

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

**2016 Annual Report**

**FINAL REPORT**

**24th July 2017**

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# MOSSMORRAN & BRAEFOOT BAY INDEPENDENT AIR QUALITY MONITORING REVIEW GROUP

## 2016 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 2016;

- 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 2016 there were no plant changes at Shell Mossmorran and Braefoot Bay facilities that would be anticipated to adversely affect local air quality. During 2016 there were no substantive plant changes at ExxonMobil that would adversely affect local air quality. ExxonMobil underwent a permit variation to incorporate Industrial Emissions Directive (IED) legislative updates which came into force on 1<sup>st</sup> January 2016.

There were no breaches of agreed emission limits from regulated sources at the Mossmorran and Braefoot Bay facilities in 2016.

SEPA carries out an annual review of the environmental performance of each site under the Compliance Assessment Scheme. ExxonMobil was rated Excellent for 2016 at both Mossmorran and Braefoot Bay. Shell UK Ltd was also rated Excellent for 2016.

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.

Continued high availability of the two ground flares and delays in the planned replacement of one of the elevated flares thermocouples has resulted in the continued increase in volume of gas required for purge and pilot in the flares at the Shell Mossmorran facility.

The total quantities of gas flared in 2016 were higher than those in 2015. The increased flaring was primarily due to a planned maintenance activity undertaken in September 2016 at the ExxonMobil Fife Ethylene Plant.

Concentrations of benzene and other hydrocarbons in air monitored along the Fife coastline for BP Production and Exploration were very low. 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. There has been an overall reduction in the levels of hydrocarbons, including benzene, present in air over the last decade.

Fife Council's Air Quality team did not identify any new issues in the vicinity of Mossmorran or Braefoot Bay in their 2017 Air Quality Annual Progress Report. This report is to be submitted to the relevant Council Committee for approval later in 2017 and following this will be published on the Fife Council website at [www.fifedirect.org.uk/airquality](http://www.fifedirect.org.uk/airquality).

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. There have been no additional turbine applications within the 3km buffer for the period 1<sup>st</sup> January 2016 to date. Planning approval was granted for one additional wind turbine (application considered in 2015 report) although this is external to the buffer area.

The outcomes of air quality monitoring to date in the vicinity of the 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 2016 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

## 2016 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 2016.

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 has continued to supply approximately 10% of the total volume of produced propane and butane to the adjacent Avanti Gas Road Loading Terminal. The ExxonMobil Fife Ethylene Plant (FEP) 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 2016;

- 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 2016 were as follows.

- i) There were no major changes to the ExxonMobil Fife Ethylene Plant during 2015. There was a permit variation to incorporate Industrial Emissions Directive (IED) legislative updates which came into force on 1<sup>st</sup> January 2016. This varied the boiler monitoring frequency from quarterly to 6-monthly and the fuel-weighted SO<sub>x</sub> emission limits.
- ii) There were no major changes to the Shell Plant during 2016.
- iii) ExxonMobil's Pollution Prevention and Control (PPC) permit was varied in December 2015 to implement the requirements of Chapter 3 of the IED. Future changes may be required at the Fife Ethylene Plant following the ongoing revision of Large Volume Organic Chemical Industry Best Available Techniques Reference Document (BREF), Common Waste Water Treatment / Management Systems in the Chemical Sector BREF and the Large Combustion Plant (LCP) BREF.

The PPC permit for the Shell NGL Plant is currently being reviewed following the issue of the Refineries BREF in October 2014.

- iv) There were no breaches of agreed emission limits from regulated sources at the Mossmorran and Braefoot Bay facilities in 2016 (Appendix 4). Emission limits are set to ensure that the impact of emissions is minimised through the efficient operation of a process. Given that it can be difficult to monitor a substance once it has been released into the atmosphere, operators are required to carry out periodic or continuous measurements of gases before exit from 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, 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 relevant returns are made to SEPA.

At the end of 2016, monitoring by ExxonMobil of their boiler stacks was carried out in a manner to provide additional information to support a Best Available Techniques assessment. The results of the monitoring indicated that human health and the environment continued to be protected.

- 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. ExxonMobil was rated Excellent for 2016 at both Mossmorran and Braefoot Bay. Shell UK Ltd was also rated Excellent for 2016.
- vi) The page on the SEPA website dedicated to the Mossmorran and Braefoot Bay complexes that contains general information and bulletins on operational matters<sup>1</sup> continues to be available.

