage tanks; Fugitive emissions.
Comments	Refineries, oil & gas terminals and major chemical and petrochemical production facilities are all required to report their annual emission estimates to regulators under IPPC. Emissions of each pollutant are estimated across all sources and the total submitted to a public register.	All EU ETS annual emissions reports, monitoring data are verified by an independent, accredited verifier. The detailed site scope and fuel data are not in the public domain, although the annual site emissions are published. All refineries, oil & gas terminals and many major chemical and petrochemical plant report under the EU ETS. The scope of sources included in EU ETS for each site is determined by the Schedule 1 activities, which may be less than the scope of IPPC or EEMS.	In the context of this study, the EEMS reporting system only applies to onshore oil & gas terminals; refineries and chemical plant do not report to EEMS. Where emissions are reported to EEMS and under EU ETS, then the same emission factors are to be used by operators. The reporting requirements of EEMS (substances, thresholds) may need to be extended to meet the requirements of the E-PRTR Regulation

2.3 IPPC Permits

IPPC permits include a breakdown of the different emission sources on site, such as combustion units (boilers, engines), flares, vents, process activities, waste and water treatment facilities, materials storage, transfer and handling facilities. The information most commonly of interest includes the breakdown of combustion units on site, the main fuel sources used within each unit and any emissions abatement equipment information that may be included in the permit.

To understand the scope and detail of the IPPC installations is extremely useful for the development of the UK inventories, as it (i) enables inventory compilers to make more informed decisions regarding emissions data (e.g. dealing with time-series inconsistencies, making judgements on source allocation issues, assessing likely impacts of new policy initiatives / legislation), and (ii) provides evidence for dealing with enquiries from inventory review teams, for example where the completeness of the UK inventory is questioned.

IPPC permits were obtained for all of the UK oil & gas terminals and refineries as these sectors are known to exhibit variable energy and emissions data via different systems and all are major emitting sites that have a high impact on GHG and air quality pollutant emission maps and inventories. The scoping analysis also indicated a handful of priority sites within the chemical, petrochemical and non-ferrous metal sectors for which the IPPC permits were also obtained.

The IPPC permit information has been collected for the following sites:

Table 2.3.1 IPPC Documents for Sites Regulated by the Environment Agency

Site Name	IPPC Permit Reference
Milford Haven Refinery, Murco Petroleum Ltd	AP3830XQ
Coryton Refinery, Petroplus Refining and Marketing Ltd	BP3135LK
Fawley Refinery, Hampshire. Esso Petroleum Company Ltd*	BR69961C
Lindsey Oil Refinery Total UK Ltd *	UP3430LQ
Eastham Refinery, Wirral.*	BS5215IZ
Petroplus Refining Teeside	NP3733LM
Stanlow Manufacturing Complex*	NP3237LS
Chevron, Pembroke Refinery*	QP3033LW
Harwich Refinery (Colchester Essex)*	NP3139LM
ConocoPhillips Ltd Humber Refinery	UP3230LR
Point of Ayr Terminal: BHP Billiton Petroleum Ltd*	ZP3331LM
Easington Gas Terminal: Centrica Storage Limited (Yorkshire)	AP3833LW
Eastern Bacton Gas Terminal Shell UK Ltd	NP3637SW
Central Bacton Gas Terminal, Perenco UK Ltd	PP3633LM
ConocoPhillips (UK) Limited, Theddlethorpe Gas Terminal*	LP3933LX
Barrow Gas Terminals - North, South & Rivers.	BX1675IT/V002
ConocoPhilips Oil Stabilisation Terminal	NP3033LN
Dimlington Gas Terminal	QP3133LR
Petroplus Tankstorage Milford Haven Limited	BK1341
BP Chemicals, Saltend, Hull	BJ8162IR
Hunstman Petrochemicals (Winton Olefins Installation)	BS3590IE
BASF Seal Sands	BU2527IB
Tioxide Europe Ltd, Grimsby	NP3438SE
Ineos Silicas, Warrington	RP3233GW / BM0354IP
BP Wytch Farm Gathering Station and Wellsites	CP3039MV

Table 2.3.2 IPPC Documents for Sites Regulated by SEPA

Site Name	IPPC Permit Reference
Ineos Manufacturing Scotland Ltd, Grangemouth	PPC/A/1013141
Nynas Dundee	PPC/A/1013015
Fortum, Grangemouth CHP, Stirlingshire	PPC/A/1013071
Fortum, Sullom Voe*	PPC/A/1013522
Shell UK St Fergus Gas Plant, Aberdeenshire*	PPC/A/1013096
Shell UK Mossmoran	PPC/A/1013495
Total E&P, St Fergus, Aberdeenshire*	PPC/A/1012811

Site Name	IPPC Permit Reference
National Grid St Fergus, Aberdeenshire*	PPC/A/1013002
Goldeneye, Shell, St Fergus Gas plant, Aberdeenshire	PPC/N/20014
SAGE Terminal St Fergus, Peterhead*	PPC/A/1000158
Cruden Bay Oil reception facility*	PPC/A/1013111
Talisman Nigg*	PPC/A/1012611
Talisman Energy, Flotta Oil terminal*	PPC/A/1012610
Shell Gas Ltd, Cowdenbeath, Fife (NGL Plant)*	PPC/E/30082
GE Plastics ABS Ltd	PPC/A/1008676
Kemfine Ltd, Grangemouth	PPC/A/1008834

Table 2.3.3 IPPC Documents for Sites Regulated by the NIEA

Site Name	IPPC Permit Reference
Quinn Glass*	P0053/04A
Lafarge Cement*	P0052/04A
Premier Power, Ballylumford*	P0125/06A
AES Kilroot Power*	P0120/06A
Coolkeeragh ESB*	P0126/06A
Invista Textiles, Maydown*	P0129/06A
Quinn Cement (Gortmullan)*	P0054/04A
Balcas Timber Ltd*	P0131/06A

All of these IPPC permit documents were reviewed and summary information tabulated, to determine:

- Scope of licenses, combustion unit information (thermal capacity, fuel types, abatement), other process unit information (design and capacity);
- Range of permitted activities on site to assess the aggregation of source emissions within PI/SPRI/ISR emissions data, to enable comparison against EU ETS and EEMS data;
- Available information on permit variations or planned changes to plant design in future;

In addition to obtaining the IPPC permit information, where possible the study team also researched other studies available from the public registers; these included a small number of local air quality impact risk assessment reports and emission modelling studies for some of the Scottish oil & gas terminals. Unfortunately these documents are not always readily accessible, and may be held within large paper-based filing systems from IPPC applications.

[Those sites for which supplementary information has been obtained from the public register have been marked with an asterisk (*) in Tables 2.3.1 to 2.3.3.]

A summary of site details from IPPC permits and supplementary information is presented in Appendix 3.

2.4 EU ETS Site Information

Through consultation with the EU ETS regulatory teams in the Environment Agency, SEPA and NIEA, we have obtained site-specific summaries of the scope of EU ETS reporting. EU ETS information has been collected for all EU ETS installations regulated by the EA and NIEA, and for a list of priority sites regulated by SEPA. The EU ETS information from the regulators is less consistent and comprehensive than the IPPC permits; the study team approached the DECC EU ETS team for more detailed National Allocation Plan documentation, but data confidentiality issues could not be resolved in time to provide data for this research.

The EU ETS site descriptions are not publicly available documents, and the information provided does not follow a prescribed format. Typically the information includes a summary of the thermal capacity of combustion units, fuel types and an insight into any process sources of CO_2 included under the scheme. For some sites the descriptions summarise the sources included under EU ETS and present a direct comparison against IPPC permits, citing emission points and units that are excluded from EU ETS but within IPPC.

In addition to obtaining the EU ETS site summary information, several site-specific issues were resolved in consultation with the regulatory teams. Site commissioning dates and other operational information were provided, and a number of data reporting inconsistencies (i.e. within the detailed EU ETS energy and emissions data used in inventory analysis – not related to scope of reporting) were resolved.

The scope of emissions reported under EU ETS is outlined in Appendix 2; for many sites, the scope of EU ETS sources does not include all emission sources that are regulated and reported under IPPC or EEMS. There are defined activities under EU ETS Schedule 1 that must be included within the trading scheme, which includes combustion sources and other processes that emit CO_2. The EU ETS Phase I ran from 2005 to 2007, and Phase II started in 2008. In Phase II, the UK Government expanded the scope of EU ETS activities, and this affects the data reported by oil & gas installations and petrochemical installations being considered in this study.

EU ETS Expansion in Phase II
[Reference: *"EU Emissions Trading Scheme Phase II (2008-2012), Expansion – Explanatory Note" Defra (March 2006)]*
In Phase I, the EU ETS Directive was interpreted differently by Member States, especially regarding reporting scope; notably, Member States adopted different definitions of a "combustion installation" activity. As a result, the EU Commission sought greater harmonisation of scope in Phase II.

In Phase I, the UK Government adopted the 'medium' definition of a combustion installation (i.e. "*a stationary technical unit that burns fuel for the production of an energy product which could be electricity, heat or mechanical power*") whilst other Member States interpreted the term more broadly.

Therefore for Phase II (2008-2012) the UK Government has broadened the scope to implement a more harmonised approach with other Member States. This expansion of the scope of the Scheme covers additional carbon dioxide emissions from various industry sectors including: glass, mineral wool, gypsum, **flaring from offshore oil and gas production, petrochemicals (crackers)**, carbon black, and integrated steelworks.

Oil & Gas Flaring

In Phase I, the offshore oil and gas industry was regulated by the EU ETS due to the combustion installations (gas turbines, diesel engines and fired heaters) that power the production of oil and gas. Around 90 offshore installations and 20 terminals were included in Phase I, and their total CO_2 emissions from Schedule 1 sources were approximately 20 $MtCO_2$ per annum.

In Phase II, the scope has been extended to cover emissions from:

- *"Continuous flaring of purge gases and vapours;*
- *Periodic routine flaring from pipeline and platform blowdown;*
- *Emergency flaring during system trips, well blowouts;*
- *Gas disposal where there is no outlet for the gas, or where waste processing gases must be disposed;*
- *Flaring of gases produced during exploration drilling."*

The expansion of the EU ETS scope covers installations that carry out flaring in association with offshore oil and gas production according to the following definition:

"The combustion of materials derived from the exploration, appraisal, production, storage and processing of offshore oil and gas (including imported oil and gas stored in offshore reservoirs), for purposes other than energy production, where such activities are undertaken at offshore oil and gas facilities or onshore oil and gas reception terminals that are designated combustion installations with a rated thermal input exceeding 20 MW".

This extension to scope has affected the reported EU ETS CO_2 emissions from nearly all of the oil & gas terminals.

Petrochemicals (Crackers)

In the petrochemical sector, the UK Government has followed European Commission's guidance and has focussed on combustion emissions from crackers, implementing an expansion to scope of EU ETS in Phase II that is based on production thresholds:

"Combustion emissions from chemical installations with processes designed for the production on an industrial scale, either individually or in combination, of propylene and ethylene. Within this, "industrial scale" is the product output of at least 50 ktpa."

This extension to scope has had a marked impact on the reported EU ETS CO_2 emissions from Olefin manufacturing plant in the UK, where emissions from the furnaces that fire cracker units have been added to the scope between 2007 and 2008. (See the Results chapter for site-specific information.)

2.5 EEMS Site Information

The EEMS reporting system does not include site-specific permits with defined emission points, but guidance to operators and the structure of the reporting system provides details of the scope of emissions reported by each installation. The reporting system provides a detailed breakdown of emissions by source type, including separate annual estimates for emissions from:

- Gas combustion
- Diesel combustion
- Fuel Oil Combustion
- Flaring
- Venting

- Direct Processes (e.g. acid gas stripping)
- Fugitives
- Oil loading / unloading
- Well Testing
- Other sources

It should be noted that there is no legal requirement for mandatory reporting under EEMS by the onshore oil & gas terminals, but since 1998 all terminals have undertaken to report voluntarily through this system, in addition to their regulatory reporting under IPPC to the Environment Agency or SEPA.

Guidance developed by DECC and Oil and Gas UK outlines the sampling, monitoring and reporting requirements. Each installation submits an annual report of all atmospheric emissions from: (i) production of oil and gas from offshore reservoirs (including loading operations), (ii) onshore terminals engaged in processing/storing/loading, and (iii) exploration and development drilling rigs.

The EEMS methodology applies emission factors to process information covering: (i) fuel consumption (in process turbines, engines, heaters), (ii) flaring and venting activities, (iii) tanker loading volumes, and (iv) other sources such as fugitive emission estimates and process sources. The EEMS estimation calculations may use generic emission factors developed by Oil and Gas UK, but installation-specific factors should be used in place of the default factors, in line with specific EU ETS consent requirements.

