

**MOSSMORRAN & BRAEFOOT BAY
INDEPENDENT
AIR QUALITY MONITORING REVIEW GROUP**

2015 Annual Report

Final

30th May 2016

CONTENTS

	EXECUTIVE SUMMARY	ii
1.	INTRODUCTION	1
2.	OBSERVATIONS	2
3.	CONCLUSIONS	5
APPENDIX 1	The Review Group: Constitution and Terms of Reference	6
APPENDIX 2	Membership of the Review Group	9
APPENDIX 3	Regulatory and policy changes relating to air quality in 2015	11
APPENDIX 4	Regulated emissions to air in 2015	13
APPENDIX 5	2015 flaring report	17
APPENDIX 6	EU ETS CO₂ Submissions	21
APPENDIX 7	Glossary	23

MOSSMORRAN & BRAEFOOT BAY INDEPENDENT AIR QUALITY MONITORING REVIEW GROUP

2015 Annual Report

EXECUTIVE SUMMARY

The Mossmorran & Braefoot Bay Independent Air Quality Monitoring Review Group advises Fife Council regarding the monitoring of air emissions arising from the operations at the Mossmorran plants and the Braefoot Bay terminal facilities. Air quality monitoring has demonstrated that concentrations of benzene and other hydrocarbons are low in the vicinity of the facilities. The Review Group concluded in 1999 that its work was nearing completion. It was reconstituted in 2001 following concern expressed by local communities with regard to perceived air quality and cancer-related health issues in the vicinity of Mossmorran and Braefoot Bay. The Review Group continues to liaise with local communities and representatives of the local health service.

Shell UK Ltd (Shell) operates the Mossmorran Gas Fractionation Plant that extracts natural gasoline, ethane, propane and butane from natural gas liquids pumped from the St Fergus gas plant at Peterhead. Propane, butane and gasoline are supplied by underground pipeline to the Braefoot Bay deep water loading facility, where they are loaded on to tankers. Ethane is piped to feed the neighbouring Fife Ethylene Plant operated by ExxonMobil Chemical Ltd (ExxonMobil) and can be routed to the INEOS site at Grangemouth. The facilities at Mossmorran and Braefoot Bay operate under Pollution Prevention and Control (PPC) permits issued by the Scottish Environment Protection Agency (SEPA). These permits set limits on environmental emissions from the facilities.

The aims of the Annual Report are to:

- Outline any substantive changes in the facilities at Mossmorran and Braefoot Bay and their likely impact on local air quality;

- Describe any changes in air quality regulation and changes in knowledge on health effects of benzene or any other possible emissions from the plants;

- Comment on the emissions from the facilities;

- Summarise the available data on flaring during 2015;

- Review other information about local air quality; and

- Continue to review the potential impact of the installed and other planned wind turbines in the vicinity of the Mossmorran site on pollutant dispersion.

During 2015 there were no plant changes that would be anticipated to adversely affect local air quality.

Emissions from all regulated sources at the Mossmorran and Braefoot Bay facilities in 2015 were well within the limits set by SEPA for the protection of human health and the environment.

SEPA carries out an annual review of the environmental performance of each site under the Compliance Assessment Scheme. ExxonMobil at Braefoot Bay was rated as Excellent for 2015 while Shell UK Ltd and ExxonMobil at Mossmorran were rated as Good.

Flaring is undertaken to protect the plant safety during planned and unplanned maintenance work. The ground level flares are used in preference to the elevated flare to minimise noise and light nuisance for local residents. The quantity flared varies from year to year depending on circumstances. The total quantities of gas flared in 2015 were higher than those in 2014 (which were the lowest since the plants were commissioned). Elevated flaring occurred in June, July and October at the Fife Ethylene Plant site due to plant process upsets. In each instance, an investigation was undertaken and the outcomes reported to, and discussed with SEPA. Following completion of a BAT assessment and in collaboration with SEPA, Shell completed a ground flare refurbishment programme in 2015. As a result, ground flare availability was increased considerably with the pilots requiring a greater consumption of fuel gas from August 2015 onwards.

Fuel gas required in advance of commissioning a replacement Nitrogen Generator in April/May 2016 and planned replacement of the thermocouples on the Flare pilots late 2016 contributed to the increased volumes during 2015.

Concentrations of benzene and other hydrocarbons in air monitored along the Fife coastline for BP Production and Exploration during 2015 were very low and similar to the levels measured in 2014. The measured hydrocarbons are emitted from a variety of sources around the Forth including BP's operations at Hound Point, the operations of ExxonMobil and Shell at Braefoot Bay and Mossmorran, and road transport. It should be appreciated that measured concentrations at any one location are highly dependent on weather conditions.

Fife Council's Air Quality team did not identify any new issues in the vicinity of Mossmorran or Braefoot Bay in their 2015 Air Quality Updating and Screening Assessment Report.

The Review Group has continued to review the possible impact of the wind farm at Little Raith Farm, (immediately north of the Mossmorran site perimeter) on pollutant dispersion from Mossmorran, but is not aware of any significant new information that would assist in the prediction of possible impacts. A proposal to erect a further six turbines at Little Raith was refused planning permission by the Scottish Government on the 1st July 2015. The reporter agreed that the community's concern about benzene was a valid planning matter but concluded that there was no evidence to indicate that the turbines would have an adverse impact on local concentrations of benzene. Planning approval has been granted for five additional wind turbines in the vicinity of Mossmorran.

The outcomes of air quality monitoring to date in the vicinity of Mossmorran and Braefoot Bay facilities indicate that automatic continuous monitoring of pollutants in surrounding local community areas is not required.

In conclusion, the work undertaken by the Review Group in 2015 demonstrates that emissions from the Shell and ExxonMobil Plants at Mossmorran and Braefoot Bay continue to pose no significant risk to the health of members of the local community.

MOSSMORRAN & BRAEFOOT BAY INDEPENDENT AIR QUALITY MONITORING REVIEW GROUP

2015 Annual Report

1. INTRODUCTION

The Mossmorran & Braefoot Bay Independent Air Quality Monitoring Review Group (the Review Group) was formed to provide advice and recommendations to Fife Council (formerly Fife Regional Council and Dunfermline and Kirkcaldy District Councils) regarding the monitoring of air emissions arising from the operations at the Mossmorran plants and the Braefoot Bay terminal facilities (operated by Shell UK Limited and ExxonMobil Chemical Limited). The constitution and terms of reference of the Review Group are described in Appendix 1. Appendix 2 lists the members of the Review Group during 2015.

Shell UK Ltd (Shell) operates the Mossmorran Natural Gas Fractionation (NGL) Plant that extracts natural gasoline, ethane, propane and butane from natural gas liquids pumped from the St Fergus gas plant at Peterhead. The plant at Mossmorran comprises three identical process units that are fed directly from the pipeline. Large atmospheric pressure tanks store propane, butane and gasoline. These products are supplied by underground pipeline to the Braefoot Bay deep water loading facility, where they are loaded on to tankers. Ethane is piped to feed the Fife Ethylene Plant operated by ExxonMobil Chemical Ltd (ExxonMobil) and can be routed to the INEOS site at Grangemouth. The Shell NGL plant also supplies approximately 10% of the total propane and butane to the adjacent Avanti Gas Road Loading Terminal. The ExxonMobil Fife Ethylene Plant is one of Europe's largest and most modern ethylene plants. It has the capacity to produce 830,000 tonnes of ethylene per year.

Previous air quality monitoring has demonstrated that concentrations of benzene and other hydrocarbons were low in the vicinity of the facilities. The Review Group concluded in 1999 that its work was nearing completion and that further air quality monitoring was probably not required. However, the Review Group was reconstituted in 2001 following concern expressed by local communities and highlighted in media reports, with regard to perceived air quality and cancer-related health issues in the vicinity of Mossmorran and Braefoot Bay. The Review Group continues to liaise with local communities and representatives of the local health service.