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

- vii) The total quantities of gas flared in 2016 at the Shell Mossmorran facility were higher than in 2015 though this was due solely to an increase in the volume of gas used for pilots and purging. Continued high availability of the two ground flares and delays in the planned replacement of one of the elevated flares thermocouples has resulted in the continued increase in volume of gas required for purge and pilot in the flares. Operational flaring was at a reduced level compared to 2015. The total quantities of gas flared in 2016 at the ExxonMobil Mossmorran facility were higher than in 2015. The increased flaring was primarily due to a planned maintenance activity undertaken in September 2016. For both facilities there are no obvious trends 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 (CO<sub>2</sub>) is produced each year and this must be verified by a third-party registered verifier. Once emissions are verified, companies have to buy credits to pay for the CO<sub>2</sub> 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 IED has brought a 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 2017 Air Quality Annual Progress 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 (NO<sub>2</sub>) and particulates (as PM<sub>10</sub>). This report is to be submitted to the relevant Council Committee for approval later in 2017 and following this will be published on the Fife Council website at [www.fifedirect.org.uk/airquality](http://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 2016 (29/12/2015-06/01/2017). Samples were collected over 2-week periods using passive samplers at 12 locations between the Forth Bridges and West Wemyss. Ambient concentrations of volatile organic hydrocarbons, iso-butane, n-butane, iso-pentane, n-pentane, n-hexane, n-heptane, benzene, toluene and xylenes were monitored during the survey period. These hydrocarbons are emitted from a variety of sources around the Forth, including operations at Hound Point, but also traffic and other industrial sites such as the operations of ExxonMobil and Shell at Braefoot Bay and Mossmorran.
- xii) BP have commissioned monitoring along the Fife coastline for many years and there has been an overall reduction in the levels of hydrocarbons, including benzene, present in air over the last decade. The measurements made in 2016 indicate that concentrations of most of the monitored substances were lower than 2015 at most locations, with the exception of toluene which showed a slight increase in value.
- 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 (1<sup>st</sup> 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. A benzene monitoring programme for the existing wind farm at Little Raith was carried out from 2011, and it was 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. Measured 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) There have been proposals for a number of other wind turbines of various sizes within the vicinity of the Mossmorran site. During 2016 Fife Council received no new applications. Updates to the applications detailed in the 2015 report are as follows,
- 16/03110/FULL - Site West Of M90 and South Of Cuddyhouse Road, Kingseat. Application approval was given on 6<sup>th</sup> March 2017 for one turbine, with height of 38.5 m to blade tip although this is external to the 3km buffer.
  - 15/03189/FULL - Site to the East of Wester Bucklyvie, Donibristle – one turbine, height 67 m to blade tip. Application was withdrawn on 14<sup>th</sup> July 2016.
- xv) NHS Fife confirmed that there is no evidence of higher-than-expected cancer rates in the area surrounding Mossmorran once the effects of the Scottish index of multiple deprivation are taken into account<sup>2</sup>. 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 2002-2014 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 wind farm, the Review Group does not believe that it is necessary or appropriate to instigate a continuous monitoring programme for benzene.

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<sup>2</sup> 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.

### 3. CONCLUSIONS

- i) There were no breaches of agreed emission limits from regulated sources at the Mossmorran and Braefoot Bay facilities in 2016.
- 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 the Mossmorran plants were higher in 2016 than those reported in 2015 but there is no evidence of a longer-term trend towards increased flaring. The increased flaring was primarily due to a planned maintenance activity undertaken in September 2016 at the ExxonMobil Fife Ethylene Plant. 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 the plants at 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 the Scottish index of multiple deprivation are taken into account.
- vi) The work undertaken in 2016 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.