The more detailed source-specific emissions reporting of EEMS, compared to the IPPC system (through which all sources on site are aggregated for each pollutant within the annual emission submissions) is much more useful and transparent for the purposes of emissions inventory reporting to IPCC guidelines, as required in the UK and DA GHGI.

However, it is the IPPC and EU ETS datasets that are mandatory, regulated annual emissions reporting systems which have been developed and resourced to incorporate specific data quality assurance systems (managed by the EA and SEPA).

The breakdown of EEMS emissions data is useful to allow comparison between EU ETS and IPPC annual emission estimates, where the scope of reporting under each system can be aligned with the detailed split provided by EEMS. For example, until 2007 the oil & gas terminals were included within EU ETS, but the scope of data reporting was limited to combustion sources (such as boilers and engines fired on gas or diesel). For Phase II of the EU ETS, from 2008 onwards, the scope of reporting was extended to include gas flaring emissions at oil & gas terminals. Within this study, the EEMS data has been useful to analyse the site-specific EU ETS changes in scope, and to help identify where the main differences in scope may lie between EU ETS and IPPC, to supplement the information available from the IPPC and EU ETS site descriptions.

2.6 IPPC Application Documents

In addition to obtaining site IPPC permit authorisation information (which typically includes a summary of the main emission source on site), the study team has also accessed IPPC permit *application* documents wherever possible, as these documents typically contain the more detailed site plan and physical details of the stack emission points (e.g. stack height, diameter, flue gas temperature, grid references). These detailed data are used to inform the Pollutant Climate Mapping (PCM) work under research programmes such as the NAEI. In many cases the access to these detailed data have been very limited since the inception of IPPC and hence these updates to the PCM site data records is extremely useful to enable an

update to emission modelling for the sites in question, all of which are major point source emission sources for a wide range of GHGs and air quality pollutants (such as NO_X).

Unfortunately the IPPC permit application files are frequently only available in paper format and are a sub-set of large site files on the IPPC public registers, and hence it is often time-consuming to access and identify the key data. For some sites within England and Wales, the local registry teams were able to collate these data on our behalf, but for many other sites this was not possible and site visits to registries were conducted to obtain the information for priority sites. IPPC permit application information on stack parameters and other site-specific details have been collected for the following sites:

- Stanlow Manufacturing Complex
- Chevron, Pembroke Refinery
- Harwich Refinery (Colchester Essex)
- Lindsey Oil Refinery Total UK Ltd
- Eastham Refinery, Wirral
- Fawley Refinery, Hampshire. Esso Petroleum Company Ltd
- Point of Ayr Terminal: BHP Billiton Petroleum Ltd
- Fortum, Sullom Voe
- Shell UK St Fergus Gas Plant, Aberdeenshire
- Total E&P, St Fergus, Aberdeenshire
- National Grid St Fergus, Aberdeenshire
- SAGE Terminal St Fergus, Peterhead
- Cruden Bay Oil reception facility
- Talisman Energy, Flotta Oil terminal
- Kemfine Ltd
- GE Plastics (ABS) Ltd
- Quinn Glass
- Lafarge Cement
- Premier Power, Ballylumford
- AES Kilroot Power
- Coolkeeragh ESB
- Invista Textiles, Maydown
- Quinn Cement (Gortmullan)
- Balcas Timber Ltd
- Moy Park Ltd – Craigavon
- Ulster Farm By-Products Ltd - Glenavy

The collection of this detailed site-specific information has enabled the NAEI team to improve data resources across a range of applications for Government research under the NAEI inventory, mapping and modelling programme. This is quite a resource-intensive process, but through this research we have gained a valuable insight into the development of electronic permitting information systems within the environmental regulatory agencies in the UK, and are now better-equipped to take forward further focussed research where information gaps are evident for key sites or sectors.

2.7 Oil & Gas Industry Consultation

The study team has consulted with DECC Oil and Gas (the industry regulator) and Oil & Gas UK (the industry trade association) to determine current information on data reporting by offshore oil & gas sites and onshore terminals. Previous work by Oil & Gas UK presents a top-level overview of the data reporting requirements, but no detailed scope of data reporting is available for each site that reports under EEMS; there is industry guidance on data

estimation (to ensure consistency of data reporting by oil & gas installation operators) and the reporting is checked by DECC each year.

Reporting to EEMS by Oil & Gas terminals has been a contentious issue in recent years, as it is perceived as duplication of effort with significant overlap in terms of data reporting under IPPC. However, so far all terminals continue to report (voluntarily) to EEMS. The data in EEMS are presented in a source-specific format which enables some degree of analysis of scope of reporting, but there are no plant-specific or stack-specific references in the dataset and hence comparison against IPPC scope is not straightforward.

Unfortunately, no previous industry research was identified that compared the emissions data reported for specific sites via IPPC, EU ETS and EEMS.

3 Results

[Note that due to data disclosure issues, there are limitations to the detail of information that can be presented within this report.]

3.1 Refinery Emissions

Emissions from refineries are a large contributor to total GHG emissions in England, Wales and Scotland. In 2007, refinery GHG emissions accounted for 2% of England emissions, 3.5% of Scotland emissions and 6.7% of Wales emissions.

Refinery emission estimates are available from IPPC and EU ETS, and in addition to these sources of information the AEA inventory team consults directly with the refinery trade association, the UK Petroleum Industries Association (UKPIA) to obtain more detailed breakdowns of refinery emissions, to enable inventory estimates to be presented separately for combustion sources and process sources.

The emissions data show good consistency for most sites, as the table below shows:

Table 3.1 UK Refinery CO_2 Emissions: IPPC and EU ETS in 2007 and 2008

Installation	IPPC Reference	Year	Pollutant	IPPC Emission (kg)	EU ETS Emission (kg)	IPPC/EUETS
Grangemouth	PPC/A/1013141	2007	CO_2 total	2,240,443,000	1,574,638,000	**1.42**
Dundee	PPC/A/1013015	2007	CO_2 total	25,583,000	25,093,000	1.02
Milford Haven	AP3830XQ	2007	CO_2 total	1,209,000,000	1,208,529,340	1.00
Harwich	NP3139LM	2007	CO_2 total	22,000,000	22,138,420	0.99
Stanlow	NP3237LS	2007	CO_2 thermal	2,896,000,000	2,700,933,000	**1.09**
			CO_2 chemical	35,200,000		
Pembroke	QP3033LW	2007	CO_2 thermal	1,590,000,000	2,450,798,000	1.00
Pembroke	QP3033LW	2007	CO_2 chemical	860,000,000		
South Killingholme	UP3230LR	2007	CO_2 thermal	1,403,000,000	2,141,980,878	1.00
			CO_2 chemical	738,000,000		
North Tees	NP3733LM	2007	CO_2 total	247,993,000	261,290,000	**0.95**
Coryton	BP3135LK	2007	CO_2 total	1,930,000,000	1,926,271,000	1.00
Fawley	BR6996IC	2007	CO_2 total	3,016,000,000	3,017,467,300	1.00
Killingholme	UP3430LQ	2007	CO_2 total	1,765,000,000	1,765,327,600	1.00
Grangemouth	PPC/A/1013141	2008	CO_2 total	3,437,163,300	1,692,244,778	**2.03**
Dundee	PPC/A/1013015	2008	CO_2 total	24,474,000	24,741,714	0.99
Milford Haven	AP3830XQ	2008	CO_2 total	1,133,000,000	1,118,104,391	1.01
Harwich	NP3139LM	2008	CO_2 total	24,300,000	24,304,508	1.00
Stanlow	NP3237LS	2008	CO_2 total	2,940,000,000	2,739,957,000	**1.07**
Pembroke	QP3033LW	2008	CO_2 thermal	1,570,000,000	2,212,998,892	1.00
			CO_2 chemical	643,000,000		
South Killingholme	UP3230LR	2008	CO_2 thermal	1,298,000,000	1,883,315,795	**1.07**
			CO_2 chemical	722,000,000		
North Tees	NP3733LM	2008	CO_2 total	215,529,000	215,729,927	1.00
Coryton	BP3135LK	2008	CO_2 total	1,888,000,000	1,884,672,712	1.00
Fawley	BR6996IC	2008	CO_2 total	3,044,000,000	3,036,256,699	1.00
Killingholme	UP3430LQ	2008	CO_2 total	1,733,000,000	1,727,934,591	1.00

For the majority of sites during 2007 and 2008, the IPCC and EU ETS emissions data show very close consistency. The exceptions are:

2007 North Tees

- UKPIA data are consistent with the EU ETS data, and higher than the IPPC data;
- The EU ETS data are subject to independent verification; the process operator has also confirmed via UKPIA that carbon emissions data for North Tees were revised subsequent to reporting to the PI and so the PI figure is considered less reliable;
- There are no reporting scope uncertainties to resolve, and the AEA point source database should apply the EU ETS estimates for CO_2 emission estimates for this site.

2008 South Killingholme

- The UKPIA data are consistent with the EU ETS data. IPPC data are 7% higher than EU ETS data (136kt CO_2 difference, less than 0.1% of England emissions);
- The site IPPC permit does include some sources of CO_2 that are excluded from the EU ETS scope of scheduled activities, such as an activated sludge biological effluent treatment plant, although these are not likely to emit large amounts of CO_2.
- The IPPC data may be an over-estimate, and the AEA point source analysis uses the EU ETS (and UKPIA) emissions data.

2007 and 2008 Stanlow

- The UKPIA data are consistent with the EU ETS data for 2007, but are slightly lower than the EU ETS data in 2008. For the combustion and refinery process emissions of CO_2, therefore, the EU ETS data are considered to be the most likely to be accurate given the third-party verification requirements under the ETS. IPPC data are 7-9% higher than the EU ETS data (200kt CO_2 difference, less than 0.1% of England emissions);
- The IPPC permit outlines a number of organic chemical manufacturing activities (and related process heaters) on site, which are outside of the scope of the EU ETS schedule for the installation and operated by Shell Chemicals UK. Hence the difference between the EU ETS and IPPC emissions estimates should be allocated to these organic chemical manufacturing sources within the GHGI and AEA point source database; the most appropriate NAEI source is “Other Industrial combustion” as the process heaters are the most likely source. The process operator has confirmed via UKPIA that the difference between carbon emissions reported under EU ETS and IPPC is due to the inclusion of the emissions from chemical processes in the PI data.

2007 and 2008 Grangemouth

- The Grangemouth site includes a wide range of different operational units with separate IPPC and EU ETS permits. Whilst initial comparisons of IPPC and EUETS data appeared to indicate some large data differences, subsequent analysis of data from individual units on the installation enables good data consistency to be derived. The table below summarises the sites included under EU ETS at Grangemouth:

EU ETS Reference	Plant ID	SourceNo	Operator	Site
SEPA_ETS_10003	9005	29	Fortum E&P UK Plc	Grangemouth CHP
SEPA_ETS_10009	11476	29	Polimeri Europa UK Ltd	Grangemouth (Chemical site boilers)
SEPA_ETS_10014	n/a	29	Rohm & Haas	Grangemouth (Chemical site boilers)
SEPA_ETS_10027	9018	29	Kemfine Ltd	Grangemouth (Chemical site CHP plant)
SEPA_ETS_10035	9021	37	Ineos Manufacturing Scotland Ltd	Grangemouth Refinery
SEPA_ETS_10036	9022	29	Ineos Manufacturing Scotland Ltd	Grangemouth Power Station
SEPA_ETS_10037	9023	29	Ineos Manufacturing Scotland Ltd	Grangemouth Olefins
SEPA_ETS_10039	9024	29	GE / SABIC Plastics	Grangemouth (Plastics manufacture)
SEPA_ETS_10046	11129	26	BP Exploration Operating Co Ltd	Grangemouth (Kinneil Terminal)

- The four chemical sites (Polimera, Rohm and Haas, Kemfine and SABIC plastics) raise no significant data concerns. The Polimera and Kemfine sites show good consistency in emissions between SPRI and EU ETS, whilst the other two sites are small emitters and do not appear in both EU ETS and SPRI in any year.
- The other sites are higher GHG emitters and are integrated in their operations on the Grangemouth petrochemical complex.