The aims within this Annual Report are to:

Outline any substantive changes in the facilities at Mossmorran and Braefoot Bay and their likely impact on local air quality;

Describe any changes in air quality regulation and changes in knowledge on health effects of benzene or any other possible emissions from the plants;

Comment on the emissions from the facilities;

Summarise the available data on flaring during 2015;

Review other information about local air quality; and

Continue to review the potential impact of installed and planned wind turbines in the vicinity of the Mossmorran site on pollutant dispersion.

2. OBSERVATIONS

The main observations of the Review Group in 2015 were as follows.

- i) There were no major changes to the Fife Ethylene Plant during 2015. There was a permit variation to incorporate IED legislative updates which came into force 1 Jan 2016. In November 2015 it was announced that the plant would be receiving ethane from Ineos's new import terminal in Grangemouth from mid-2017. This new feedstock will complement supplies from the North-Sea natural gas fields.
- ii) There were no major changes to the Shell Plant during 2015.
- iii) Future changes in emissions limits may be required at the Fife Ethylene Plant following the ongoing revision of Large Volume Organic Chemical Industry Best Available Techniques Reference Document (BREF) and also to implement Chapter 3 of the IED on Large Combustion plant in 2016. Changes in permit conditions may also follow the review of the Large Combustion Plant (LCP) BREF and the Common Waste Water Treatment / Management Systems in the Chemical Sector BREF. Future changes in emissions limits may be required at the Shell NGL Plant following the issue of the Refineries BREF in October 2014. In the more distant future, further changes in permit conditions for both ExxonMobil and Shell operations may arise as a result of the ongoing review of the Common Waste Gas Treatment/Management Systems in the Chemical Sector BREF and General Principles of Monitoring BREF.
- iv) Emissions from all regulated sources at the Mossmorran and Braefoot Bay facilities in 2015 were well within the limits set by SEPA for the protection of human health and the environment (Appendix 4). Emission limits are set to ensure that the impact of emissions is minimised through the efficient operation of a process. As it can be difficult to monitor a substance once it has been released into the atmosphere, operators are required to carry out periodic measurements of gases before they exit the stacks. Emission Limit Values (ELVs) are specified in a Permit or Authorisation and relate generally to the principal emissions from industrial processes where control is necessary. ELVs can be a direct requirement of legislation, set in connection with what is achievable in terms of Best Available Techniques (BAT), or be generated on a site-specific basis. ELVs are set for the protection of human health and the environment. In addition, under the current permit arrangements, fugitive emissions are estimated each year for the two sites and returns made to SEPA.
- v) SEPA carries out an annual review of the environmental performance of each site under the Compliance Assessment Scheme (CAS), taking into account any breaches of the Pollution Prevention and Control (PPC) permit with regard to emission monitoring of the process or management failings. For 2015 ExxonMobil at Braefoot Bay was rated as Excellent and both Shell UK Ltd and ExxonMobil at Mossmorran were rated as Good.
- vi) The page on the SEPA website dedicated to the Mossmorran and Braefoot Bay complexes that contains general information and bulletins on operational matters¹ is again available following an upgrade of the SEPA website in March 2015.
- vii) The total quantities of gas flared in 2015 were higher than those in 2014 (which were the lowest since the plants were commissioned). Elevated flaring occurred in June, July and October at the Fife Ethylene Plant site due to plant process upsets. In each instance, an investigation was undertaken and the outcomes reported to, and

¹ <https://www.sepa.org.uk/regulations/air/air-quality/mossmorran-and-braefoot-bay-complexes/>

discussed with SEPA. Following completion of a BAT assessment and in collaboration with SEPA, Shell completed a ground flare refurbishment programme in 2015. As a result ground flare availability was increased considerably with the pilots requiring a greater consumption of fuel gas from August 2015 onwards. Fuel gas required in advance of commissioning a replacement Nitrogen Generator in April/May 2016 and planned replacement of the thermocouples on the Flare pilots late 2016 contributed to the increased volumes during 2015. There is no obvious trend towards more or less flaring over time (Appendix 5).

- viii) Under the European Union Emissions Trading Scheme (EU ETS) companies now have to declare to SEPA how much carbon dioxide (CO₂) they produce each year and this must be verified by a third-party registered verifier. Once emissions are verified, companies must buy credits to pay for the CO₂ produced. ExxonMobil and Shell's submissions to SEPA are shown in Appendix 6. [Carbon dioxide is a greenhouse gas and has no direct effects on human health at environmental concentrations].
- ix) The PPC permits require the operators to submit results, returns and reports to SEPA. These can be accessed by contacting Registry at SEPA's Angus Smith Building: Maxim 6 Parklands Avenue, Eurocentral, North Lanarkshire, ML1 4WQ. Tel: 01698 839000. Currently inspection reports for sites that are regulated by SEPA are not placed on SEPA'S Public Register but can be obtained by members of the public under the Freedom of Information Act. The Industrial Emissions Directive has brought in the requirement to publish certain compliance aspects of inspection reports for existing sites. These can be viewed online via the following link: <http://Apps.sepa.org.uk/compliance/>
- x) Fife Council's Air Quality team did not identify any new issues in the vicinity of Mossmorran or Braefoot Bay in their 2015 Air Quality Updating and Screening Assessment Report The Council continues to undertake detailed monitoring at several locations elsewhere in Fife where earlier investigation had shown that traffic emissions are leading to elevated levels of nitrogen dioxide (NO₂) and particles (as PM₁₀). The 2015 Air Quality Updating and Screening Assessment Report 2016 is available at the Fife Council air quality web pages at www.fifedirect.org.uk/airquality.
- xi) The National Physical Laboratory (NPL) on the behalf of BP Exploration North Sea Region monitored hydrocarbon levels on the Forth coastline during 2014 (29/12/2014-29/12/2015). Samples were collected over 2-week periods using passive samplers at 12 locations between the Forth Bridges and West Wemyss including 4 locations between Dalgety Bay and Burntisland. Samples were analysed for iso-butane, n-butane, iso-pentane, n-pentane, n-hexane, n-heptane, benzene, toluene, xylene and total hydrocarbons (C4-C19). These hydrocarbons are emitted from a variety of sources around the Forth including the operations at Hound Point but also from traffic and other industrial sites such as the operations of ExxonMobil and Shell at Braefoot Bay and Mossmorran. The results of this monitoring indicate that concentrations of benzene over the 12-month period were low (annual means range from 0.2-0.4 ppb) and well within the air quality standard. Concentrations of other hydrocarbons were also low, but there are no air quality standards for these substances. The substance present in the greatest concentrations at most locations, as in 2014, was n-butane for which annual mean concentrations ranged from 1.4 ppb to 11.1 ppb. Annual mean concentrations of other individual substances ranged from <0.3 ppb to 2.16 ppb. Annual mean concentrations of total hydrocarbons at different locations ranged from 8-33 ppb.