## 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 a representative from NHS Fife, Public Health Department 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 regarding 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)
- NHS Fife Public Health Department
- 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 2016)

Name	Designation/ Representing	Address
<b>A. MEMBERS</b>		
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, Edinburgh Office, Silvan House, 231 Corstorphine Road, Edinburgh, EH12 7AT
Dr Chris McGuigan	NHS Fife (Public Health)	Cameron House, Windygates
Elizabeth Beattie	Crossgates & Mossgreen Community Council	Crossgates (Inland)
William Dryburgh	Aberdour Community Council	Aberdour (Coastal)
<b><u>B. BY INVITATION</u></b>		
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
James Shannon	Shell UK Limited	Fife NGL Plant, Mossmorran
Isabel Matson	Shell UK Limited	Fife NGL Plant, Mossmorran
Kylie Bishop	ExxonMobil Chemical Limited	Fife Ethylene Plant, Mossmorran
Catherine Cubitt	Exxon Mobil Chemical Limited	Fife Ethylene Plant, Mossmorran
Cllr Linda Erskine	Lochgelly, Cardenden and Benarty Ward	Fife House, Glenrothes
Cllr Rosemary Liewald	Lochgelly, Cardenden and Benarty Ward	Fife House, Glenrothes
Cllr Mary Bain Lockhart	Lochgelly, Cardenden and Benarty Ward	Fife House, Glenrothes
Cllr Lea Mclelland	Lochgelly, Cardenden and Benarty Ward	Fife House, Glenrothes
Cllr Lesley	Burntisland, Kinghorn and	Fife House, Glenrothes

<b>Name</b>	<b>Designation/ Representing</b>	<b>Address</b>
Backhouse	Western Kirkcaldy Ward	
Cllr Gordon Langlands	Burntisland, Kinghorn and Western Kirkcaldy Ward	Fife House, Glenrothes
Cllr Kathleen Leslie	Burntisland, Kinghorn and Western Kirkcaldy Ward	Fife House, Glenrothes
Cllr Alistair Bain	Cowdenbeath Ward	Fife House, Glenrothes
Cllr Alex Campbell	Cowdenbeath Ward	Fife House, Glenrothes
Cllr Gary Guichan	Cowdenbeath Ward	Fife House, Glenrothes
Cllr Darren Watt	Cowdenbeath Ward	Fife House, Glenrothes
Cllr David Barratt	Inverkeithing and Dalgety Bay Ward	Fife House, Glenrothes
Cllr Dave Dempsey	Inverkeithing and Dalgety Bay Ward	Fife House, Glenrothes
Cllr Lesley Laird	Inverkeithing and Dalgety Bay Ward	Fife House, Glenrothes
Cllr Alice McGarry	Inverkeithing and Dalgety Bay Ward	Fife House, Glenrothes
Stephen Bygrave	British Petroleum	Hound Point
Rachel Morrell	Ineos Ltd	Grangemouth Petrochemical Complex
Mark Armitage	Auchtertool Community Council	Auchtertool
Alexander Macdonald	Burntisland Community Council	Burntisland
David A. Taylor	Cardenden & Kinglassie Community Council	Cardenden
Christine Gourlay	Cowdenbeath Community Council	Cowdenbeath
Roy Green	Dalgety Bay & Hillend Community Council	Dalgety Bay
Steven Murray	Lochgelly Community Council	Lochgelly
Amelia Howie	Lumphinnans Community Council	Lumphinnans

### **APPENDIX 3: Regulatory and Policy changes relating to air quality in 2016**

The main regulatory change in Scotland relating to air quality during 2016 was the requirement for Large Combustion Plant to be compliant with Chapter 3 of the Industrial Emissions Directive (IED). This required ExxonMobil's PPC permit to be reviewed and new conditions inserted in December 2015.

Future changes may be required at the Fife Ethylene Plant following the ongoing revision of Large Volume Organic Chemical Industry Best Available Techniques Reference Document (BREF), Common Waste Water Treatment / Management Systems in the Chemical Sector BREF and the Large Combustion Plant (LCP) BREF.

The PPC permit for the Shell NGL Plant is currently being reviewed following the issue of the Refineries BREF in October 2014.

PPC permit conditions take account of relevant Best Available Technique (BAT) reference documents (BREF) Notes published by the European IPPC Bureau<sup>3</sup> and the BAT Conclusions contained within them.

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 to 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 SO<sub>2</sub>, NO<sub>x</sub>, non-methane 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 SO<sub>2</sub>, NO<sub>x</sub>, NMVOC, ammonia, fine particulate matter (PM<sub>2.5</sub>) 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<sub>2.5</sub>. The Scottish Government recently introduced a new air quality objective for PM<sub>2.5</sub><sup>4</sup>, committing to include in legislation as Scottish objectives, World Health Organisation guideline values of 10 µg/m<sup>3</sup> annual averages.