EU ETS Reference	Operator	Year	SPRI kt CO2	EU ETS ktCO2	IPPC/EU ETS
SEPA_ETS_10003	Fortum E&P UK Plc	2005	708	707.5	100%
	CHP	2006	745.4	745.4	100%
		2007	723.4	723.4	100%
		2008	647.3	647.3	100%
SEPA_ETS_10035	Ineos Manufacturing Scotland Ltd	2005	2403	1607.9	100%
	Refinery	2006	2208	1450	100%
		2007	2240	1574.6	100%
		2008	3437	1692.2	146%
SEPA_ETS_10036	Ineos Manufacturing Scotland Ltd	2005		794.9	
	Power Station	2006		751	
		2007		665.4	
		2008		657	
SEPA_ETS_10037	Ineos Manufacturing Scotland Ltd	2005	1317	259.7	507%
	Olefins	2006	1118	255.9	437%
		2007	1063.5	227.3	468%
		2008	nd	948.5	
SEPA_ETS_10046	BP Exploration Operating Co Ltd	2005	421	nd	
	Kinneil Terminal	2006	384.9	nd	
		2007	498	273.5	182%
		2008	387.8	387.8	100%

- The Fortum E&P CHP plant emissions are identical in SPRI and EU ETS.
- The Kinneil Terminal emissions are identical in SPRI and EU ETS in 2008, but the EU ETS data are lower in 2007. The scope of EU ETS reporting for oil and gas terminals increased between 2007 and 2008 to include flaring sources, so the 2007 data for the Kinneil terminal exclude flaring emissions.
- UKPIA have confirmed that the emissions data that they supply for the Grangemouth refinery corresponds to two EU ETS installations ("Grangemouth Refinery" and "Grangemouth Power Station") and that this is also the basis for reporting in SPRI. Once this is taken into account, then the data show 100% consistency for the years 2005-2007. However, in 2008 the SPRI emissions data increase and there is no longer consistency with EU ETS emissions data. SEPA have confirmed that SPRI data in 2008 also cover the chemicals manufacturing processes operated on the Ineos Grangemouth site, which also explains why the Olefin site does not report any emissions in 2008. Therefore, for 2008, the SPRI emissions data includes all of the Ineos plant, i.e. the refinery, power station and olefin plant (all are covered by the same IPPC authorisation - PPC/A/1013141). The sum of the EU ETS data for these three sites in 2008 comes to 96% of the reported SPRI total from Ineos. The reasons for this difference are likely to be due to differences in scope for the Olefins plant; sources such as flaring related to chemical production are excluded from EU ETS until Phase III.
- The Ineos Olefin plant EU ETS emissions are consistently much lower than the SPRI data for 2005 to 2007. The installation produces ethylene and its derivatives for the petrochemicals market, and the CO_2 sources on site include thermal cracking processes to produce ethylene, numerous flares, and a number of boilers. The higher

emissions in SPRI will include all of these sources, whereas the EU ETS installation will include only those emissions from the boilers.

- In the case of 2008 data, there is a considerably smaller difference between the SPRI emission, and the combined EU ETS emission for the refinery, power station, and olefins plant. The decreased difference between SPRI and EU ETS data (compared with 2005-2007) is because the EU ETS permit should now cover the furnaces in the Olefins plant, as well as the boilers. The residual difference between SPRI and EU ETS is therefore likely to represent the emissions from the flares alone.
- The above analysis seems robust, given the data available. However, we are engaging in further consultation with the SEPA Process Engineer to verify that our analysis is correct and to ensure the most appropriate allocation of emissions within the NAEI.

3.2 Oil & Gas Terminal Emissions

Emissions from oil and gas terminals are a large contributor to total GHG emissions in some parts of the UK, most notably in Scotland where in 2007 the oil and gas terminals accounted for nearly 5% of total emissions. In England and Wales the overall significance is less, at under 1%.

Oil and gas terminal emission estimates are available from IPPC, EEMS and EU ETS. The EEMS data are not a mandatory reporting requirement for the onshore terminal operators; the detailed breakdown of emissions by source within the EEMS dataset enables inventory estimates to be presented separately for sources such as gas combustion, flaring, venting, direct process emissions, oil loading / unloading and fugitives.

For some sites the emissions data show good consistency, whereas for others there are some notable patterns when the three datasets are compared. Not all of the details for data inconsistencies are fully transparent, due to the lack of a clear scope of reporting (for EEMS, where there is no defined list of sources) and a lack of detailed reporting (for IPPC, where all emission sources are aggregated in the published data).

The analysis shows that for a given site, the CO_2 emission estimates tend to follow some "typical" trends, as outlined below (although there are many exceptions to these trends):

1) **IPPC > EEMS > EU ETS**

[The EU ETS data is expected to be the smallest number, as the scope of EU ETS is typically narrower than the other two mechanisms. The link between IPPC and EEMS is typically less clear as the scope and detail of reporting is limited.]

2) **2007 EU ETS = 2007 EEMS Fuel Combustion emissions**
   2008 EU ETS = 2008 EEMS Fuel Combustion PLUS Flaring emissions

[The scope of EU ETS for oil & gas installations was expanded between 2007 and 2008. Initially the EU ETS only covered combustion activities, but in Phase II from 2008 onwards the gas flaring emissions are also included within EU ETS.]

The table below summarises the analysis of emissions data for the UK oil and gas terminals.

Table 3.1.1 UK Oil & Gas CO_2 Emissions: IPPC, EEMS and EU ETS in 2007

Year	InstallationName	SPRI or PI CO2 (kg)	EU ETS CO2 (kg)	EEMS total CO2 (kg)	EEMS combustion	EEMS flaring	EEMS Other	IPPC / EU ETS	EEMS (combustion) / EUETS	IPPC / EEMS
2007	Talisman Energy (UK) Ltd - Flotta	196,274,330	167,175,000	195,865,760	167,976,650	27,768,260	120,850	117%	100%	100%
2007	Talisman Energy (UK) Ltd - Nigg Bay	10,384,400	7,801,000	10,332,530	7,873,600	2,458,930	-	133%	101%	101%
2007	BP Exploration Co Ltd - Kinneil	498,000,000	273,531,000	491,885,300	310,598,300	181,287,000	-	182%	114%	101%
2007	Shell UK Ltd - Cowdenbeath	163,612,900	154,270,000	156,393,440	154,538,500	1,854,940	-	106%	100%	105%
2007	Shell UK Ltd - St Fergus	312,429,620	295,868,000	320,917,070	319,547,910	1,328,870	40,290	106%	108%	97%
2007	ExxonMobil - SAGE	549,427,000	194,238,000	611,673,740	196,354,640	32,994,340	382,324,760	283%	101%	90%
2007	Total E & P Ltd - St Fergus	80,227,116	59,786,000	80,039,670	60,022,610	20,005,400	11,660	134%	100%	100%
2007	Interconnector (UK) Ltd - Norwich	84,539,000	84,539,000					100%		
2007	Centrica Storage Ltd - Easington Terminal	90,794,000	87,851,510	88,940,850	88,272,220	668,630	-	103%	100%	102%
2007	Hydrocarbon Resources - Barrow-In-Furness	326,857,000	215,693,000	320,355,040	212,382,610	10,661,280	97,311,150	152%	98%	102%
2007	BP Exploration Operating Co Ltd - Wytch Farm	87,497,150	42,438,020	78,761,863	60,459,490	18,293,130	9,243	206%	142%	111%
2007	BP Exploration Operating Co Ltd - CATS	43,876,000	34,087,380	47,831,000	34,088,000	13,743,000	-	129%	100%	92%
2007	BP Exploration Operating Co Ltd - Sullom Voe	100,400,000	(no data)	340,643,000	240,932,000	99,711,000	-	40%	97%	29%
2007	Fortum O&M Ltd - Sullom Voe (power station)	(no data)	249,601,000							
2007	ConocoPhillips (UK) Ltd - Theddlethorpe	180,000,000	81,154,333	141,347,947	81,298,430	59,974,990	74,527	222%	100%	127%
2007	ConocoPhillips - Seal Sands	360,197,000	172,873,000	390,367,940	349,284,080	41,083,860	-	208%	202%	92%
2007	px (TGPP) - Teesside Gas Plant	47,887,000	45,518,000					105%		
2007	Star Energy UK Onshore Ltd - Humbly Grove	25,107,308	21,748,183					115%		
2007	Shell UK Ltd - Bacton	25,754,000	17,461,637	36,414,290	36,412,120	-	2,170	147%	209%	71%
2007	Perenco UK Ltd - Bacton	4,590,000	4,359,016	5,021,177	5,020,320	-	857	105%	115%	91%
2007	BP Exploration Operating Co Ltd - Dimlington	71,417,000	67,063,700	67,080,560	67,079,000	-	1,560	106%	100%	106%
2007	Innogy Cogen Ltd - Seal Sands	210,129,000	209,032,568					101%		
2007	Tullow Oil UK Ltd - Bacton Gas Terminal	151,766,000	149,954,000	151,689,630	150,632,430	1,054,140	3,060	101%	100%	100%
2007	BHP Billiton - Point of Ayr Terminal	70,833,000	53,683,667	69,827,894	52,947,840	931,370	15,948,684	132%	99%	101%

Table 3.1.2 UK Oil & Gas CO_2 Emissions: IPPC, EEMS and EU ETS in 2008

Year	InstallationName	SPRI or PI CO2 (kg)	EU ETS CO2 (kg)	EEMS total CO2 (kg)	EEMS combustion	EEMS flaring	EEMS Other	IPPC / EU ETS	EEMS (combustion and flaring) / EUETS	IPPC / EEMS
2008	Talisman Energy (UK) Ltd - Flotta	242,212,019	244,825,993	241,147,590	190,352,030	50,656,340	139,220	99%	98%	100%
2008	BP Exploration Co Ltd - Kinneil	387,758,000	387,758,405	475,939,530	294,652,530	181,287,000	-	100%	123%	81%
2008	Shell UK Ltd - Cowdenbeath	182,028,600	176,834,215	182,240,400	179,936,530	2,303,870	-	103%	103%	100%
2008	Shell UK Ltd - St Fergus	328,959,000	324,498,894	335,661,500	333,050,810	2,565,100	45,590	101%	103%	98%
2008	ExxonMobil - SAGE	146,134,000	473,094,200	435,289,460	179,466,080	23,500,340	232,323,040	31%	43%	34%
2008	Total E & P Ltd - St Fergus	70,759,144	70,744,064	67,349,950	51,486,390	15,848,050	15,510	100%	95%	105%
2008	Interconnector (UK) Ltd - Norwich	79,900,000	79,874,409					100%		
2008	BP Exploration Ltd - Sullom Voe	260,000,000	257,596,314	382,220,760	253,362,400	128,855,090	3,270	101%	148%	68%
2008	Gassco AS - Easington	36,395,000	28,471,558					128%		
2008	Centrica Storage Ltd - Easington Terminal	105,843,000	109,163,345	109,052,070	108,287,500	749,750	14,820	97%	100%	97%
2008	Hydrocarbon Resources - Barrow-In-Furness	353,357,000	256,924,746	347,979,150	243,420,370	9,845,820	94,712,960	138%	99%	102%
2008	BP Exploration Operating Co Ltd - Wytch Farm	75,550,900	72,736,106	72,745,353	42,314,540	30,421,570	9,243	104%	100%	104%
2008	BP Exploration Operating Co Ltd - CATS	44,362,000	44,575,836	45,413,000	37,480,000	7,933,000	-	100%	102%	98%
2008	BP Exploration Operating Co Ltd - Sullom Voe	124,100,000	(no data)	382,220,000	253,362,000	128,855,000	3,000	149%	148%	100%
2008	Fortum O&M Ltd - Sullom Voe (power station)	260,000,000	257,596,314							
2008	ConocoPhillips (UK) Ltd - Theddlethorpe	190,000,000	174,284,000	171,917,967	107,489,640	64,376,130	52,197	109%	99%	111%
2008	ConocoPhillips - Seal Sands	370,324,000	238,681,117	358,335,510	324,428,240	33,907,270	-	155%	150%	103%
2008	px (TGPP) - Teesside Gas Plant	46,527,000	50,195,121					93%		
2008	Star Energy UK Onshore Ltd - Humbly Grove	43,840,720	10,411,792					421%		
2008	Shell UK Ltd - Bacton	29,052,000	17,657,458	30,153,980	30,150,130	-	3,850	165%	171%	96%
2008	BP Exploration Operating Co Ltd - Dimlington	87,944,000	69,523,611	75,331,800	75,010,400	320,400	1,000	126%	108%	117%
2008	Innogy Cogen Ltd - Seal Sands	214,126,000	213,881,664					100%		
2008	Tullow Oil UK Ltd - Bacton Gas Terminal	146,855,000	145,816,279	147,338,307	146,270,699	1,064,548	3,060	101%	101%	100%
2008	BHP Billiton - Point of Ayr Terminal	63,156,000	47,871,733	60,400,804	44,065,310	1,050,810	15,284,684	132%	94%	105%