- xii) The monitoring along the Fife coastline which BP commissioned has been ongoing for many years and there has been an observed overall reduction in the levels of hydrocarbons, including benzene, present in air over the last decade. Concentrations at any one locality are of course highly dependent on weather conditions. The measurements made in 2015 indicate that concentrations of the majority of the monitored substances were lower than those recorded in 2014 at most locations.
- xiii) The Review Group has continued to review the possible impact of the wind farm (9 turbines, 126.5 m height to blade tip) at Little Raith Farm (north of Auchtertool and immediately north of the Mossmorran site perimeter) with regard to pollutant dispersion during flaring episodes at Mossmorran. During 2014 Fife Council received and considered an application to erect a further 6 wind turbines at Little Raith, at locations north of the existing turbines. The Scottish Government (1st July 2015) has upheld Fife Council's decision to refuse planning permission for these turbines. The reporter noted that concentrations of benzene and the potential increase that might occur with the installation of the six additional turbines was an issue of concern for some of those making objections to the proposal. The existing wind farm at Little Raith carried out a benzene monitoring programme from 2011, which concluded in 2013 that benzene concentrations in Cowdenbeath and Lochgelly were below the Scottish Air Quality Objective before and after the installation of the wind farm. Concentrations of benzene have not increased since the installation of the wind farm, and at 2013 concentrations were below typical rural outdoor locations. Fife Council had accepted the findings of the benzene monitoring report. The reporter agreed that the community's concern about benzene was a valid planning matter but concluded that there was no evidence to indicate that the turbines would have an adverse impact on local concentrations of benzene.
- xiv) In addition to the Little Raith wind farm, there are proposals for a number of other wind turbines of various sizes within the vicinity of the Mossmorran site. In addition to the applications considered in the 2014 report, during 2015 Fife Council received applications for the following wind turbines within 3 km of Mossmorran:
- Clentrie Farm, Auchtertool - three turbines, height 99.9m to blade tip (application permitted with conditions);
 - Land 650m South East of Shawsmill Farm, Kirkcaldy – one turbine, height 56.7 m to blade tip (withdrawn).
 - Site West of M90 and South of Cuddyhouse Road, Kingseat – one turbine, height 38.5 m to blade tip (application pending consideration);
 - Site to the East of Wester Bucklyvie, Donibristle – one turbine, height 67 m to blade tip(application pending consideration);
- Fife Council also received applications for the following wind turbines Shawsmill Farm and Cuddyhouse Road, Kingseat in 2015:
- Site West of M90 and South of Cuddyhouse Road, Kingseat – one turbine, height 50 m to blade tip (application permitted with conditions);
 - Land 400m West of Shawsmill Farm, Shawsmill, Kirkcaldy – one turbine, height 46.3 m to blade tip (application permitted with conditions)
 - Land 650m South East of Shawsmill Farm, Shawsmill – one turbine, height 56.7 m to blade tip (withdrawn)
- xv) NHS Fife confirmed that there is no evidence of higher-than-expected cancer rates in the area surrounding Mossmorran once the effects of deprivation are taken into

account². This assertion is based on the rates of new cancer registrations for each of the nine interzones (statistical geographical areas) in the Mossmorran Defined Area for the years 2002-2013 and on the “Cancer Mortality Rates Surrounding Mossmorran Chemical Plant”, 2011. Routine health and wellbeing data are available for each interzone at <http://www.scotpho.org.uk/comparative-health/profiles/online-profiles-tool>.

- xvi) The Review Group are not aware of any new technical data that relate to the impact of wind turbines on the dispersion of stack emissions. Given the low levels of benzene that were measured in the local area following commissioning of the Little Raith windfarm, the Review Group does not believe that it is necessary or appropriate to instigate a continuous monitoring programme for benzene.

3. CONCLUSIONS

- i) Emissions from regulated sources within the Shell and ExxonMobil Plants in 2015 remained well within the limit values set by SEPA for the protection of public health and the environment.
- ii) These results are consistent with the previous work reported by the Review Group. In the areas around Mossmorran and Braefoot Bay the 2010 air quality objective for benzene is being satisfied readily.
- iii) The quantities flared at Mossmorran were higher in 2015 than reported in 2014 however there is no evidence of a longer-term trend towards increased flaring. The Review Group will continue to review the potential for interaction between the wind turbines at Little Raith and other local sites, and the dispersion of emissions from Mossmorran.
- iv) The Review Group are not aware of any new information describing the impact of wind turbines on the dispersion of stack emissions. Given the low levels of benzene that were measured in the local area following commissioning of the Little Raith windfarm, the Review Group does not believe that it is necessary or appropriate to instigate a continuous monitoring programme for benzene.
- v) There is no evidence of higher than expected cancer rates in the Mossmorran area once the effects of deprivation are taken into account.
- vi) The work undertaken in 2015 demonstrates that emissions from the facilities at Mossmorran and Braefoot Bay continue to pose no significant risk to the health of members of the local community.

² For all cancers combined, the most deprived areas have incidence rates that are almost a third higher than the least deprived areas. . <http://www.isdscotland.org/Health-Topics/Cancer/Publications/2015-11-17/2015-11-17-CancerMortality-Report.pdf>. Accessed 16/03/2016.

APPENDIX 1

The Review Group: Constitution and Terms of Reference

The Review Group reports to Fife Council which requires its operating costs to be financed by ExxonMobil Chemical Limited (ExxonMobil) and Shell UK Limited (Shell). Review Group members are appointed by Fife Council.

Professor Sibbett continues as Independent Chair, with representatives from Fife Council, SEPA and the Institute of Occupational Medicine (IOM) participating as members. The Review Group also includes representation in public health from the Dunfermline and West Fife Community Health Partnership (formerly West Fife Local Health Care Co-operative) on behalf of NHS Fife and two members represent the local Community Councils. This is designed to ensure that timely and informative communications can be provided in respect of any relevant health issues that might arise in the local communities. Representatives of ExxonMobil and Shell attend the Review Group meetings by invitation.

The full constitution and terms of reference of this reconstituted group are given below. Briefly, the Review Group's approach to carrying out its functions has been re-assessed, allowing it to take less involvement in the monitoring of air quality, but instead to focus attention on the review of such data. Of particular relevance are issues relating to any health concerns raised by residents within the local communities and a key role is assisting with the communication of information relating to environmental air quality.

Detailed Constitution and Terms of Reference

1.0 TITLE

1.1 The Group is known as the Mossmorran & Braefoot Bay Independent Air Quality Monitoring Review Group (referred to below as the Review Group).

2.0 INTRODUCTION

2.1 The Review Group was formed to provide advice and recommendations to Fife Council (formerly Fife Regional Council and Dunfermline and Kirkcaldy District Councils) regarding the monitoring of air emissions arising from the operations at the Mossmorran plants and the Braefoot Bay terminal facilities. Specific terms of reference which previously pertained were as required by planning conditions applying to the operation of the plants.

2.2 The Review Group's approach to carrying out its functions has been re-assessed, allowing it to take less involvement in the monitoring of air quality, with its primary responsibilities being re-directed towards reviewing such data. Of particular relevance are issues relating to any health concerns raised by residents within the local communities, and a key role is assisting with communications of air quality related information.

3.0 TERMS OF REFERENCE

3.1 The Review Group (as reconstituted in terms of para. 2.2 above) has the following remit:

- (i) To provide advice on air quality related monitoring arrangements.
- (ii) To review air quality monitoring data obtained at sites in the vicinity of the Mossmorran complex and the Braefoot Bay terminal.
- (iii) To consider, advise and make recommendations on the outcome of monitoring data. The Review Group intends by inclusion in its membership of public health representation that timely and informative communications can be provided in respect of any relevant health issues that might arise in the local communities.