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

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<sup>3</sup> <http://eippcb.jrc.ec.europa.eu/reference/>

<sup>4</sup> Cleaner Air for Scotland The Road to A Healthier Future. Nov 2015.  
<http://www.gov.scot/Resource/0048/00488493.pdf>

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.

## APPENDIX 4: Regulated emissions to air

- **Emissions from all regulated sources at Mossmorran during 2016 were 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 the said legislation. Therefore, whereas in previous reports, measured emissions of CO, NO<sub>x</sub>, total hydrocarbons and benzene from regulated source at the VCU were provided, this information is not included in the current report because ExxonMobil no longer report this information to SEPA.

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 whole site. The companies must report results to SEPA for appraisal.

The emissions monitoring measurements for 2016 submitted to SEPA are summarised for each regulated Shell and ExxonMobil source at Mossmorran in Tables A4.1 to A4.4. The Emission Limit Values (ELVs) set by SEPA for each emission source, are also shown. During 2016, emissions from all regulated sources at Mossmorran were 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 2016 (mg/m<sup>3</sup> at 3% O<sub>2</sub>, 273K Dry) – Furnace stacks 1 to 3; no limit = no limit applied by SEPA**

	CO Concentration (mg/m <sup>3</sup> )				NO <sub>x</sub> Concentration (mg/m <sup>3</sup> )				SO <sub>2</sub> Concentration (mg/m <sup>3</sup> )			
	ELV	2016 Average	2016 Maximum	2016 Minimum	ELV	2016 Average	2016 Maximum	2016 Minimum	ELV	2016 Average	2016 Maximum	2016 Minimum
<b>Furnace 1</b>	100	<6	<6	<6	150	98	114	88	10	<10	<10	<10
<b>Furnace 2</b>	100	<6	<6	<6	150	104	131	84.9	10	<10	<10	<10
<b>Furnace 3</b>	100	<6	<6	<6	150	95.5	116	74.8	10	<10	<10	<10

**Table A4.2: Emissions from Regulated Sources at ExxonMobil Mossmorran during 2016 (mg/m<sup>3</sup> at 3% O<sub>2</sub>, 273K Dry) from Furnaces 1-7 and Gas Turbine Exhaust Stack**

	CO Concentration (mg/m <sup>3</sup> )				NO <sub>x</sub> Concentration (mg/m <sup>3</sup> )				SO <sub>2</sub> Concentration (mg/m <sup>3</sup> )			
	ELV	2016 Average	2016 Maximum	2016 Minimum	ELV	2016 Average	2016 Maximum	2016 Minimum	ELV	2016 Average	2016 Maximum	2016 Minimum
Furnace 1	no limit	13.7	42.0	0.0	350	240.3	292.9	159.5	no limit	0.0	0.0	0.0
Furnace 2	no limit	21.6	41.8	9.2	350	212.0	291.5	154.7	no limit	1.2	2.8	0.0
Furnace 3	no limit	0.4	1.6	0.0	350	197.4	301.1	156.4	no limit	0.0	0.0	0.0
Furnace 4	no limit	28.6	114.3	0.0	350	206.1	285.8	167.5	no limit	0.0	0.0	0.0
Furnace 5	no limit	0.8	2.3	0.0	350	265.8	334.3	206.4	no limit	0.1	0.4	0.0
Furnace 6	no limit	2.0	2.7	1.4	350	247.4	336.5	166.4	no limit	0.0	0.0	0.0
Furnace 7	no limit	1.3	3.1	0.0	350	252.5	292.3	213.5	no limit	1.2	2.3	0.0
Gas Turbine Stack	no limit	5.5	24.9	0.0	550	306.2	366.9	261.3	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 2016 – Measured CO and NO<sub>x</sub> Values (mg/m<sup>3</sup> at 3% O<sub>2</sub>, 273K Dry) from Boiler stacks.**