3.2.1 Oil and Gas Terminal Site-Specific Analysis

Site	Emissions Data Analysis
Talisman Flotta	2007: IPPC=EEMS>EU ETS. EU ETS = (EEMS Combustion). 2008: Very close consistency between the three datasets, with EU ETS fractionally higher than the other two. IPPC = EEMS. No uncertainties over scope, or source allocation due to EEMS detail. EU ETS slightly higher, perhaps due to use of site-specific EF.
Talisman Nigg Bay	2007: IPPC=EEMS>EU ETS. EU ETS = (EEMS Combustion). (no 2008 data) No uncertainties over scope, or source allocation due to EEMS detail.
BP Kinneil	2007: IPPC = EEMS > EU ETS, and EU ETS = (EEMS gas use only). 2008: EEMS > IPPC = EU ETS. EEMS (combustion and flaring) > EU ETS In both years there is poor correlation between the EU ETS and the expected components of EEMS, with EEMS data 23% higher in 2008 (88kt CO_2 difference, approx. 0.2% of Scotland total), although in 2007 the EEMS gas use emissions data are very close to the EU ETS total. The SEPA information on EU ETS scope does not resolve this discrepancy. The Process Engineer site has been contacted and we await information.
Shell Cowdenbeath	2007: IPPC>EEMS>EU ETS. EU ETS = (EEMS Combustion). 2008: IPPC=EEMS>EU ETS. EEMS (combustion and flaring) > EU ETS Close consistency in 2007, with a slightly higher IPPC emission. In 2008, though, the IPPC and EEMS data are identical whilst the EU ETS data are lower than the EEMS combustion and flaring data (or even the EEMS combustion data alone). This may indicate a revision to EF used in the 2008 EU ETS data. The differences are not very large, so this will be reviewed in the 2009 dataset.
Shell St Fergus	2007 and 2008: EEMS>IPPC>EU ETS, but all data quite close. Identical data trends in both years. Also in both years the EU ETS data is slightly lower than the expected components of EEMS. Differences are low, so no further action required. Assume small scope differences with EEMS having the most complete coverage.
ExxonMobil SAGE	2007: EEMS>IPPC>>EU ETS. EU ETS = (EEMS Combustion). 2008: EU ETS>EEMS>>IPPC. The 2007 data show reasonable correlation, although the SPRI data is around 10% lower than the EEMS data. The EU ETS data are very consistent with the EEMS combustion data. However the 2008 data show very poor correlation. The SPRI CO_2 data in 2008 look very low (289kt CO_2 or 0.5% of the Scotland GHG emissions, and 70% lower than the EU ETS data for the site and much lower than in the SPRI in previous years). The SEPA Process Engineer has been contacted to review the data, as there are such large inconsistencies evident. Carbon dioxide emissions arise from heaters, boilers and incinerators in the separations and treatment trains, and from gas flaring, and all these sources may be within the EU ETS and IPPC scope. Also noted in the SPRI data is a very large decrease in NO_X emissions between 2006 and 2007 (629t to 175t, then 147t in 2008).
Total E&P St Fergus	2007: IPPC=EEMS>EU ETS. EU ETS = (EEMS combustion). 2008: IPPC = EU ETS > EEMS. Very close consistency across all data. The data illustrates the increase in scope of EU ETS. EEMS data is fractionally lower in 2008, perhaps due to use of site-specific EF in EU ETS. No uncertainties over scope or source allocation due to EEMS detail.

Site	Emissions Data Analysis
Interconnector Norwich	2007 and 2008: IPPC = EU ETS. No EEMS data. No EEMS data. Propose review of source allocation in NAEI, to gas industry.=
Centrica Easington	2007: IPPC>EEMS>EU ETS. EU ETS = EEMS (combustion). All data very close. 2008: EEMS=EU ETS>IPPC. Very close consistency between all data in both years. 2008 IPPC data assumed to be fractionally under-reported, as the EEMS and EU ETS data are almost exact. No uncertainties over scope, or source allocation due to EEMS detail.
Hydrocarbon Resources Barrow-in-Furness	2007: IPPC>EEMS>EU ETS. EU ETS = EEMS (combustion). 2008: IPPC>EEMS>EU ETS. EU ETS = EEMS (combustion and flaring). Very close consistency between the IPPC and EEMS data, and the EU ETS data are very consistent with the EEMS components as expected in each year. No uncertainties over scope, or source allocation due to EEMS detail.
BP Wytch Farm	2007: IPPC>EEMS>EU ETS. EU ETS lower than EEMS combustion. 2008: IPPC>EEMS=EU ETS. In 2008, IPPC data 4% higher than the others, otherwise consistent. 2007 data very inconsistent across all data. No information from permits to indicate why scope of reporting different. The differences are not very large, so this will be reviewed in the 2009 dataset. Remove duplicate entry within NAEI point source DB for 2007.
BP CATS	2007: EEMS>IPPC>EU ETS. EU ETS = EEMS (combustion). 2008: EEMS=EU ETS=IPPC. The EEMS and EU ETS data are exactly consistent in 2007, and suspect IPPC data is an under-report. 2008 data are all very closely consistent. No uncertainties over scope or source allocation due to EEMS detail.
BP Sullom Voe **(including Fortum O&M site)**	At the Sullom Voe terminal, Fortum O&M operate the on-site power station, and separate emissions data appear to be submitted to the SPRI from the two sites, but the reporting is inconsistent. The data for the two sites have been analysed together. In 2008, the sum of the IPPC data are very consistent with the total EEMS data (which is reported as "BP Sullom Voe"). In 2007 there are no emissions data in the SPRI for the power station, which could constitute a 250kt CO_2 gap, or 0.5% of the Scotland total GHGI. In both years, there are no EU ETS data for the refinery. These issues have been raised with the site Process Engineer at SEPA. We currently assume that the EEMS data provide the most comprehensive summary of total site emissions. There is good consistency in EEMS data going back to 2005. Within the NAEI point source database, the site allocations to NAEI sourcecodes need revision.
ConocoPhillips Theddlethorpe	2007: IPPC>EEMS>EU ETS. EU ETS = EEMS (combustion). 2008: IPPC>EU ETS>EEMS. (EU ETS only fractionally higher than EEMS.) In both years, there is very close consistency between the EU ETS and EEMS data, when the scope of EU ETS reporting is considered. However, the IPPC data are higher than EEMS by 18kt CO_2 (11%) in 2008 and 39kt CO_2 (27%) in 2007; both of these difference are less than 0.1% of the England inventory total. Within the EU ETS and IPPC scope descriptions, the overall thermal capacity of the combustion units is very close, but the IPPC permit includes other units such as offgas compressors and ground flares which could be a reason for the difference. The Environment Agency has been approached for further insight into possible IPPC emission sources excluded from EEMS and EU ETS.
ConocoPhillips Seal Sands	2007: EEMS>IPPC>>EU ETS. EU ETS << EEMS (combustion). 2008: IPPC>EU ETS>>EEMS. EU ETS << EEMS (combustion and flaring). There is no clear consistency in the data; the EU ETS emissions data for the site in 2007 and 2008 are much lower than the EEMS data of emissions from gas use, and IPPC emission estimates. In 2008, the IPPC data are 4% higher than the

Site	Emissions Data Analysis
	EEMS data, but in 2007 the EEMS data are much higher than the IPPC data. The site distils oil and natural gas liquids to produce stabilised crude oil, ethane, propane, iso and normal butane product streams. Boilers, turbines and generators on site have a combined thermal input capacity of 415MW. There are also several flares and a CO_2 source as a by-product, removed from the incoming fluids. The scope of emission sources reported at the site under IPPC is broader than that under the EU ETS, and includes the combustion of waste by-products, chemical CO_2 generation, around 240MWth reboiler units and emissions from waste water treatment. It is assumed that these sources must account for the huge disparity in the data. This has been confirmed by the Site Inspector; the reboiler units are the main additional source of emissions.
Px (TGPP) Teesside Gas Plant	2007: IPPC>EU ETS. No EEMS data. 2008: EU ETS>IPPC. No EEMS data. EU ETS data higher than IPPC in 2008; suspect IPPC under-report. Small data differences. No EEMS data. Review the source allocation in NAEI, to gas industry.
Star Energy Humbly Grove	2007 and 2008: IPPC>EU ETS. No EEMS data. Low emissions, so not a high priority, but very different data in 2007 and 2008. IPPC data doubles between 2007 and 2008, whereas EU ETS halves. In 2007, there is close consistency between the data, but the 2008 data are very different.
Shell Bacton	2007 and 2008: EEMS>IPPC>EU ETS. EEMS and IPPC data are very close in 2008, whilst there is a 30% difference in 2007. The EU ETS data are very similar in both 2007 and 2008, and around half of the total EEMS combustion data. The site processes natural gas and associated liquids, and CO_2 emissions arise from combustion processes (combined 58MWth capacity) and venting gas. Other sources in the IPPC scope include a thermal oxidiser, effluent treatment and gas compressors (70MWth). Non-ETS emissions are assumed to be from these non-combustion process sources.
Perenco Bacton	Very low emissions.
BP Dimlington	2007: IPPC>EEMS=EU ETS. 2008: IPPC>EEMS>EU ETS. EU ETS<EEMS (combustion and flaring). There is close consistency in 2007, with 6% higher emissions in IPPC, but in 2008 the differences are greater. There are several combustion processes on site, including gas turbine compressors rated at around 100MWth in total. The IPPC scope includes additional process sources such as gas-fired heaters to regenerate glycol and a thermal oxidiser to abate NMVOCs, and it is assumed that these sources account for the higher IPPC data. The 2008 inconsistency between EEMS and EU ETS will be reviewed in the 2009 dataset.
Innogy Cogen Seal Sands	2007 and 2008: IPPC = EU ETS. No EEMS data. Data fully consistent, but no EEMS data. Revise source allocation in the NAEI to "Other industrial combustion", rather than the oil and gas sector.
Tullow Bacton	2007: IPPC=EEMS>EU ETS. EU ETS consistent with EEMS (combustion). 2008: EEMS>IPPC>EU ETS. EU ETS<EEMS (combustion and flaring) All data show good consistency, although the EU ETS data in 2008 are slightly lower than the sum of EEMS combustion and flaring processes. Minor issue. No uncertainties over scope or source allocation due to EEMS detail.
BHP Billiton Point of Ayr	2007: IPPC=EEMS>EU ETS. EU ETS=EEMS (combustion). 2008: IPPC>EEMS>EU ETS. EU ETS>EEMS (combustion and flaring) Note high "EEMS other" emissions, due to thermal oxidiser. EU ETS data in 2008 are higher than the EEMS data for combustion and flaring, which suggests an under-report in EEMS. EU ETS plus "EEMS Other" gives exactly the IPPC data. No uncertainties over scope or source allocation due to EEMS detail. Revise 2008 EEMS data to match EU ETS and IPPC.

3.3 Petrochemical and Other Installations

A number of other sites have been identified from the initial scoping exercise as high priorities to understand the difference in scope and reporting of emissions between EU ETS and IPPC. In some cases, very large differences in CO_2 emissions are reported, and therefore it is important to quality check the data to research any possible mis-reports.

Year	Operator	Site	IPPC Permit	PI (kg CO2)	EUETS (kg CO2)	PI / EUETS
2008	BP Chemicals	Saltend Acety	BJ8162IR	374,390,000	115,910,161	323%
2008	Hunstman Petrochemi	Wilton	BS3590IE	939,000,000	803,469,391	117%
2008	Elementis Chromium	Eaglescliffe	BL2025IW	94,290,000	12,461,058	757%
2008	BASF	Seal Sands	BU2527IB	528,000,000	138,539,380	381%
2008	Ineos Silicas	Warrington	BM0354IP	83,290,000	24,779,681	336%
2008	PPG Industries	Wigan	BR5213IG	13,540,000	34,701,333	39%

BP Chemicals, Saltend Acetyls

The site includes boilers (fired on natural gas and other site-generated fuels) that generate steam to support chemical manufacturing processes of organic chemicals, including acetic acid, acetic anhydride, formic acid, propionic acid, acetone, ethyl acetate, vinyl acetate, ammonia and eythylene vinyl alcohol co-polymer. In addition, the site is supplied with steam and power from a 1200MWe Combined Cycle Gas Turbine power station from an adjacent site (Saltend Cogeneration Company Limited), which is not included in the site scope.

Vinyl Acetate Monomer is produced by the exothermic reaction between ethylene, acetic acid and oxygen in a fluidised bed reactor. Carbon dioxide is one of the components of the product mixture leaving the reactor and is removed and vented to atmosphere. The chemical process source of CO_2 is included in IPPC data but is not thought to be in the scope of the EU ETS data; in some years there is a specific line in the Pollution Inventory for "chemical CO_2", which varies between 20-70 $ktCO_2$ in recent years. Since 2006, the PI data are consistently 350-400 $ktCO_2$, whereas the EU ETS data are consistently around 110-115 $ktCO_2$. It is assumed, therefore, that there must be other boilers directly supporting non-ETS activities on site that contribute to the IPPC CO_2 emissions data, to make up the rest of the difference from the EU ETS data. This is our current assumption, but the Site Inspector has also been contacted and we await any further clarifications.