- (iv) To submit reports to Fife Council and to make presentations as appropriate to representatives of the Community Councils that are local to the Mossmorran plants and the Braefoot Bay terminal. The Review Group intends inclusion in its membership of representation from the local Community Councils to assist with this communications related responsibility.
- 3.2 These terms of reference shall not imply any responsibility for, control over, or restriction of the statutory or common law positions of Fife Council, Shell UK Limited (Shell), ExxonMobil Chemical Limited (ExxonMobil), or any other local authority, statutory authority or agency, or company, or institution, nor derogate from the rights, powers and responsibilities of such authorities, agencies, companies or institutions.
- 4.0 APPROACH
- 4.1 The Review Group's approach will be based on:
- (i) Making the Minutes of its meetings publicly available;
- (ii) Ensuring that all reports produced by, or on behalf of, the Review Group are fully documented and contain source references to all relevant data;
- (iii) Providing regular and non-technical summaries on its activities;
- (iv) Informing the local communities through submissions to existing liaison structures (i.e. primarily the Mossmorran & Braefoot Bay Community & Safety Committee) and through direct presentations by Review Group members as appropriate, and
- (v) Being open to approaches from local communities and individuals.
- 5.0 MEMBERSHIP
- 5.1 Membership of the Review Group comprises appropriate representation from the following:
- An Independent Chair
 - Fife Council officials
 - Institute of Occupational Medicine (IOM)
 - Scottish Environment Protection Agency (SEPA)
 - Public health services
 - Community Councils on the Mossmorran & Braefoot Bay Community & Safety Committee (inland and coastal)
- 5.2 The Review Group will invite representatives of Shell and ExxonMobil to attend meetings, and may invite others to address group members on issues related to the terms of reference set out at paragraph 3.1 above.
- 5.3 The Review Group Secretary (see para. 6.2 below) shall maintain a current register of members, for distribution and information purposes.
- 5.4 ExxonMobil and Shell maintain a list of Community Council contacts who are notified of flaring.
- 6.0 OFFICE BEARERS
- 6.1 The Independent Chair may be nominated by any member of the Review Group. If any change in the appointment as Chair is proposed, the agreement of Fife Council will be required.

6.2 The Review Group approves the appointment of a Secretary, who prepares a record of meetings and is responsible, in consultation with the Chair, for preparing agenda papers, summoning the meetings, and circulating a record of meetings to the membership.

6.3 The finalisation of reports by the Review Group shall be as determined by the Chair.

7.0 MEETINGS

7.1 The Review Group will meet as frequently as is considered necessary by the Chair (normally at least once a year), having regard to the remit set out at paragraph 3.1 above.

7.2 The Secretary shall send to all members and others, as appropriate, a record of the previous meeting, together with notice and agenda papers for all meetings of the Review Group, at least seven days before the day of the meeting.

7.3 Business shall be in keeping with the terms of reference set out at paragraph 3.1 above.

8.0 FINANCE

8.1 The companies, having met the cost of monitoring work previously undertaken in fulfilment of planning conditions, shall meet relevant costs based on the advice of the Review Group.

8.2 The local authority shall meet any reasonable costs of the administration of the Review Group.

APPENDIX 2: Membership of the Review Group (as at December 2015)

Name	Designation/ Representing	Address
A. MEMBERS		
Prof. Wilson Sibbett	Independent Chair	School of Physics & Astronomy, University of St Andrews
Mary Stewart	Major Business & Customer Service Fife Council	Enterprise, Planning and Protective Services, Glenrothes
Kenny Bisset	Fife Council (Enterprise, Planning and Protective Services)	Enterprise, Planning and Protective Services, Glenrothes
Dr Karen Galea	Institute of Occupational Medicine (IOM)	Research Avenue North, Riccarton, Edinburgh
Ian Brocklebank	Scottish Environment Protection Agency (SEPA)	Operations Technical Support Unit East, Scottish Environment Protection Agency, Strathearn House, Broxden Business Park, Perth
Dr Lynne Hamilton	NHS Fife, Cameron Hospital	Leven, Fife
Robert Arnott	Crossgates & Mossgreen Community Council	Crossgates (Inland)
William Dryburgh	Aberdour Community Council	Aberdour (Coastal)
<u>B. BY INVITATION</u>		
Norman White	Shell UK Limited	Fife NGL Plant, Mossmorran
David Burgess	Shell UK Limited	Fife NGL Plant, Mossmorran
John Raine	Shell UK Limited	Fife NGL Plant, Mossmorran
Lesley Houston	Shell UK Limited	Fife NGL Plant, Mossmorran
Isabel Matson	Shell UK Limited	Fife NGL Plant, Mossmorran
Ian Hackers	ExxonMobil Chemical Limited	Fife Ethylene Plant, Mossmorran
Catherine Cubitt	Exxon Mobil Chemical Limited	Fife Ethylene Plant, Mossmorran
Julie Marnell	Exxon Mobil Chemical Limited	Fife Ethylene Plant, Mossmorran
Cllr Gavin Yates	Inverkeithing and Dalgety Bay Ward	Fife House Glenrothes
Cllr Peter Lockhart	Cowdenbeath Ward	Fife House Glenrothes
Cllr Susan Leslie	Burntisland, Kinghorn and Western Kirkcaldy Ward	Fife House Glenrothes
Stephen Bygrave	British Petroleum	Hound Point

Name	Designation/ Representing	Address
Rachel Morrell	Ineos Ltd	Grangemouth Petrochemical Complex
John Lamb	Air Quality Management Specialist, SEPA	Edinburgh
Ron Mackenzie	Auchtertool Community Council	Auchtertool
Alexander Macdonald	Burntisland Community Council	Burntisland
David Taylor	Cardenden & Kinglassie Community Council	Cardenden
Alex Haddow	Cowdenbeath Community Council	Cowdenbeath
Colin McPhail	Dalgety Bay & Hillend Community Council	Dalgety Bay
James Glen	Lochgelly Community Council	Lochgelly
Amelia Howie	Lumphinnans Community Council	Lumphinnans

APPENDIX 3: Regulatory and Policy changes relating to air quality in 2015

There was one major regulatory change in Scotland relating to air quality during 2014. The provisions of the Pollution Prevention and Control (PPC) (Scotland) Regulations 2012 (PPC 2012) became applicable to Mossmorran Complex and Braefoot Bay from January 2014 implementing the Industrial Emissions Directive (IED) (2010/75/EU). PPC 2012 automatically inserted new standard conditions into the PPC permits. The new standard conditions include new requirements with regards to accidents and incidents, breach of Permit conditions and monitoring of groundwater and soil.

There were no major regulatory changes in 2015.

Future changes in emissions limits may be required at the Fife Ethylene Plant following the ongoing revision of Large Volume Organic Chemical Industry Best Available Techniques Reference Document (LVOC BREF) and also to implement Chapter 3 of the IED on Large Combustion plant in 2016. Changes in permit conditions may also follow the review of the Large Combustion Plant (LCP) BREF and Common Waste Water (CWW) BREF. Future changes in emissions limits may be required at the Shell NGL Plant following the issue of the Refineries BREF in October 2014. In the more distant future, further changes in permit conditions for both ExxonMobil and Shell operations may arise as a result of the ongoing review of the Common Waste Gas Treatment/Management Systems in the Chemical Sector BREF and General Principles of Monitoring BREFs.

The Industrial Emissions Directive (IED) provides the framework for the permitting of industrial facilities in the EU. IED mandates the application of permits of Emission Limit Values (ELVs) that are consistent with Best Available Techniques (BATs); BATs are documented in BAT Reference Documents (BREFs). The Refinery BREF has been published and will trigger permit reviews by early 2018. The Large Combustion Plant (LCP), Large Volume Organic Chemicals (LVOC), Common Waste Water (CWW), Emissions from Storage (EFS) and Industrial Cooling Systems BREFs are currently being revised and are all potentially relevant to the Mossmorran complex. A new Waste Gas Treatment in the Chemicals sector (WGC) BREF has been proposed and will begin development in 2016. Final texts will be agreed at the EU level. Permits are to be updated and ELVs compliant within a timeframe set by SEPA.

PPC permit conditions take account of relevant Best Available Technique (BAT) reference documents (BREF) Notes published by the European IPPC Bureau, now referred to as 'BAT Conclusions Documents'. A BREF is currently being drafted for large combustion plant (LCP) that may impact on the Fife Ethylene Plant is currently being drafted. (Final draft version published in October 2013). No timetable has been set for the replacement of the existing BREF documents.