	CO Concentration (mg/m <sup>3</sup> )				NO <sub>x</sub> (as NO <sub>2</sub> )			
	Authorised Emissions Limit	PPC	Average	Max	Min	Authorised Emissions Limit	PPC/LCPD	LCPD fuel weighted consent (mg/m <sup>3</sup> )
<b>Boiler A</b>	200		3.3	4.8	1.8	Limit is fuel weighted (450 on liquid fuel, 300 on gas).	353.4	141.4
							380.0	148.5
<b>Boiler B</b>	200		3.2	4.9	1.5	Limit is fuel weighted (450 on liquid fuel, 300 on gas).	300.0	212.1
							339.0	148.7
<b>Boiler C</b>	200		2.7	4.1	1.3	Limit is fuel weighted (450 on liquid fuel, 300 on gas).	300.0	247.0
							300.0	179.9

Note: ExxonMobil underwent a permit variation to incorporate IED legislative updates which came into force on 1<sup>st</sup> January 2016. This varied the boiler monitoring frequency from quarterly to 6-monthly. The authorization PPC/ LCPD for NO<sub>x</sub> changed to fuel-weighted limits (450 on liquid fuel, 350 on gas) in 2015 to fuel-weighted limits (450 on liquid fuel, 300 on gas) in 2016.

**Table A4.4: Emissions from Regulated ExxonMobil Sources at Mossmorran during 2016 – Measured SO<sub>x</sub> and PM<sub>10</sub> Values (mg/m<sup>3</sup> at 3% O<sub>2</sub>, 273K Dry) from Boiler stacks.**

	SO <sub>x</sub>			PM <sub>10</sub>				
	Authorised Emissions Limit	PPC/LCPD	LCPD fuel weighted consent (mg/m <sup>3</sup> )	Concentration (mg/m <sup>3</sup> )	Authorised Emissions Limit	PPC/LCPD	LCPD fuel weighted consent (mg/m <sup>3</sup> )	Concentration (mg/m <sup>3</sup> )
<b>Boiler A</b>	Limit is fuel weighted (350 on liquid fuel, 35 on gas).		628.2	295.8	Limit is fuel weighted (50 on liquid fuel, 5 on gas).		21.0	2.0
			N/A	113.4			29.0	2.0
<b>Boiler B</b>	Limit is fuel weighted (350 on liquid fuel, 35 on gas).		35.0	0.9	Limit is fuel weighted (50 on liquid fuel, 5 on gas).		5.0	1.7
			N/A	60.2			16.7	1.0
<b>Boiler C</b>	Limit is fuel weighted (350 on liquid fuel, 35 on gas).		35.0	2.5	Limit is fuel weighted (50 on liquid fuel, 5 on gas).		5.0	1.4
			N/A	48.4			5.0	1.6

Note: ExxonMobil underwent a permit variation to incorporate IED legislative updates which came into force on 1<sup>st</sup> January 2016. This varied the boiler monitoring frequency from quarterly to 6-monthly. The authorization PPC/ LCPD for SO<sub>x</sub> changed to fuel-weighted limits (1,700 on liquid fuel, 35 on gas) in 2015 to fuel-weighted limits (350 on liquid fuel, 35 on gas) in 2016.

## APPENDIX 5: 2016 Flaring Report

### A5.1 ExxonMobil Fife Ethylene Plant

Table A5.1, below, indicates the quantities flared at the Fife Ethylene Plant during 2016.

**Table A5.1 Quantities Flared (tonnes) from the ExxonMobil Fife Ethylene Plant**

	<b>Ground</b>	<b>Elevated</b>	<b>Total</b>	<b>Reason</b>
<b>Jan</b>	721	10	731	
<b>Feb</b>	684	6	690	
<b>Mar</b>	641	0	641	
<b>Apr</b>	558	7	565	
<b>May</b>	719	5	724	
<b>Jun</b>	559	125	684	
<b>Jul</b>	736	39	775	
<b>Aug</b>	406	78	485	H1B09 replacement, C-T-52 process upset
<b>Sep</b>	14,381	10,849	25,229	PGC trip, planned maintenance
<b>Oct</b>	1,088	1,308	2,396	Planned maintenance, filter pressure
<b>Nov</b>	768	17	784	Liquid overfill of S-D-11, debutaniser start-up
<b>Dec</b>	1,306	151	1,457	Loss of LP steam header, drier regeneration
<b>Total</b>	<b>22,567</b>	<b>12,594</b>	<b>35,162</b>	

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.