Hunstman Petrochemicals (Wilton Olefins Installation)

There are large differences in the CO_2 emissions data from IPPC and EU ETS for 2007 and 2008 indicating differences in reporting scope via these two mechanisms.

The main production plant is Olefins, a large cracker, mostly using naphtha as a feedstock, and producing a variety of aliphatic and aromatic hydrocarbons products which are the feedstocks for other plants on and off the Wilton Site. Average annual production is around 1,250,000 tonnes of primary products (ethylene and propylene) with around another 1,000,000 tonnes of co-products (predominantly gasoline and mixed C4s) and materials recycled fore use as fuel (methane). The production process uses high temperature furnaces to break down feedstocks into products which are then separated and purified using distillation. The site also includes above ground storage for liquid and gas products, a road tanker loading facility, below ground cavity storage for ethylene and mixed C4s. In addition, products are distributed by pipeline directly to customers or to ship loading facilities outside the installation.

All of the site CO_2 emissions are reported under IPPC as "thermal" (not "chemical"). Emissions of CO_2 from the site reported under the EU ETS in 2008 were much higher than those reported in 2007, and this is assumed to be due to the addition of Petrochemical 'Crackers' to the listed Schedule 1 activities within Phase II of the EU ETS. The Wilton

Olefins installation meets the required EU ETS Phase II Schedule 1 criteria (production of ethylene and propylene in excess of 50 kt yr-1), and thus all combustion emissions related to the chemical production on site are included in the scope of EU ETS in Phase II (2008 onwards). In 2008, there remains a difference in IPPC and EU ETS CO_2 estimates of around 100kt which are assumed to be derived from combustion activities that provide steam and heat to other chemical production on site which are outside of the EU ETS Schedule 1 scope. The IPPC permit notes other activities such as post-processing of gasoline ("Gasoline Treatment Unit"), and separation of mixed C4s into a butadiene product and a raffinate product using a solvent extraction process ("Butadiene 3 plant"). Heating of these processes is likely to be the source of the additional emissions in IPPC.

2008, BASF Plc, Seal Sands

The IPPC CO_2 emissions data are much higher than those reported within EU ETS for the Seal Sands site, indicating a difference in scope of reporting. The IPPC permit outlines the main emissions sources to include combustion from boilers and air heaters, an offgas oxidiser, and also the potential generation of CO_2 from the catalytic cracking and waste water treatment processes. In addition, the on-site CHP plant operated by Innogy Cogen (Permit BV2867) is listed on the IPPC permit for the BASF site as providing the bulk of the site's energy demands but emissions are reported separately within both IPPC and EU ETS for the CHP site.

The BASF site manufactures intermediate organic chemicals used for the production of plastics and fibres at other locations, with annual capacities in the order of hundreds of thousands of tonnes per annum. These processes require high energy input, provided by 3 independently operable boilers each capable of raising steam for use throughout the site. Each boiler can be fired using imported natural gas and also site-generated by-product fuels. In addition, the acrylonitrile process uses two reactors that require heated air, for start-up purposes, supplied by natural gas-fired air heaters. The IPPC permit covers CO_2 emissions from the main activities which are the boilers and the air heaters.

Due to the large difference in estimated CO_2 emissions via IPPC and EU ETS, it is assumed that the higher levels of emissions reported under IPPC are derived primarily from the boilers and air heaters operated for non-Schedule 1 EU ETS chemical production activities on site, and from the offgas oxidisers and catalytic cracking process. We have contacted the Site Inspector to review this analysis and have received some initial feedback.

Ineos Silicas, Warrington

The CO_2 emissions reported under IPPC are much higher than those reported under EU ETS indicating a difference in reporting scope. The site produces a range of chemical products, none of which fall under the EU ETS Schedule 1 activities, including manufacture of sodium silicates, silicon dioxides and aluminosilicates. The site has three boilers to provide steam and power, which have a total capacity of 98.4MWth and are fired on natural gas and fuel oil. The boiler emissions are reported under the EU ETS as they comprise a Schedule 1 activity.

However there are a number of chemical processes involving product drying which will not fall under EU ETS, and the emissions from these activities are likely to be the primary source of emissions under IPPC that are not reported within the EU ETS. For example, the IPPC permit includes reference to gas fired furnaces (in associated activities).

Elementis Chromium

The CO_2 emissions reported under IPPC are much higher than those reported under EU ETS indicating a difference in reporting scope. Elementis Chromium carry out a number of prescribed processes at the Eaglescliffe site, none of which are directly associated or Schedule 1 EU ETS activities. The site boilers comprise a 55MWth plant, and emissions from the boilers will be included under EU ETS.

The chemical processes on site include:

- Calcination of chromite ore in a high temperature rotary kiln to produce sodium chromate;
- Manufacture of various other chromium chemicals such as chromic oxide, produced by reacting sodium dichromate and ammonium sulphate at high temperatures.
- Drying of chemical products

The emissions from these activities are assumed to be the primary source of emissions under IPPC that are not reported within the EU ETS. We have contacted the Site Inspector to review this analysis. We have had some feedback but await further information.

PPG Industries, Wigan

The EU ETS CO_2 emissions are higher than IPPC data in 2008, which is unusual. The site manufactures glass fibre at over 20 tonnes per day, which meets the criteria in Schedule 1 of the EU ETS regulations. The process includes mixing of raw materials and feeding the batch into one of two oxy-gas fired furnace melters where it is melted and conditioned. The molten glass from each furnace melter then passes through a refining zone and canals (air-gas fired), and finally products are dried in gas fired or radio frequency ovens.

Two small gas fired boilers also supply steam for heating process oils and waters. Emissions of carbon dioxide arise from the combustion of natural gas/fuel oil in the furnace, natural gas during drying wet glass fibre packages, and the decomposition of carbonate minerals during the melting of the glass batch.

There appears to be no clear reason for the discrepancy in the reported emissions, as all of the processes appear to be reportable under both IPPC and EU ETS, and therefore it is assumed that either the Pollution Inventory data for the site are an under-report, or that there are other IPPC permits covering the site that have not been traced. The data reported are consistent since 2005, with the IPPC date around 14 $ktCO_2$, and the EU ETS data around 35-40 $ktCO_2$. It is perhaps conceivable that the IPPC data only includes chemical or thermal-derived emissions. The site emissions query has been raised with the North West Environment Agency office and we await any clarifications. Currently within the NAEI we assume that the EU ETS data are the correct CO_2 emissions for the site.

In addition to the above sites, our analysis also highlighted where mis-allocations within the NAEI database were leading to erroneous comparisons between IPPC and EU ETS data, i.e. where emissions data from different sites was being compared. In these instances, the NAEI assignation of installations to NAEI sources has been revised to correct these errors.

4 Conclusions & Recommendations

4.1 Main Study Findings

The primary focus of the work has been to review regulatory information / documentation for specific sectors and sites, and to analyse emissions data from different reporting mechanisms and the available information on the scope and detail of emissions reporting across sites. The aim of this analysis is to enable the inventory team to identify and resolve data gaps and inconsistencies, in order to improve the use of the available information across inventory deliverables; the work has led to direct improvements in site emission allocations and will lead to improvements within emission maps and inventories for Local Authorities, Devolved Administrations, and it will also help to improve the UK GHG inventory.

It has been apparent for some years that there are many instances where large differences occur between emissions data for carbon dioxide reported for the same site in different data sets. These differences posed a problem for inventory compilation - which data should be used, and were the differences due to errors or differences in scope? This research has enabled some of those differences to be understood, and has shown that there are many sites where the scope of emissions data differs depending upon whether the reporting is done for IPPC purposes, for EU ETS, or for reporting to EEMS. In some, but not all, cases, the differences in scope we have found allow the different emission estimates to be reconciled i.e. the data are consistent once differences in scope are taken into account.

However, there are still several sites where differences in scope have not been confirmed or where differences do not appear to explain the differences in reported emissions. This is partly due to a paucity of information for some sites, e.g. the level of information on EU ETS installations is not uniform. In other cases, the available data appear sufficient to determine the scope of reported data and yet still the differences in reported emissions cannot be explained. In this latter case, it could be assumed that errors in data or revisions between submission of one data set and submission of the next could have led to the differences in reported emissions. Only one instance of a revision to data has been found, and it seems unlikely that errors and revisions can account for all of the numerous and often very large differences in reported emissions. A further possibility is that we have not yet resolved the scope of reporting to a sufficient level of detail in order to identify differences. Further consultation with regulatory and industry experts is therefore recommended in order to identify the reasons for differences in emissions at these sites, and for several sites we await responses from the Site Inspectors / Process Engineers.

Sites where uncertainties remain about the reporting differences, and we await further clarifications or confirmation of our analysis findings from regulators include:

- Sullom Voe terminal
- SAGE terminal
- Kinneil terminal
- Theddlethorpe terminal
- BASF Seal Sands
- Hunstman Petrochemicals
- Elementis Chromium
- BP Chemicals Saltend
- PPG Industries, Wigan

Sites where we have identified misallocations or data discrepancies within the NAEI point source work that have now been resolved include:

- BP Wytch Farm (duplicate entry)
- South Killingholme refinery (use EU ETS, UKPIA data)
- Stanlow refinery (division of emission sources to include chemical processes)
- Grangemouth refinery (source allocations, scope of Olefins plant emissions data)
- Interconnector Norwich (revise source allocation)
- Sullom Voe (revise source allocations for power and refinery sites)
- Seal Sands terminal (allocation of extra IPPC emissions to reboilers)
- Teesside Gas Plant (revise source allocation)
- Innogy Cogen Seal Sands (revise source allocation)
- Point of Ayr terminal (use EU ETS and IPPC data, not EEMS data)
- Tioxide Europe (revise source allocations for chemical and CHP sites)
- Ineos Silica (allocation of extra IPPC emissions to chemical driers etc)

For many other complex and high-emitting sites, the research has enabled a much needed detailed quality check of emissions data, such as the research conducted to resolve the emissions totals and allocations across the Grangemouth installation of power station, refinery and petrochemical manufacturing plant.

The research has provided an initial opportunity to address specific issues for key emission sectors in the DA and UK inventories, and there are a number of ongoing areas of consultation with Site Inspectors and Process Engineers that have not been completed in time for this report. These clarifications will be pursued by the inventory team over the coming months and resolved within the 2010 UK and DA GHGI compilation cycle. The tables below summarise the site-specific research activities, findings and future work:

Table 4.1.1. Summary of Refinery Research Findings

DA	Site	Research Summary	Further work
Scotland	Grangemouth	IPPC permits reviewed for all units. Data reporting issues all resolved, with improved understanding of scope of reporting and allocation of emissions.	Review 2009 data.
Scotland	Dundee	IPPC permit reviewed. Data analysis - quality check.	Review 2009 data.
Wales	Pembroke	IPPC permit reviewed. Data analysis - quality check.	Review 2009 data.
Wales	Milford Haven	IPPC permit reviewed. Data analysis - quality check.	Review 2009 data.
England	Harwich	IPPC permit reviewed. Data analysis - quality check.	Review 2009 data.
England	Stanlow	IPPC permit reviewed. Site Inspector contacted. Data analysis resolved reporting issues, through clarification of scope. Changes made to NAEI source allocation for residual IPPC emissions.	Review 2009 data.
England	South Killingholme	IPPC permit reviewed. Data analysis indicated that EUETS and UKPIA data are consistent, IPPC data slightly higher. NAEI data to use EUETS / UKPIA data.	Review 2009 data.
England	North Tees	IPPC permit reviewed. Data analysis indicated that EUETS and UKPIA data are consistent, IPPC data slightly lower – suspect under-report. NAEI data to use EUETS / UKPIA data.	Review 2009 data.

DA	Site	Research Summary	Further work
England	Coryton	IPPC permit reviewed. Data analysis - quality check.	Review 2009 data.
England	Fawley	IPPC permit reviewed. Data analysis - quality check.	Review 2009 data.
England	Killingholme	IPPC permit reviewed. Data analysis - quality check.	Review 2009 data.