The European Commission adopted a new Clean Air Policy Package in December 2013, consisting of A new Clean Air Programme for Europe (CAFÉ) with new air quality objectives for the period up to 2030, a revised National Emission Ceilings (NEC) Directive with stricter national emission ceilings for the six main pollutants, and a proposal for a new Directive to reduce pollution from medium-sized combustion installations. The new CAFÉ programme aims to improve the implementation of existing EU legislation with a focus on achieving compliance with existing air quality standards by 2020 at the latest, and on using a revised NEC Directive to bring down pollution emissions in the period to 2030. The targets for 2030 will require additional EU action to reduce emissions at source. There is also a focus on climate change mitigation by reducing levels of pollutants that contribute significantly to climate impacts as well as air pollution and promoting measures that tackle air pollutants and climate gases simultaneously (such as ammonia and nitrous oxide). Progress on achievement of the objectives and implementation of the programme will be reviewed on a

five-yearly basis, with the first review by 2020. Progress towards the new air policy targets for 2030 will be assessed using the indicators in which they are expressed.

The NECs set in the old NEC Directive for 2010 onwards for SO₂, NO_x, nonmethane volatile organic compounds (NMVOCs) and ammonia shall apply until 2020 and new national emission reduction commitments ("reduction commitments") have been set out that are applicable from 2020 and 2030 for SO₂, NO_x, NMVOC, ammonia, fine particulate matter (PM_{2.5}) and methane as well as intermediate emission levels for the year 2025 applicable to the same pollutants. Particular emphasis will be placed on reduction of black carbon as part of the overall reduction in emissions of PM_{2.5}. The Scottish Government recently introduced a new air quality objective for PM_{2.5}³, committing to include in legislation as Scottish objectives, World Health Organisation guideline values of 10 µg/m³ annual means.

The Gothenburg Convention on Long-Range Transboundary Air Pollution (the LRTAP Convention) agreed in 1979 under the auspices of the UN Economic Commission for Europe (UNECE) is the main international legal framework for cooperation and measures to limit and gradually reduce and prevent air pollution and its adverse effects with a specific focus on long-range transboundary air pollution. The EU's new international obligations agreed under the amended Gothenburg Protocol will be transposed in 2020 with further reduction obligations arising in 2025, in order to achieve 2030 targets.

The 2013 EU Clean Air Policy Package is unlikely to lead to any changes in permit conditions for the plants at Mossmorran and Braefoot Bay prior to 2020. The longer term implications will depend on how the Scottish Government decides to implement the required emissions reductions.

The Scottish Government is currently consulting on a Low Emissions Strategy (January 2015) that is primarily aimed at Local Authority air quality management and is intended to support the development of Low Emission Zones in areas where air quality objectives are not currently met or it is likely that they would not be met. The strategy is intended to largely address emissions from road traffic and cumulative impacts from small combustion plant like biomass boilers rather than emissions from major industrial sites such as Mossmorran or Braefoot Bay which are regulated through the SEPA PPC permitting process. It would not be anticipated to impinge on the operations of Mossmorran or Braefoot Bay and pollutant concentrations in the vicinity of these operations are well within statutory air quality objectives and therefore below levels where a low emission zone might be considered appropriate.

³ Cleaner Air for Scotland The Road to A Healthier Future. Nov 2015.
<http://www.gov.scot/Resource/0048/00488493.pdf>

APPENDIX 4: Regulated emissions to air

- **Emissions from all regulated sources at Mossmorran and Braefoot Bay during 2015 were well within the limits set by SEPA.**

SEPA authorises the operations carried out by Shell and ExxonMobil at Mossmorran under the Pollution Prevention and Control (PPC) (Scotland) Regulations 2012. The PPC permits are based on the concept of Integrated Pollution Prevention and Control (IPPC) and define limits for emissions from the facilities at Mossmorran to air, water and land. SEPA has set permit conditions that ensure that Best Available Techniques (BAT) are employed by the companies to prevent or reduce the impact of emissions on the environment. ExxonMobil's ethylene bulk storage at Braefoot Bay is also authorised under the PPC Regulations for emissions to air only. The vapour control unit (VCU), also at Braefoot Bay previously authorised under the Environmental Protection Act 1990, is no longer regulated by SEPA with the repeal of said legislation.

For airborne emissions from Mossmorran, the Shell and ExxonMobil permits concentrate on stacks from furnaces, boilers and a gas turbine. They define emission limits for each regulated source and set out sampling and reporting regimes for assessing compliance with these limits. The PPC permits also require monitoring and reporting of emissions from fugitive sources. Fugitive emissions are estimated using a standard methodology based on a combination of measurement in sample areas and calculation based on the total number of potential fugitive emissions sources e.g. flanges, valves, etc across the entire site. The companies must report results to SEPA for appraisal.

The emissions monitoring measurements for 2015 submitted to SEPA are summarised for each regulated Shell and ExxonMobil source at Mossmorran in Tables A4.1 to A4.4, and for Braefoot Bay in Table A4.5. The Emission Limit Values (ELVs) set by SEPA for each emission source, are also shown. During 2015, emissions from all regulated sources at Mossmorran were well within the limits set by SEPA. Emissions remained within the permitted levels at all times throughout the year (Tables A4.1 – A4.4).

Table A4.1: Emissions from Regulated Sources at Shell Mossmorran during 2015 (mg/m³ at 3% O₂, 273K Dry) – Furnace stacks 1 to 3; no limit = no limit applied by SEPA

	CO Concentration (mg/m ³)				NO _x Concentration (mg/m ³)				SO ₂ Concentration (mg/m ³)			
	ELV	2015 Average	2015 Maximum	2015 Minimum	ELV	2015 Average	2015 Maximum	2015 Minimum	ELV	2015 Average	2015 Maximum	2015 Minimum
Furnace 1	100	<6	<6	<6	150	91.6	111.0	70.96	10	<10	<10	<10
Furnace 2	100	<6	<6	<6	150	95.26	101.21	86.32	10	<10	<10	<10
Furnace 3	100	<6	<6	<6	150	87.33	109.55	65.16	10	<10	<10	<10

Table A4.2: Emissions from Regulated Sources at ExxonMobil Mossmorran during 2015 (mg/m³ at 3% O₂, 273K Dry) from Furnaces 1-7 and Gas Turbine Exhaust Stack

	CO Concentration (mg/m ³)				NO _x Concentration (mg/m ³)				SO ₂ Concentration (mg/m ³)			
	ELV	2015 Average	2015 Maximum	2015 Minimum	ELV	2015 Average	2015 Maximum	2015 Minimum	ELV	2015 Average	2015 Maximum	2015 Minimum
Furnace 1	no limit	27.4	105.5	1.3	350	107.2	118.4	92.2	no limit	2.2	6.1	0.0
Furnace 2	no limit	20.9	40.1	2.7	350	129.4	167.2	92.4	no limit	3.3	5.7	0.0
Furnace 3	no limit	2.5	6.8	0.0	350	107.6	146.2	81.2	no limit	0.0	0.0	0.0
Furnace 4	no limit	0.8	1.8	0.0	350	133.7	240.4	76.9	no limit	0.0	0.0	0.0
Furnace 5	no limit	5.2	19.8	0.0	350	130.5	222.8	87.9	no limit	0.0	0.0	0.0
Furnace 6	no limit	3.2	7.6	1.3	350	105.3	134.9	87.8	no limit	0.2	0.5	0.0
Furnace 7	no limit	86.4	268.6	1.3	350	96.1	102.7	80.5	no limit	0.2	0.5	0.0
Gas Turbine Stack	no limit	2.4	5.4	0.0	550	234.2	408.0	126.1	no limit	0.0	0.0	0.0

No limit: no emission limit applied by SEPA

Table A4.3: Emissions from Regulated ExxonMobil Sources at Mossmorran during 2015 – Measured CO and NO_x Values (mg/m³ at 3% O₂, 273K Dry) from Boiler stacks.