From September 16<sup>th</sup> – October 3<sup>rd</sup> 2016, planned maintenance activities took place which resulted in increased flaring. This was communicated in advance to SEPA, community groups and members via letters, email, radio and newspaper.

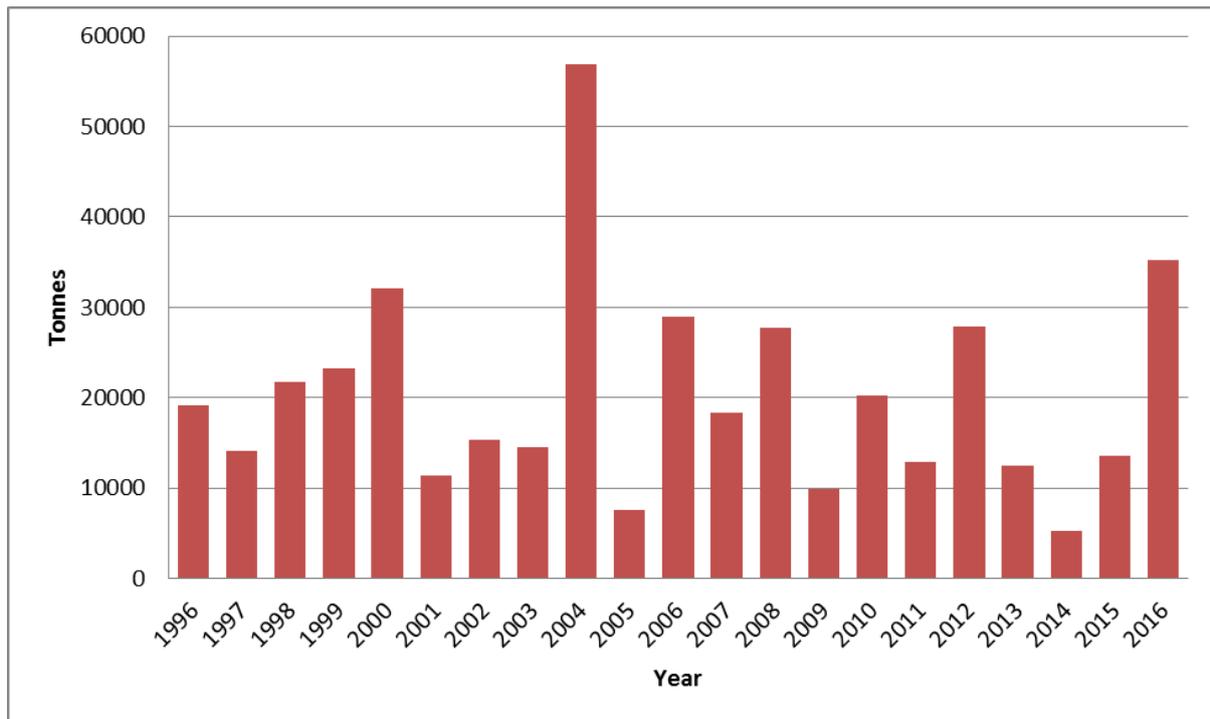
The quantity of gas flared in 2016 was higher than that in 2015. There were several process upsets which resulted in elevated flaring at the facility. The elevated flaring events occurred on the following dates and the reasons for these are summarised in Table A5.1:

- 10<sup>th</sup> August
- 16<sup>th</sup> August
- 14<sup>th</sup> September
- 17<sup>th</sup> October
- 4<sup>th</sup> November
- 10<sup>th</sup> December