Table 4.1.2. Summary of Oil and Gas Terminal Research Findings

DA	Site	Research Summary	Further work
Scotland	Flotta	IPPC permit reviewed. Data analysis shows good consistency, with some evidence of small differences in EFs. Scope of reporting confirmed, and allocation of emissions to source in NAEI resolved.	Review 2009 data.
Scotland	Kinneil	IPPC permit reviewed and Process Engineer contacted. Data analysis indicates inconsistencies, approx 0.2% of Scotland total emissions. Uncertain scope differences between EEMS and EUETS.	Awaiting clarification from site Process Engineer.
Scotland	Cowdenbeath	IPPC permit reviewed. Data analysis shows good consistency, with some evidence of small differences in EFs. Scope of reporting confirmed, and allocation of emissions to source in NAEI resolved.	Review 2009 data.
Scotland	Shell St Fergus	IPPC permit reviewed. Data analysis shows good consistency. Reviewed assumptions regarding reporting scope under different mechanisms.	Review 2009 data.
Scotland	SAGE	IPPC permit reviewed and Process Engineer contacted. Data analysis indicates inconsistencies, approx 0.5% of Scotland total emissions. Uncertain scope differences between EEMS and IPPC, with inconsistent timeseries of CO_2 emissions within SPRI that requires clarification with SEPA.	Awaiting clarification from site Process Engineer.
Scotland	Total St Fergus	IPPC permit reviewed. Data analysis shows good consistency, with some evidence of small differences in EFs. Scope of reporting confirmed, and allocation of emissions to source in NAEI resolved.	Review 2009 data.
Scotland	Sullom Voe	IPPC permit reviewed and Process Engineer contacted. Data analysis indicates inconsistencies, approx 0.5% of Scotland total emissions. Uncertain scope differences between EEMS and IPPC, with inconsistent timeseries of CO_2 emissions within SPRI that requires clarification with SEPA. Source allocations in NAEI revised for the power station and oil refinery sites.	Awaiting clarification from site Process Engineer.
Wales	Point of Ayr	IPPC permit reviewed. Data analysis shows good consistency, except slightly low EEMS data in 2008. Scope of reporting confirmed. Allocation of emissions to source in NAEI resolved. 2008 data in NAEI to use the EUETS data, not EEMS.	Review 2009 data.
England	Easington	IPPC permit reviewed. Data analysis shows good consistency.	Review 2009 data.

DA	Site	Research Summary	Further work
		Scope of reporting confirmed, and allocation of emissions to source in NAEI resolved.	
England	Barrow	IPPC permit reviewed. Data analysis shows good consistency. Scope of reporting confirmed, and allocation of emissions to source in NAEI resolved.	Review 2009 data.
England	Wytch Farm	IPPC permit reviewed. Data analysis shows good consistency, except suspected IPPC under-report in 2007. Scope of reporting confirmed, and allocation of emissions to source in NAEI resolved. Duplicate entry in NAEI database removed.	Review 2009 data.
England	CATS	IPPC permit reviewed. Data analysis shows good consistency. Scope of reporting confirmed, and allocation of emissions to source in NAEI resolved.	Review 2009 data.
England	Theddlethorpe	IPPC permit reviewed. Site Inspector contacted. Data analysis shows good consistency, with IPPC slightly higher than EEMS and EUETS. Scope of reporting confirmed, and allocation of emissions to source in NAEI resolved.	Awaiting feedback from Site Inspector to clarify IPPC scope. Review 2009 data.
England	Seal Sands	IPPC permit reviewed. Site Inspector contacted. Data analysis shows good consistency, except higher emissions in IPPC – scope confirmed by Site Inspector. Allocation of emissions to source in NAEI resolved.	Review 2009 data.
England	Shell Bacton	IPPC permit reviewed. Data analysis shows good consistency. Reviewed assumptions regarding reporting scope under different mechanisms.	Review 2009 data.
England	Dimlington	IPPC permit reviewed. Data analysis shows good consistency. Reviewed assumptions regarding reporting scope under different mechanisms.	Review 2009 data.
England	Tullow Bacton	IPPC permit reviewed. Data analysis shows good consistency. Scope of reporting confirmed, and allocation of emissions to source in NAEI resolved.	Review 2009 data.

Table 4.1.3. Summary of Chemical Site Research Findings

DA	Site	Research Summary	Further work
England	BP Chemicals	IPPC permit reviewed. Site Inspector contacted. Reviewed assumptions regarding reporting scope under different mechanisms and allocation of IPPC "residual" emissions.	Awaiting response from Site Inspector to clarify IPPC scope. Review 2009 data.
England	Hunstman Petrochemicals	IPPC permit reviewed. Site Inspector contacted. Reviewed assumptions regarding reporting scope under different mechanisms and allocation of IPPC "residual" emissions.	Awaiting response from Site Inspector to clarify IPPC scope. Review 2009 data.
England	BASF	IPPC permit reviewed. Site Inspector contacted and has provided initial feedback to clarify scope of reporting. Reviewed assumptions regarding reporting scope under different mechanisms and allocation of IPPC "residual" emissions.	Follow-up with Site Inspector. Review 2009 data.
England	Ineos Silicas	IPPC permit reviewed. Site Inspector contacted and has provided initial feedback to clarify	Review 2009 data.

DA	Site	Research Summary	Further work
		scope of reporting. Reviewed assumptions regarding reporting scope under different mechanisms and allocation of IPPC "residual" emissions.	
England	Elementis	IPPC permit reviewed. Site Inspector contacted and has provided initial feedback to clarify scope of reporting. Reviewed assumptions regarding reporting scope under different mechanisms and allocation of IPPC "residual" emissions.	Review 2009 data.
England	PPG	IPPC permit reviewed. Site Inspector contacted. Reviewed assumptions regarding reporting scope under different mechanisms and allocation of IPPC "residual" emissions.	Awaiting response from Site Inspector to clarify IPPC scope. Review 2009 data.

4.2 Additional Benefits of the Research

In addition to meeting the primary objectives noted above, this research has enabled the NAEI/GHGI team to access resources of information that are useful across a range of emissions mapping, inventory and modelling improvement programmes, including:

4.2.1 IPPC Information Resource

The NAEI team now has access to a more up to date resource of site information for high-emitting sites across the UK, not only within the key target sectors of oil & gas, refineries and petrochemicals, but also for ALL IPPC and EU ETS sites in Northern Ireland, plus a number of specific chemical sites in England and Wales. These documents are an extremely useful resource for the ongoing work to improve the UK emission inventories, through providing an up to date understanding of plant design, fuel use, abatement options and so on. Not all of the documents have been reviewed in full within this research project, due to time and resource limitations. The documents will provide useful evidence for analysing the scope of IPPC reporting to respond to UNFCCC and EUMM enquiries; for example, the permits describe where on-site industrial waste water treatment works are included in the permit scope and hence the PI/SPRI/ISR emission estimates are required to include emissions from that source within the installation total.

4.2.2 Stack Parameters: Pollution Climate Mapping

Stack parameters for many of the high priority sites have been obtained through review of available IPPC application documentation. This information is being used to update the UK stack database to improve the Pollution Climate Mapping work undertaken on behalf of DECC and Defra.

4.2.3 Landfill Design Information

Updated information (from consultations with regulators during site visits) on details of landfill design and application of methane capture and oxidation (e.g. flaring, gas engines) has been collected to augment the research to revise the landfill emission mapping grids by the AEA emissions mapping team.

4.2.4 Upstream Oil, Upstream Gas

The allocation of sites to "oil" or "gas" industries separately has been agreed in consultation with the DECC regulators of EEMS. This now enables the NAEI team to prepare for the improvements required by the IPCC 2006 Guidelines on national inventory reporting, and

also to review and improve End User emission inventory data and methodologies. The site allocations are provided in the Table A1 in Appendix 1, whilst the analysis of the division of 2008 CO_2 emissions between upstream oil and upstream gas are provided in Table A2 in Appendix 1.

4.3 Recommendations

4.3.1 Annual process to prioritise and obtain site-specific data and regulatory information

The research team has found that site information and data availability between agencies and regions within agencies is somewhat variable. We understand that the Environment Agency is implementing a new data access system for all EPR information, but that is not available yet and hence contact with local area offices has been necessary to acquire information. Several of the IPPC permits were available electronically from a database called the Permit Administration System (PAS), whilst others were not. The SEPA PPC Registry system is managed through a small number of regional offices, with some permits available electronically and others scanned or photocopied for the purposes of this research. In Northern Ireland, all site information was accessed via a central registry in Belfast.

The study team managed to acquire all of the key IPPC information for priority sites, although the process was quite resource-intensive. The focus on oil and gas, refinery and petrochemical sites, which are often co-located on a small number of coastal sites, enabled the data gathering from local offices to be a reasonably cost-effective option; for example, in Scotland all of the sites were accessed via the Edinburgh, Aberdeen or Dingwall SEPA offices. For research on other industrial sectors this is unlikely to be the case. The development of a centralised system of access to electronic IPPC permits in Scotland would enable such research to be conducted more quickly and efficiently, but this would require the provision of resources to SEPA to enable system development and maintenance.

- It is recommended that an annual process of prioritising sites and requesting IPPC / EPR permit and application information be conducted as part of the NAEI programme, to gradually build up access to up to date IPPC / EPR permit information.

4.3.2 Data Supply Agreements

The difficulty in obtaining site-specific information from some sources has highlighted the need for Data Supply Agreements to be established with environmental regulators of IPPC and EU ETS in order that the UK GHGI compilation team can access permits and data more readily in future. In particular, access to the Environment Agency's (IPPC) Permit Administration System (or its replacement system which is under construction) and the DECC EU ETS site information from the National Allocation Plans would enable further improvements to research into energy and emissions data, which in turn would facilitate improved analysis of policy options, drawing upon site-specific information.

- It is recommended that these matters be taken forward through the arrangement of Data Supply Agreements between DECC and UK GHGI data providers, through the inventory improvement programme under the National Inventory Steering Committee.

4.3.3 Future Access to EEMS Data from Onshore Oil & Gas Terminals

Through this research, it is apparent that the EEMS data from oil & gas terminals is an incredibly useful dataset that provides a good degree of transparency as regards emission

sources for oil and gas terminal emissions. These are high-emitting sites, but there is no legal requirement for oil & gas terminals to report these data to DECC; it is our understanding that the EEMS data submissions by onshore installations are currently performed on a voluntary basis. The detail of the EEMS data makes it very useful from a policy perspective, as it provides transparency regarding which activities / emission sources on site are priorities for working with industry to mitigate emissions. There is a risk that industry may cease to provide the data to DECC, due to the duplication of reporting under IPPC (mandatory) and EEMS (voluntary).

- It is recommended that the EEMS reporting arrangements for onshore oil and gas terminals be reviewed. The future provision of the detailed EEMS data could be secured through implementation of a Data Supply Agreements between DECC and the terminal operators, as part of the inventory improvement programme under the National Inventory Steering Committee.

4.3.4 Review of EU ETS Phase III data on Chemicals Sector

From 2012, the EU ETS Phase III scope will be extended to include new activities, and there will be a need to review the available data for specific sources to improve the UK and DA GHGI. One key example is that of flaring on chemical production sites; this research has indicated that several of the chemical sites where the IPPC emissions data are higher than those from the EU ETS exhibit potentially high CO_2 emissions from flaring of off-gases, waste solvents and other process effluents. These emission sources are estimated within the UK and DA GHG inventories, but the estimates are based on limited industry information and the EU ETS data will be an important new dataset to improve those national, regional and local estimates.

The improvement of these estimates may be possible in advance of the EU ETS Phase III data reporting (in 2013) were the Inventory Agency granted access to the Phase III National Allocation Plan documentation.

[Note that currently within point source emission estimates, where the IPPC data include estimates of these sources the data WILL be included in the AEA database, but may not be allocated to the correct source.]

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- Ian Furneaux of the DECC Oil & Gas team;
- Emilie Sinet of UK Oil and Gas.