	CO Concentration (mg/m ³)				NO _x Concentration (mg/m ³)				
	Authorised PPC Emissions Limit	Average	Max	Min	Authorised PPC/LCPD Emissions Limit	LCPD fuel weighted consent	Average	Max	Min
Boiler A	200	0.0	0.0	0.0	Limit is fuel weighted (450 on liquid fuel, 350 on gas)	387.6	106.5	120.8	96.7
Boiler B	200	0.0	0.0	0.0	Limit is fuel weighted (450 on liquid fuel, 350 on gas).	300.0	122.6	137.9	111.4
Boiler C	200	0.7	2.1	0.0	Limit is fuel weighted (450 on liquid fuel, 350 on gas).	391.0	125.9	142.6	104.2

Table A4.4: Emissions from Regulated ExxonMobil Sources at Mossmorran during 2015 – Measured SO_x and PM₁₀ Values (mg/m³ at 3% O₂, 273K Dry) from Boiler stacks.

	SO ₂ Concentration (mg/m ³)					PM ₁₀ Concentration (mg/m ³)		
	Authorised PPC/LCPD Emissions Limit	LCPD fuel weighted consent (mg/m ³)	Average	Max	Min	Authorised PPC/LCPD Emissions Limit	LCPD fuel weighted consent (mg/m ³)	Average
Boiler A	Limit is fuel weighted (1,700 on liquid fuel, 35 on gas).	1007.0	8.0	31.9	0.0	Limit is fuel weighted (50 on liquid fuel, 5 on gas).	22.9	5.5
Boiler B	Limit is fuel weighted (1,700 on liquid fuel, 35 on gas).	35.0	0.0	0.0	0.0	Limit is fuel weighted (50 on liquid fuel, 5 on gas).	5.0	1.5
Boiler C	Limit is fuel weighted (1,700 on liquid fuel, 35 on gas).	1045.0	6.6	26.3	0.0	Limit is fuel weighted (50 on liquid fuel, 5 on gas).	5.0	1.7

Table A4.5: Emissions from Regulated Source at ExxonMobil Braefoot Bay VCU (Vapour Control Unit) measured in 2015 (mg/m³ at 3% O₂, 273K Dry) – CO, NOx, Total Hydrocarbons and Benzene

	CO Concentration (mg/m3)	NOx Concentration (mg/m3)	VOC's Concentration (mg/m3) *	Benzene Concentration (mg/m3) *	Operations during sampling
	Authorised IPC Emissions No Limit Specified	Authorised IPC Emissions No Limit Specified	Authorised IPC Emissions ELV 20 mg/m3	Authorised IPC Emissions ELV 10 mg/m3	
21 January 2015	0.0	107.5			Road Tanker Loading
21 January 2015			4.90	1.08	Road Tanker Loading
16 February 2015			ND	0.36	Ship Loading
February to June	VCU shutdown and all vapours returned to Mossmorran				Road Tanker Loading
03 June 2015	0.0	93.2			Road Tanker Loading
10 June 2015			ND	0.35	Ship Loading
June to December	VCU shutdown and all vapours returned to Mossmorran				Road Tanker Loading

Notes

* Monitoring carried out by 3rd Party Consultant

no limit - no emission limit applied by SEPA

ND – not detected

APPENDIX 5: 2015 Flaring Report

A5.1 ExxonMobil Fife Ethylene Plant

Table A5.1, below, indicates the quantities flared at the Fife Ethylene Plant during 2015.

Table A5.1 Quantities Flared from the ExxonMobil Fife Ethylene Plant

	Ground	Elevated	Total	Reason
Jan	189	23	212	
Feb	120	43	163	
Mar	248	2	250	
Apr	241	31	272	
May	265	0	265	
Jun	275	73	347	
Jul	1163	2223	3387	Demethaniser trip & subsequent unit upset events
Aug	752	3144	3895	Process Gas Compressor unplanned shutdown
Sep	503	10	514	
Oct	294	3218	3512	Methanator trip & subsequent unit upset events
Nov	189	242	432	
Dec	259	0	259	
Total	4,498	9,009	13,507	

The quantity flared varies from year to year depending on circumstances (Fig A5.1). The ground-level flares are used in preference to the high level flare to minimise noise and light nuisance for local residents. On some occasions the elevated flare has to be used because the ground-level flare is in use by Shell or unavailable. A recent project to refurbish the ground flares has meant availability has increased. Helping 'protect' the ground flares will further increase availability, thus an agreement following discussion with the regulator was reached to use a combination of the elevated flare and ground flare at different stages of flaring, thereby preventing damage to the ground flares and increasing overall availability. There is an interlock which prevents both companies going to the ground-level flare at the same time. On average, the Fife Ethylene Plant is linked up to the ground flare units 95% of the time with control for access via the interlock.

The quantity of gas flared in 2015 was higher than that in 2014 (which was the lowest since the plant was commissioned). There were several process upsets which resulted in elevated flaring at the facility. The elevated flaring events occurred on the following dates; 18th June, 26th June, 6th July, 31st July, 26th October. The reasons for these are summarised in Table A5.1. In every instance, an investigation was undertaken and the outcomes reported to, and discussed with SEPA.

Overall, there is no obvious trend in flaring over time.