Appendices

Appendix 1: Oil and Gas Sites – Allocations and 2008 Emissions Summary

Appendix 2: The Scope of EU ETS

Appendix 3: IPPC Site Information Summaries

Appendix 1

Oil and Gas Sites: Allocations and 2008 Emissions Summary

Table A1: Allocation of Oil and Gas Sites within EEMS

Site	Gas, Light Crude or Heavy Crude	Site	Gas, Light Crude or Heavy Crude
Bacton Gas Terminal 1	Gas	Andrew Platform	Light Crude
Bacton Gas Terminal 2	Gas	Bruce PUQ Platform	Light Crude
Bacton Gas Terminal 3	Gas	Clair Phase 1 Platform	Heavy Crude
Barrow North Terminal	Gas	Cleeton CPQ Platform	Gas
Barrow South Terminal	Gas	Everest North Platform	Light Crude
CATS	Gas	Foinaven - FPSO Petrojarl	Light Crude
Condensate Storage Facility	Gas	Harding Platform	Heavy Crude
Dimlington	Gas	Hyde Platform	Gas
Easington Terminal 1	Gas	Lomond Platform	Gas
Flotta Terminal	Light Crude	Magnus Platform	Light Crude
Frigg Terminal, St Fergus - Phase II	Gas	Marnock ETAP PDR Platform	Light Crude
Frigg Terminal, St Fergus - Phase II	Gas	Ravenspurn North CPP Platform	Gas
Miller Reception Facility, St Fergus	Gas	Schiehallion FPSO	Heavy Crude
Mossmorran	Gas	West Sole WA Main Platform	Gas
Nigg	Heavy Crude	Apollo Spirit	Gas
Point of Ayr Terminal	Gas	Murchison Platform	Light Crude
SAGE - St Fergus	Gas	Ninian Central Platform	Light Crude
Seal Sands - Teeside	Heavy Crude	Ninian Northern Platform	Light Crude
St Fergus - Shell	Gas	Ninian Southern Platform	Light Crude
Hound Point	Light Crude	Petrojarl Banff	Light Crude
Sullom Voe	Light Crude	Tiffany Platform	Light Crude
Theddlethorpe	Gas	Rough BD Platform	Gas
Wytch Farm Gathering Station	Light Crude	Alba FSU	Heavy Crude
AH001	Light Crude	Alba Northern Platform	Heavy Crude
Fife FPSO - Uisge Gorm	Light Crude	Captain FPSO	Heavy Crude
Guillemot West(Triton) FPSO	Light Crude	Captain WPPA	Heavy Crude
Forties FA Platform	Light Crude	Erskine Platform	Gas
Forties FB Platform	Light Crude	Jade Platform	Light Crude
Forties FC Platform	Light Crude	Judy Platform	Light Crude
Forties FD Platform	Light Crude	LOGGS Platform Complex	Gas
Armada Platform	Gas	MacCulloch FPSO	Light Crude
Douglas DA Platform	Light Crude	Murdoch Platform Complex	Gas
Britannia Platform	Light Crude	Viking B Platform Complex	Gas
Amethyst A1D Platform	Gas	Beryl A Platform	Light Crude

Table A1: Allocation of Oil and Gas Sites within EEMS: cont.

Site	Gas, Light Crude or Heavy Crude	Site	Gas, Light Crude or Heavy Crude
Beryl B Platform	Light Crude	Goldeneye Platform	Light Crude
Dunlin A Platform	Light Crude	Guillemot, Teal FPSO Anasu	Light Crude
Morecambe North Platform	Gas	Leman AD1 Platform [SHEL	Gas
Morecambe South CPP1 Platforn	Gas	Nelson Platform	Light Crude
Beatrice AP Platform	Heavy Crude	Pierce FPSO (Haewene Brin	Light Crude
Heather A Platform	Heavy Crude	Sean PP Platform	Gas
Thistle A Platform	Light Crude	Shearwater C PUQ Platform	Gas
Gryphon A Production Vessel	Heavy Crude	Tern Platform	Light Crude
Janice A	Light Crude	Arbroath Platform	Light Crude
Brae A Platform	Light Crude	Auk A Platform	Light Crude
Brae B Platform	Light Crude	Beatrice B Platform	Heavy Crude
Brae East Platform	Light Crude	Beatrice C Platform	Heavy Crude
Buzzard Production Platform	Light Crude	Buchan A Platform	Light Crude
Scott JD Platform	Light Crude	Claymore A Platform	Heavy Crude
Balmoral FPV	Heavy Crude	Clyde Platform	Light Crude
Inde AC Platform (PERENCO)	Gas	Fulmar A Platform	Light Crude
Lancelot Platform	Gas	Montrose A Platform	Light Crude
Leman AC Platform [PERENCO]	Gas	Piper B Platform	Light Crude
Pickerill B Platform	Gas	Ross FPSO Bleo Holm	Light Crude
Thames AP Platform	Gas	Saltire A Platform	Light Crude
Trent Platform	Gas	Tartan A Platform	Light Crude
Tyne Platform	Gas	Alwyn North NAB Platform	Light Crude
Cavendish	Gas	Dunbar Platform	Light Crude
Windermere Platform	Gas	Elgin PUQ platform	Light Crude
Brent A Platform	Light Crude	Frigg MCP-01 Platform	Gas
Brent B Platform	Light Crude	Hewett 48/29 A Platform	Gas
Brent C Platform	Light Crude	Hewett 48/29 B Platform	Gas
Brent D Platform	Light Crude	Hewett 48/29 C Platform	Gas
Clipper PT Platform	Gas	Hewett 52/5 A Platform	Gas
Cormorant A Platform	Light Crude	Chestnut Hummingbird FPS	Light Crude
Cormorant North Platform	Light Crude	Kittiwake A Platform	Light Crude
Curlew FPSO	Light Crude	Chiswick Platform	Gas
Eider Platform	Light Crude	Markham ST-1 Platform	Gas
Gannet A Platform	Light Crude		

Table A2: 2008 CO_2 Emissions by Source, Upstream Gas and Upstream Oil Production

Offshore Sites	Gas	Oil	Gas	Oil
2008	**CO_2 (t)**	**CO_2 (t)**	**%**	**%**
Direct Process	-	330,842	0%	100%
Flaring	129,043	2,934,163	4%	96%
Fugitive Emissions	48	251	16%	84%
Gas Consumption	2,110,076	8,769,698	19%	81%
Gas Venting	66	7,781	1%	99%
Oil Loading	-	1,437	0%	100%
Other Gases	-	-		
Well Testing	31,599	29,042	52%	48%
Total	**2,270,832**	**12,073,213**	**16%**	**84%**

Onshore Sites	Gas	Oil	Gas	Oil
2008	**CO_2 (t)**	**CO_2 (t)**	**%**	**%**
Direct Process	342,300	-	100%	0%
Flaring	129,761	427,907	23%	77%
Fugitive Emissions	52	43	55%	45%
Gas Consumption	1,535,087	1,059,216	59%	41%
Gas Venting	106	109	49%	51%
Oil Loading	-	-		
Other Gases	-	-		
Storage Tanks	-	-		
Total	**2,007,307**	**1,487,274**	**57%**	**43%**

All Sites	Gas	Oil	Gas	Oil
2008	**CO_2 (t)**	**CO_2 (t)**	**%**	**%**
Direct Process	342,300	330,842	51%	49%
Flaring	258,804	3,362,070	7%	93%
Fugitive Emissions	100	294	25%	75%
Gas Consumption	3,645,163	9,828,914	27%	73%
Gas Venting	172	7,890	2%	98%
Oil Loading	-	1,437	0%	100%
Other Gases	-	-		
Storage Tanks	31,599	29,042	52%	48%
Total	4,278,139	13,560,488	**24%**	**76%**

Appendix 2

The Scope of EU ETS

The Scope of EU ETS

Under Phase I (2005-2007), activities covered by the EU ETS were listed in Schedule 1 of the Regulations and included:

1. Energy activities
2. Production and processing of ferrous metals
3. Mineral Industry
4. Timber and Paper Industries

For each of the activities listed in Schedule 1 of the Regulations, specific criteria and thresholds are outlined (see table below) to enable operators and regulators to identify whether each installation is covered by the scheme. In light of guidance from the European Commission in relation to the Phase II National Action Plans (NAPs), and in order to address any gaps that may have arisen in Phase I of the scheme, the UK Government decided to broaden the scope of the EU Emissions Trading Scheme in Phase II (2008-2012) to include:

5. Glass
6. Mineral Wool Production
7. Gypsum
8. Flaring from offshore oil and gas production
9. Petrochemical (Crackers)
10. Integrated steelworks
11. Carbon black

The Regulations include the provision for 'Aggregation', where an operator undertakes several activities in the same installation which fall under the same sub-heading in Schedule 1, the capacities of these should be added together, regardless of whether they are technically connected.

In addition, any other directly associated activities undertaken on the same site which have a technical connection with the Schedule 1 activities and which could have an effect on greenhouse gas emissions and pollution are regarded as part of the same installation. However, this is influenced by the 'asymmetry rule', which states that in order for a non-Schedule 1 activity to be included as part of an installation, it must serve the Schedule 1 activity. For example, where a 25 MW boiler is serving a chemical manufacturing plant (non-schedule 1 activity), the non-Schedule 1 activity is not considered to be an associated activity, as it is not serving the Schedule 1 activity.

The Guidance provides a definition of 'directly associated activities', which may be said to have a technical connection to the Schedule 1 activity. This categorizes directly associated activities into 4 main types:

1. Input activities – associated with the storage and treatment of inputs (e.g. fuel);
2. Intermediate activities – concerned with the storage and treatment of intermediate products;
3. Output activities – concerned with the treatment of waste; and,
4. Output activities – concerned with finishing, packaging and storage of products from the Schedule 1 activity.

However, only emissions from the Schedule 1 activities require to be accounted for to meet the monitoring and reporting requirements of the EU ETS.

Schedule 1 Activities – Criteria and Thresholds

Activity Category	Sub-category	Inclusion criteria	Exclusions
Energy	Combustion installations	Rated thermal input > 20 MW Combustion installations include the following appliances: • Electricity generators • Boilers • CHP • Gas turbines (including compressors)	Hazardous and municipal waste installations
	Mineral oil refineries	Activities of mineral oil refineries	
	Coke Ovens	Activities of Coke Ovens	
Production and processing of ferrous metals	Metal ore roasting and sintering plants	Activities of metal ore (including sulphide ore) roasting and sintering installations	
	Production of pig iron and steel	Primary or secondary fusion. Production of > 2.5 tonnes h^{-1}	
Mineral Industries	Production of cement clinker in rotary kilns.	Production > 500 tonnes day^{-1}	
	Production of lime in rotary kilns or other furnaces	Production > 20 tonnes day^{-1}	
	Manufacture of ceramic products by firing in kilns.	Production > 75 tonnes day^{-1} Kiln capacity more than $4m^3$ and the setting density more than 300 kg m^{-3}.	
Other Activities	Production of pulp from timber or other fibrous materials.		
	Production of paper and board.	Production capacity > 20 tonnes day^{-1}	
		Phase II	
Glass	Manufacture of glass, including glass fibre – including all fuel combustion on site related to the manufacture of glass.	All sites with a melting capacity exceeding 20 tonnes day^{-1}	
Mineral Wool	*Manufacture of mineral wool insulation material, using rock, glass or slag, including all fuel combustion on site related to the manufacture of mineral wool products.*		
Gypsum	Manufacture of gypsum products at installations where the processes on the site include grinding, calcining and board drying.	Installations with a rated thermal input > 20 MW.	
Flaring from offshore oil and gas production	*The combustion of materials derived from the exploration,*	*Activities undertaken at offshore oil and gas facilities or onshore oil and gas reception terminals that are*	

Activity Category	Sub-category	Inclusion criteria	Exclusions
	appraisal, production, storage and processing of offshore oil and gas for purposes other than energy production.	*designated combustion installations with a rated thermal input > 20 MW.*	
Petrochemicals (Crackers)	Combustion emissions from chemical installations designed for the production of propylene and/ or ethylene.	Product output of at least 50 kt yr^{-1}	
Production and processing of ferrous metals – Phase II (Integrated Steelworks)	Metal ore (including sulphide ore) roasting or sintering installations		
	Installations for the production of pig iron or steel (primary or secondary fusion) including continuous casting.	Capacity exceeding 2.5 tonnes h^{-1}	
	Additional combustion activities at integrated steelworks		
Carbon Black	Installations for the production of carbon black involving the carbonisation of organic substances such as oils, tars, cracker and still residues.	Combustion plant rated thermal input > 20 MW.	

Appendix 3

IPPC Site Information Summaries

A3.1 Environment Agency Oil & Gas: IPPC Permit information

Site Reference	IPPC Reference	Combustion emissions	Combustion > 50MWth (Aggregate)	Process emissions	Flaring	Venting	Material storage/ handling	Waste Water T/ment	Comments / Sources
Point of Ayr Terminal: BHP Billiton Petroleum Ltd	ZP3331LM	●		●	●		●		Combustion sources < 20MWth input. Gas oil standby turbine; gas/gas oil standby burner; 2 gas fired hot-oil burners; thermal oxidiser, 2 flares (LP, HP).
Easington Gas Terminal: Centrica Storage Limited	AP3833LW	●	●	●	●		●		2 regeneration gas heaters; 2 methanol reboilers; condensate flash heater; condensate stabiliser reboiler; 2 outlet gas heaters; ground flare.
E Bacton Gas Terminal, Shell UK	NP3637SW	●	●	●	●		●	●	2 Trim heaters; 2 Sales gas heaters; hot oil heater.
Central Bacton Gas Terminal, Perenco UK Ltd	PP3633LM	●		●		●	●	●	No combustion activities on site > 20 MW thermal input, aggregate activities < 50 MWth. 6 refrigerant compressors; recycle gas compressor; vapour recovery compressor; 2 MEG reboilers; 2 stabilisation reboilers; standby generator.
ConocoPhillips (UK) Limited, Theddlethorpe Gas Terminal	LP3933LX	●	●	●	●	●	●		2 thermal oil heaters; ground flare and standby diesel generator.
Barrow Gas Terminals - North, South & Rivers.	BX1675IT/ V002	●	●	●	●	●	●	●	2 hot oil heaters; dew point control regeneration heater; CO_2 removal plant vent gas incinerator; pipe flare and ground flare.

Site Reference	IPPC Reference	Combustion emissions	Combustion > 50MWth (Aggregate)	Process emissions	Flaring	Venting	Material storage/ handling	Waste Water T/ment	Comments / Sources
ConocoPhilips Oil Terminal (Seal Sands)	NP3033LN	●	●	●	●		●	●	6 reboilers and an elevated gas flare.
Dimlington Gas Terminal	QP3133LR	●	●	●	●	●	●		5 small process heaters; 2 MEG reboilers and 2 flares.
BP Wytch Farm Gathering Station	CP3039MV	●	●	●	●		●	●	3 x flares, ancillary combustion plant and waste water treatment
Milford Haven Refinery, Murco Petroleum Ltd	AP3830XQ	●	●	●	●		●	●	Schedule 1 EU ETS process.
Coryton Refinery, Petroplus Refining and Marketing Ltd	BP3135LK	●	●	●	●	●	●	●	Schedule 1 EU ETS process.
Fawley Refinery, Hampshire. Esso Petroleum Company Ltd	BR69961C	●	●	●	●	●	●		Schedule 1 EU ETS process.
Lindsey Oil Refinery Total UK Ltd	UP3430LQ	●	●	●	●	●	●	●	Schedule 1 EU ETS process.
Eastham Refinery, Wirral.	BS5215IZ	●		●	●		●	●	Schedule 1 EU ETS process.
Petroplus Refining Teeside	NP3733LM	●	●	●	●	●	●		Schedule 1 EU ETS process.
Stanlow Manufacturing	NP3237LS	●	●	●	●		●	●	Schedule 1 EU ETS process.

Site Reference	IPPC Reference	Combustion emissions	Combustion > 50MWth (Aggregate)	Process emissions	Flaring	Venting	Material storage/ handling	Waste Water T/ment	Comments / Sources
Chevron, Pembroke Refinery	QP3033LW	●	●	●	●	●	●	●	Schedule 1 EU ETS process.
Harwich Refinery (Colchester Essex)	NP3139LM	●		●		●	●		Schedule 1 EU ETS process.
ConocoPhillips Ltd Humber Refinery	UP3230LR - 2007	●	●	●	●		●	●	Schedule 1 EU ETS process.
Petroplus Tankstorage Milford Haven Limited	BK1341 - no date					●	●	●	

A3.2 SEPA Oil & Gas: IPPC Permit information

Site Reference	IPPC ID	Combustion emissions	Combustion > 50MWth (Aggregate)	Process emissions	Flaring	Venting	Material storage/ handling	Waste Water Treatment	Comments / sources
Ineos Manufacturing Scotland Ltd, Grangemouth	PPC/A/101 3141 - 2007	●	●	●	●	●	●	●	Schedule 1 EU ETS process.
SAGE Terminal St Fergus, Peterhead	PPC/A/100 0158 - 2005	●		●	●		●	●	Processing well fluids into natural gas and NGL. NGL and MEG sepn and stabilisation: 2-stage compressor. 6.5 MW electric motor. MEG Regen facility
Talisman Energy, Flotta Oil terminal	PPC/A/101 2610 - 2007	●	●	●	●		●	●	6 hot oil heaters; main flare, LPG flare; 2 ground flares; 2 gas turbine loading pumps; driers and 6 hot oil heaters.
Shell UK St Fergus Gas Plant, Aberdeenshire	PPC/A/101 3096 - 2007	●	●	●	●	●	●		2 molecular sieve regeneration heaters; 2 reboiler furnace; regeneration gas heaters; reboiler furnace; Goldeneye incinerator; 2 ground flares; sour flare; elevated flare; thermal oxidiser; thermal fluid heating system.

Site Reference	IPPC ID	Combustion emissions	Combustion > 50MWth (Aggregate)	Process emissions	Flaring	Venting	Material storage/ handling	Waste Water Treatment	Comments / sources
Nynas Dundee	PPC/A/101 3015 - 2007	●		●	●	●	●	●	Schedule 1 EU ETS process.
Goldeneye, Shell, St Fergus Gas plant, Aberdeenshire	PPC/N/200 14 - 2007	●		●	●	●	●		Thermal oxidiser; thermal fluid heating system;
Fortum, Grangemouth CHP, Stirlingshire	PPC/A/101 3071 - 2007	●	●	●		●	●	●	
Fortum, Sullom Voe	PPC/A/101 3522 - 2007	●	●	●	●		●	●	Main flare, surge flare and LPG flare; standby generator;
Kinknockie Gas Odorisation Plant	PPC/B/100 4308 - 2006						●		
Cruden Bay Oil reception facility	PPC/A/101 3111 - 2007	●		●	●		●	●	2 inline booster pumps; emergency ground flare;
Shell UK Mossmoran	PPC/A/101 3495 -2007	●	●	●	●		●	●	3 process furnaces; 3 molecular sieve regeneration heaters; 2 ground flares, HP flare and LP flare. (Petrochemical cracker).
Shell Gas Ltd, Cowdenbeath, Fife (NGL Plant)	PPC/E/300 82 - 2007						●		
Talisman Nigg	PPC/A/101 2611	●		●	●		●	●	Ground flare; elevated flare; effluent treatment plant.

Site Reference	IPPC ID	Combustion emissions	Combustion > 50MWth (Aggregate)	Process emissions	Flaring	Venting	Material storage/ handling	Waste Water Treatment	Comments / sources
Exxon Mobile St Fergus	PPC/A/1012449	•	•	•	•		•	•	Hot oil heaters; primary and secondary reboilers; inlet gas heaters; amine exchanger; LP flash condenser; amine regenerators; acid gas co-incinerator; ground flare; elevated flare.

A3.3 Environment Agency Chemical and NFM Sites: IPPC Permit information

Site Reference	IPPC Reference	Combustion emissions	Combustion > 50MWth (Aggregate)	Process emissions	Flaring	Venting	Material storage/ handling	Waste Water Treatment	Comments / sources
BP Chemicals, Saltend, Hull	BJ8162IR	Boilers fired by natural gas and site-generated fuels.	No. (Adjacent, separate 1200MWe CCGT)	•			•		Chemical generation of CO_2 from production of vinyl acetate monomer.
Hunstman Petrochemicals (Winton Olefins Installation)	BS3590IE	Boilers, furnaces, crackers, distillation columns.	•	•			•		3 boilers and 3 superheaters. 14 USC furnaces; 3 VMR furnaces and flare systems. Chemical processes: cracking naphtha, high temp furnaces to breakdown products, distil. Gasoline treatment unit and Butadiene plant also.
BASF Seal Sands	BU2527IB	Boilers, gas-fired air heaters, crackers, thermal oxidisers	•	•			•	•	Absorber offgas oxidiser. CO_2 also generated via cat. cracking process and waste water treatment. Acryonitrile process uses gas-fired air heaters.

Tioxide Europe Ltd, Grimsby	NP3438SE	•	•	•			•		Process emissions: 3 driers; CO_2 extraction unit; workshop burners (lead smelter); chemical generation of CO_2 from application of lime to neutralise acid waste.
Ineos Silicas, Warrington	RP3233GW / BM0354IP	•	98 MWth, gas and oil-fired boilers	•			•	•	Process activities include a gas fired furnace and waste water treatment plant. Lots of drying of silicate products also needed.
Elementis Chromium, Eaglescliffe	BL2025IW	•	55MWth boilers	•		•	•		Calcination of chromite ore in a high temperature rotary kiln Manufacture of various other chromium chemicals at high temperatures. Drying of chemical products
PPG Industries, Wigan	BR5213IG	Gas-fired boilers for steam, heating process oils and water.		•					2 oxy-gas fired furnaces. Melters, refining, product drying in gas-fired or radio frequency ovens. CO2 eluted from decarb of carbonate minerals

A3.4 Northern Ireland Environment Agency Sites: IPPC Permit information

Site Reference	IPPC ID	Main Activities	Associated Processes	Major Sources	Stacks/ flares and vents	Onsite waste management	Waste water/ Effluent treatment
Quinn Glass	P0053/04A	Melting and refining	Storage & handling of raw materials, Hot end surface coating, Cold end coating, Annealing, Cold end coating, storage, Storage and handling of solid and liquid wastes,	Melting mixed batch and cullet in end fired regenerative furnaces.	Main stack; Factory roof vents above Furnaces; Filter vents on lime and ash silos.	Controlled storage of wastes such as waste oils, hot and cold end coating and ferroclean.	Sand washing lagoon and oil interceptor.
Lafarge Cement	P0052/04A	Operation of cement kiln systems.	Receipt of raw materials from suppliers; storage/crushing of limestone. Storage and processing of raw materials, process feedstock, Coal & petcoke, gas oil, recovered oil, Clinker, cement and substitute fuels.	Kiln exhaust – main stack. Coal is primary source of fuel utilised. Substitute fuels include recycled liquid fuel, recycled fuel oil and used tyres.	Crusher and mill exhausts. Double rotator north – mill exhaust. Kiln exhaust main stack. Kiln auxiliary stack. Clinker conveyor; Cement separator; Bulk and bag cement packing exhausts. RLF storage tank VOC abatement vent.	General Waste, Waste Oil, Scrap metal, Scrap rubber belting, Dust and rubble, Asbestos waste, Special waste.	Settlement Ponds.
Premier Power, Ballylumford	P0125/06A	Power generation	Two operational oil fired (either light or heavy fuel oil) auxiliary boilers used to produce steam to supplement steam from the main boilers which is primarily used to heat fuel oil systems and to atomise fuel oil in the burners when	B Station consisting of 3 x 120MWe (Phase 1) and 3 x 200MWe. Primary fuel - natural gas with HFO back up. Only the Phase 2 boilers within the B Station	B station combustion gases are used to preheat combustion air to the boilers before passing to atmosphere through two 124m stacks. C station gases vent to atmosphere via 3 x	Standard waste management facilities for managing: packaging and cleaning materials; waste lubricating oils, waste oils; ion exchange resins; waste chemicals.	Oil/ water separator.

Site Reference	IPPC ID	Main Activities	Associated Processes	Major Sources	Stacks/ flares and vents	Onsite waste management	Waste water/ Effluent treatment
			firing on HFO. Storage and handling of fuel oil.	are currently operational. C Station a CCGT facility with a capacity of 600 MWe consisting of a 500 MWe CCGT block and a 100 MWe block.	75m stacks. During open cycle operation the combustion gases discharge through two 55m by-pass stacks.		
AES Kilroot Power	P0120/06A	Power generation	Combustion processes for raising steam and generation of electricity; receipt, storage and handling of fuels; ash handling and storage.	2 x 784 MWth coal-fired boilers, 2 x 118 MWth oil-fired boilers, from 2009 also 2 x 144 MWth OCGTs.	A1 – main stack boiler S1 A2 – main stack boiler S2 A3 – Gas turbine stack S3, S4, S7, S8 A4 – Main stack auxiliary boilers S5 S6	(no info)	(no info)
Coolkeeragh ESB	P0126/06A	Power generation	2 x OCGTs - emergency back-up, receipt, handling and storage of fuels, auxiliary boiler, demineralised water plant, surface drainage	400 MWe electricity generating station using CCGT technology.	CCGT Plant Stack, No. 1 Emergency OCGT Plant Stack, No. 2 Emergency OCGT Plant Stack, Auxiliary Boiler Stack, Distillate Oil Tank Vent, Distillate Oil Tank Vent	Waste management procedures for: waste oil, gas condensate and solid wastes.	Oil/ water separators.
Invista Textiles, Maydown	P0129/06A	Generation of steam and electricity in a coal fired power plant and the	Production of plastic materials, synthetic fibres, and cellulose-based fibres.	Cogen power plant consists of two travelling grate coal fired boilers each rated at 39.8	The combustion gases from the each coal fired boilers are discharged into individual flues	Storage and disposal of waste ash as hazardous waste.	effluent to a holding tank if the TOC content is high, otherwise it passes to a

Site Reference	IPPC ID	Main Activities	Associated Processes	Major Sources	Stacks/ flares and vents	Onsite waste management	Waste water/ Effluent treatment
		manufacture of Lycra		MW(Th) and one oil fired unit, rated at 32.5(Th). Steam from the coal boilers is passed through a turbo-generator, with a maximum rating of 12.1MW(e), to produce electricity which is used on site.	within a 73.5m stack. . The oil fired boiler vents to atmosphere via a 42m stack.		neutralisation tank and a bio-treatment facility where the DMAc concentration Effluent high in TOC is neutralised and treated by biotreatment facility.

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