Figure A5.1: Total quantities flared annually at the FEP between 1996 and 2015

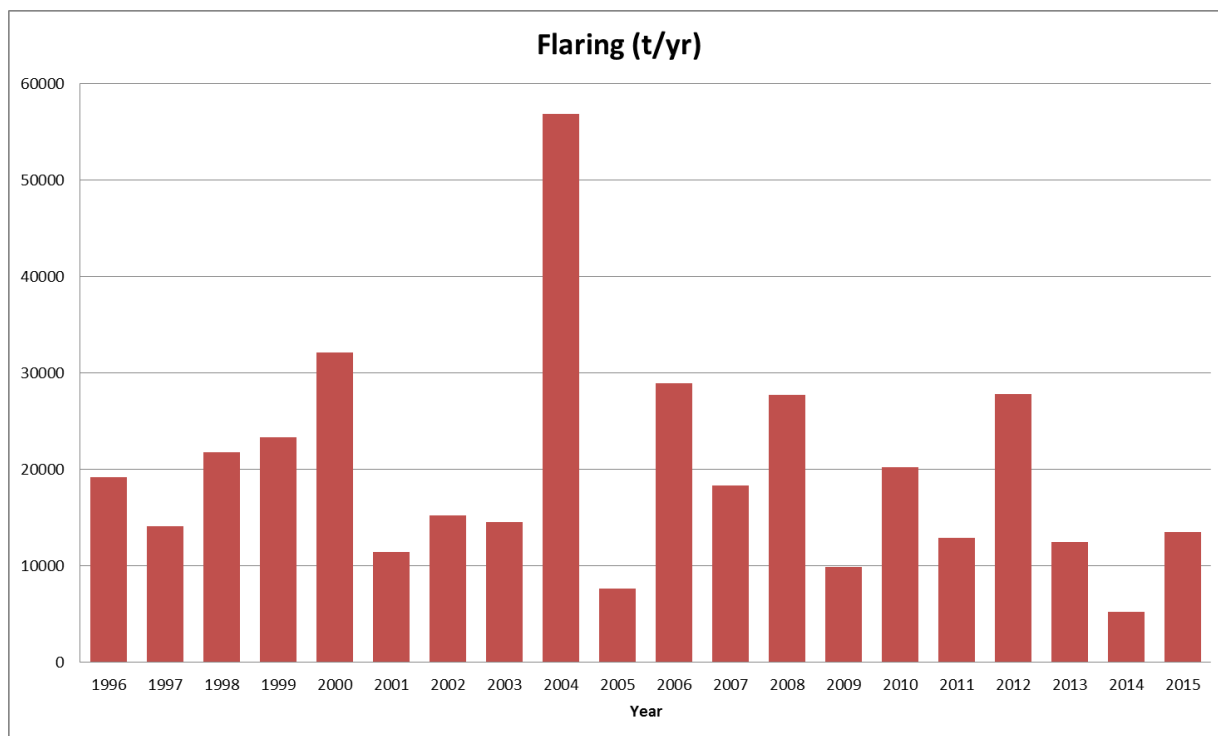
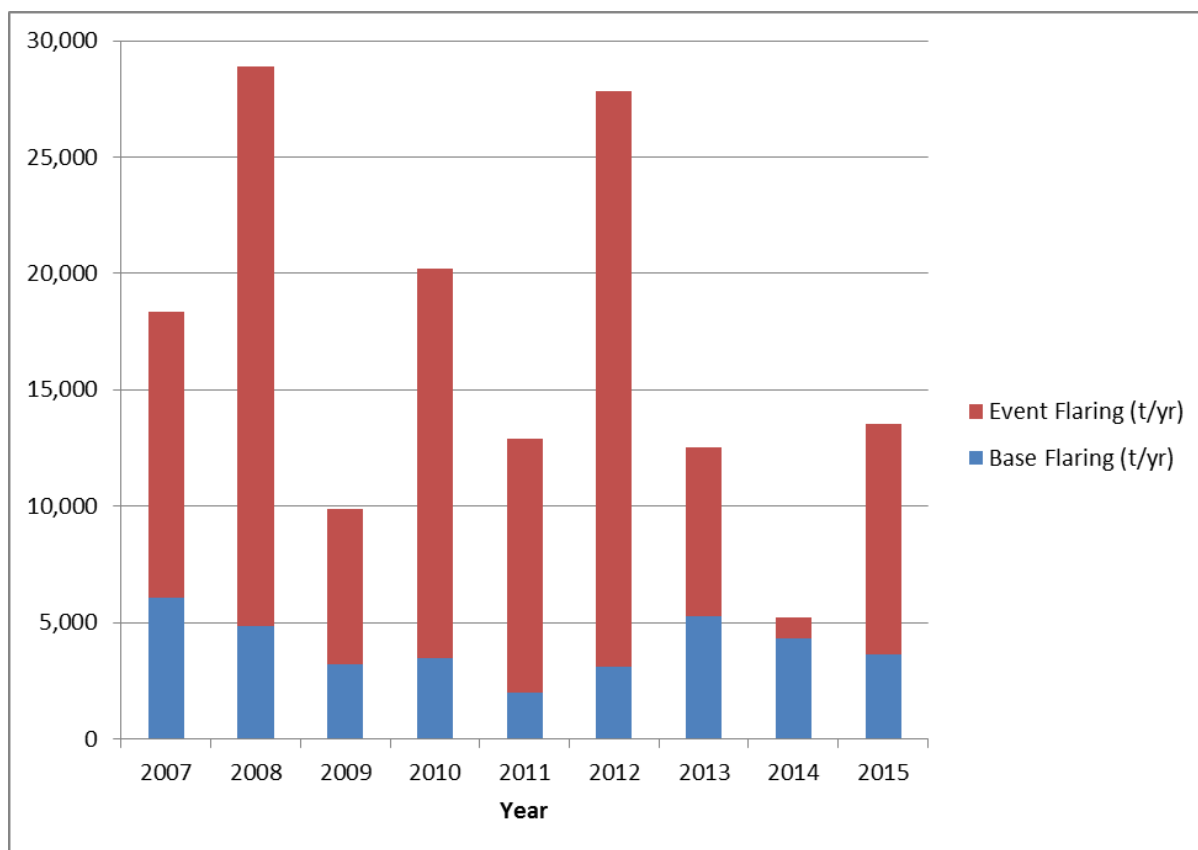


Figure A5.2: Event and base flaring at the FEP between 2006 and 2015



A5.2 Shell Fife Natural Gas Liquids Plant

The total annual mass flared at the Natural Gas Liquids Plant, operated by Shell during 2015 totalled 2643 tonnes, an increase of 1066 tonnes from 2014. The quantity flared varies from year to year depending on circumstances (Fig A5.3).

Table A5.2, below, indicates the quantities flared at the Shell Fife Natural Gas Liquids Plant during 2015.

Table A5.2: Quantities Flared from the Shell Fife Nature Gas Liquids Plant

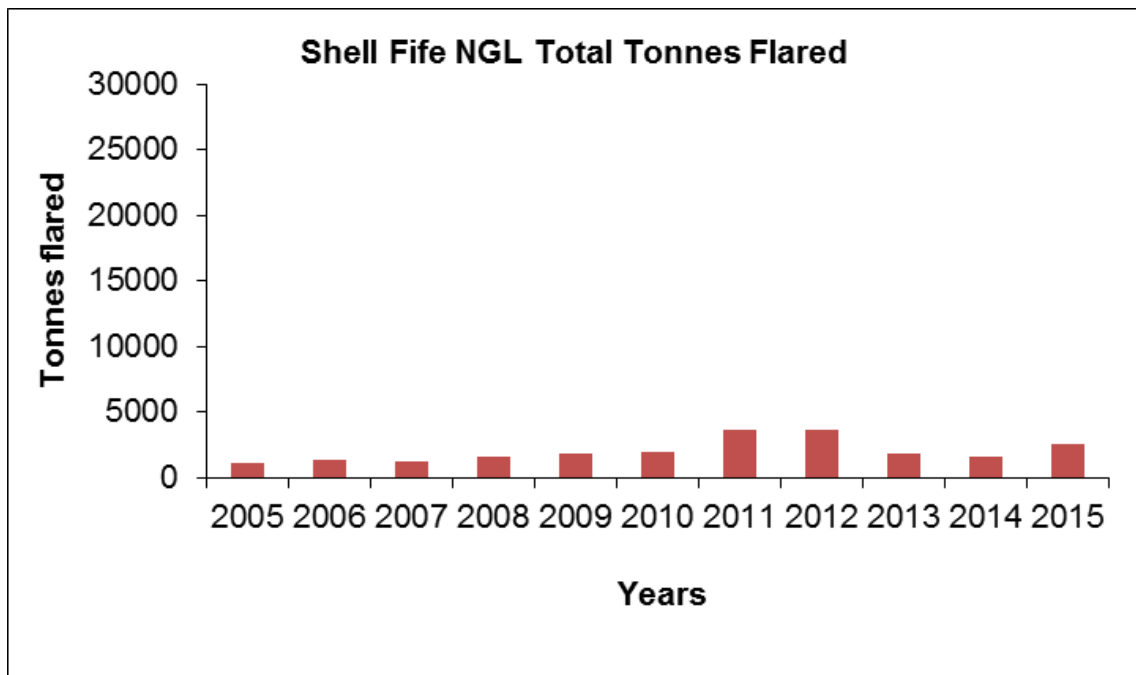
Month	Class 1 Operational Ground Flaring (tonnes)	Class 1 Operational Elevated Flaring (tonnes)	Class 1 pilots and purges (tonnes)	Class 1 total (tonnes)	Reason
January	0	19.03	100.46	119.49	Flaring from 1-PC-51 due to Modular shutdown Module 1 shut down which attributed 76 tonnes; de-burdening for maintenance Routine start-up procedures De-burdening of equipment for maintenance
February	0	16.92	120.41	137.33	
March	0	14.44	167.40	181.84	
April	0	15.05	162.00	177.05	
May	0	9.70	167.40	177.10	
June	0	14.10	162.00	176.10	
July	0	25.37	170.77	196.14	
August	75.49	4.79	250.46	330.74	
September	0	25.07	233.40	258.47	
October	0	22.06	234.59	256.65	
November	21.92	11.88	284.85	318.65	
December	0	5.16	308.76	313.92	
Total	97.41	183.57	2362.50	2643.47	

In 2012 Shell carried out a Ground Flare BAT assessment at the request of SEPA (Permit Variation PPC/A/1013495VN01), with an aim of increasing ground flare availability at Mossmorran. Following completion of the assessment and in collaboration with the regulator Mossmorran completed the ground flare refurbishment programme in 2015. As a result ground flare availability was increased considerably with the pilots requiring a greater consumption of fuel gas.

Flaring due to de-burdening for major maintenance contributed to additional flaring in 2015. This was due to the Module 1 shut down which attributed 76 tonnes for de-burdening in August and 21 tonnes in September as part of routine for start-up procedures after the shutdown. Draining and purging of Module 3 refrigeration system as part of a valve gasket replacement resulted in 24 tonnes of flaring due to de-burdening of equipment for maintenance in November.

The commissioning of a replacement Nitrogen Generator (Pressure Swing Absorber, utilising membrane technology) in April/May 2016 and planned replacement of the thermocouples on the Flare pilots late 2016 will contribute to a reduction in flaring totals going forward.

Figure A5.3: Total tonnes flared at Shell Fife NGL



Appendix 6: EU ETS CO₂ Submissions

Table A6.1 shows the ExxonMobil EU ETS submissions for CO₂ emissions from the Fife Ethylene Plant for the period 2005-15. The reporting of CO₂ emissions changed with the implementation of EU ETS Phase III. Phase III in addition to what was reported in Phase II also now includes CO₂ produced from flaring, the propane which is used to fuel the Braefoot Bay Vapour Control Unit on the C5+ system and the use of diesel on all permanent equipment i.e. fire pumps, emergency generators, Braefoot Bay air compressor. CO₂ emissions were higher in 2015 than previous years due to the plant throughput being increased as a result of having more ethane feed to crack from the North Sea. CO₂ emissions are a combustion product and are proportional to the plants throughput. In addition to increased production, the unplanned flaring events which occurred through the year also contributed to the higher CO₂ reported.

Table A6.1: ExxonMobil EU ETS returns for CO₂ emissions from 2005-15

Year	Emissions Trading Scheme	Phase
	CO ₂ tonnes	
2005	216,014	Phase I
2006	241,301	Phase I
2007	237,023	Phase I
2008	708,368	Phase II
2009	629,114	Phase II
2010	635,774	Phase II
2011	647,401	Phase II
2012	599,662	Phase II
2013	686,174	Phase III
2014	732,114	Phase III
2015	820,764	Phase III

Phase I - CO₂ emissions from Boilers and Gas Turbine Exhaust

Phase II - CO₂ emissions from all emissions sources excluding flaring

Phase III - CO₂ emissions from all emissions sources

Table A6.2 shows the Shell UK Ltd. Fife NGL EU ETS submissions for CO₂ emissions from 2005-15.

Table A6.2: Shell UK Ltd. Fife NGL EU ETS returns for CO₂ emissions from 2005-15

Year	Emissions Trading Scheme	Phase
	CO ₂ tonnes	
2005	0	Phase I
2006	0	Phase I
2007	154,270	Phase I
2008	176,834	Phase II
2009	156,212	Phase II
2010	154,189	Phase II
2011	138,891	Phase II
2012	127,481	Phase II
2013	132,100	Phase III
2014	139,513	Phase III
2015	150,158	Phase III

Phase I - CO₂ emissions from Boilers and Gas Turbine exhaust

Phase II - CO₂ emissions from all emissions sources excluding flaring

Phase III - CO₂ emissions from all emissions sources

APPENDIX 7: Glossary

Concentration Units

ppb: parts per billion by volume, concentration unit for gases and vapours, equivalent to one cubic millimetre of gas mixed with one cubic metre of air.

ppm: parts per million by volume, concentration unit for gases and vapours, equivalent to one cubic centimetre of gas in a cubic metre of air, 1ppm = 1,000 ppb.

$\mu\text{g}/\text{m}^3$: microgram per cubic metre, mass concentration unit for particulates and gases. There are 1,000,000 micrograms in a gram and 25,000,000 micrograms in an ounce.

mg/m^3 : milligram per cubic metre, mass concentration unit for particulates and gases. 1 $\text{mg}/\text{m}^3 = 1,000 \mu\text{g}/\text{m}^3$.

Pollutants

PM₁₀: This is the fine fraction of airborne dust, defined by international convention, that can be deposited in the lung. It is the fraction of airborne dust around which the UK air quality standard is defined. There are many sources, including road traffic, agriculture, industry and many personal activities. It includes particles that are approximately less than 10 μm in diameter.

PM_{2.5}: This is a subfraction of *PM₁₀* sometimes referred to as “high risk respirable”. It is the fraction of airborne particles that can penetrate to the gas exchange region of the lungs in those with compromised respiratory health. *PM_{2.5}* is largely comprised of particles generated by combustion plus particles that form as a result of reactions in the atmosphere. These include particles that form from sulphur dioxide and nitrogen oxides.

Benzene: This aromatic hydrocarbon is a minor component of petrol. Fuel distribution and car exhausts are its most important environmental source. It is present in cigarette smoke, some foods and drinks and widely in nature. Benzene is recognised as causing cancer in people.

1,3-Butadiene: Butadiene is a hydrocarbon that arises in air solely from human activity. It is an important industrial chemical, being used in synthetic rubber manufacture and is found in some liquid petroleum gases. Its main sources in the environment are, however, from road traffic emissions. It is considered as capable of causing cancer in people.

Carbon dioxide (CO₂): This gas is released from combustion processes and is an important greenhouse contributing to atmospheric warming. It is not hazardous to human health at atmospheric concentrations.

Nitrogen dioxide (NO₂): This gas is produced by the reaction of oxygen and nitrogen during combustion. Vehicle emissions are a major source. It is well known as an irritant and, more recently, has been found to affect health at concentrations that can be found in the environment and indoors. Nitric oxide always occurs when nitrogen dioxide is formed. The two gases together are known as *oxides of nitrogen*, sometimes described in shorthand form as *NO_x*.

VOCs or volatile organic compounds: Carbon-based (or organic) chemicals that readily evaporate. Many hydrocarbons, including benzene, butane, pentane and hexane are VOCs.

Organisations/facilities

SEPA: Scottish Environment Protection Agency

FEP: Fife Ethylene Plant - ExxonMobil Chemical Limited (ExxonMobil)'s production facility at Mossmorran

Fife NGL Plant: Fife Natural Gas Liquids Plant – comprises Shell UK Limited (Shell)'s production facility at Mossmorran for the fractionation of liquefied natural gas

NPL: National Physical Laboratory

Other

BAT: Best Available Techniques

BREF: Best Available Techniques Reference Document

ELV: Emission Limit Value

EU ETS: European Union Emissions Trading Scheme

IED: Industrial Emissions Directive

Interzone: this is a national small area statistical geography. There are 103 interzones in Fife. Alternative name for the same area is Intermediate Zone.

IPPC: Integrated Pollution Prevention and Control

Mossmorran Defined Area: is a created geographical area which includes the interzones lying within a 5 km radius of Mossmorran, that is Lochore and Crosshill, Lochgelly East, Lochgelly West and Lumphians, Cowdenbeath North, Cowdenbeath South, Hill of Beath, Keltly East. In addition interzones Keltly West and Balingry have been included as these are surrounded on two or more sides by interzones that are within the 5km radius.

PPC: Pollution Prevention and Control

VCU: Vapour control unit