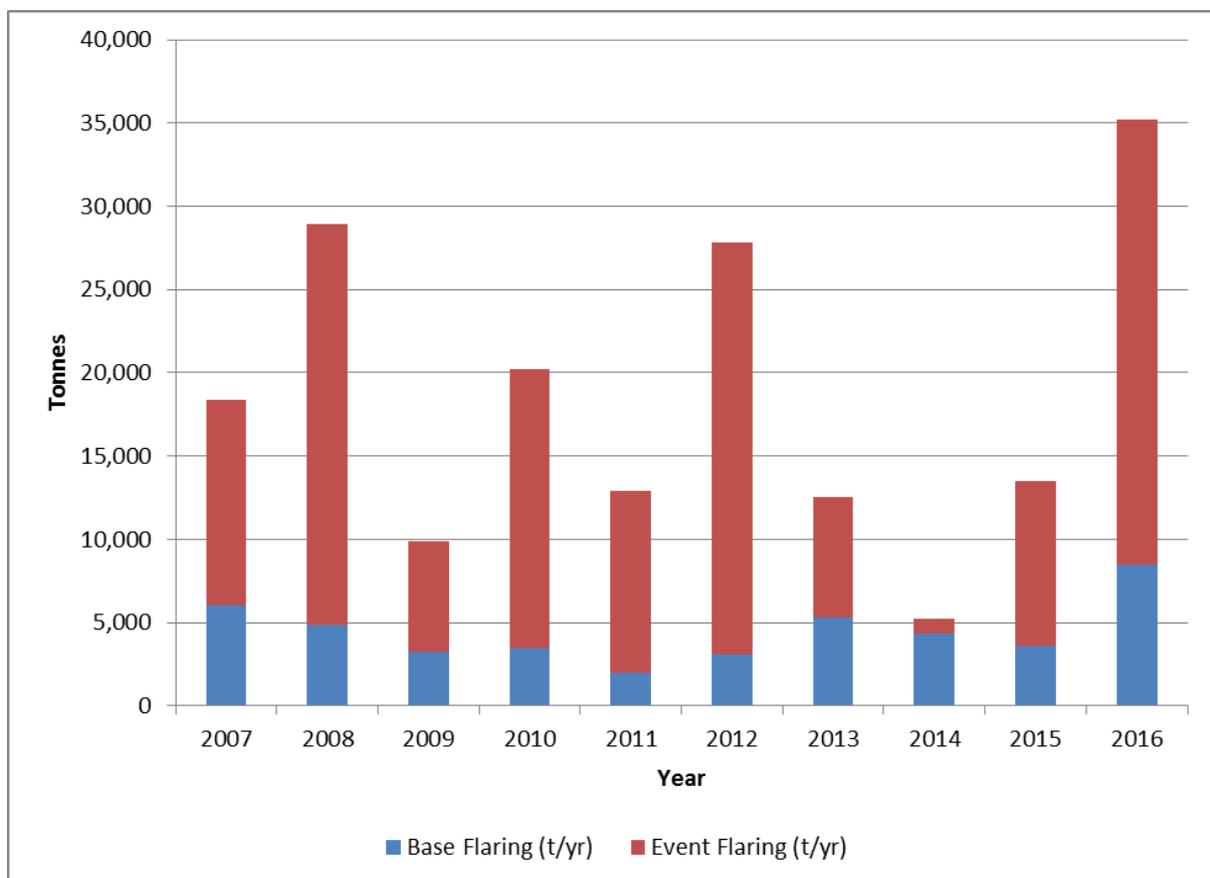
In every instance, an investigation was undertaken and the outcomes reported to, and discussed with SEPA.

Overall, there is no obvious trend over time in the quantities flared.

**Figure A5.1: Total quantities flared annually at the Fife Ethylene Plant between 1996 and 2016**



**Figure A5.2: Total event and base flaring quantities annually at the Fife Ethylene Plant between 2006 and 2016**



## A5.2 Shell Fife Natural Gas Liquids Plant

The total annual mass flared at the Natural Gas Liquids Plant, operated by Shell during 2016 totalled 3586- tonnes, an increase of 953 tonnes from the 2643 tonnes flared in 2015. 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 2016.

**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	0.00	25.25	308.17	333.43	
February	0.00	13.4	285.51	298.91	
March	0.00	8.89	308.35	317.24	
April	0.00	8.58	298.04	306.62	
May	10.07	14.08	309.16	333.31	
June	11.27	12.97	303.42	327.65	
July	0.00	50.94	264.62	315.56	
August	0.00	12.01	285.59	297.61	
September	15.12	52.91	233.80	301.83	
October	0.00	18.47	239.91	258.38	
November	0.00	19.05	228.90	247.95	
December	0.00	11	236.53	247.53	
<b>Total</b>	<b>36.46</b>	<b>247.55</b>	<b>3302.00</b>	<b>3586.01</b>	

In general, the availability of the two ground flares has continued to be high resulting in the greater consumption of fuel gas for pilots.

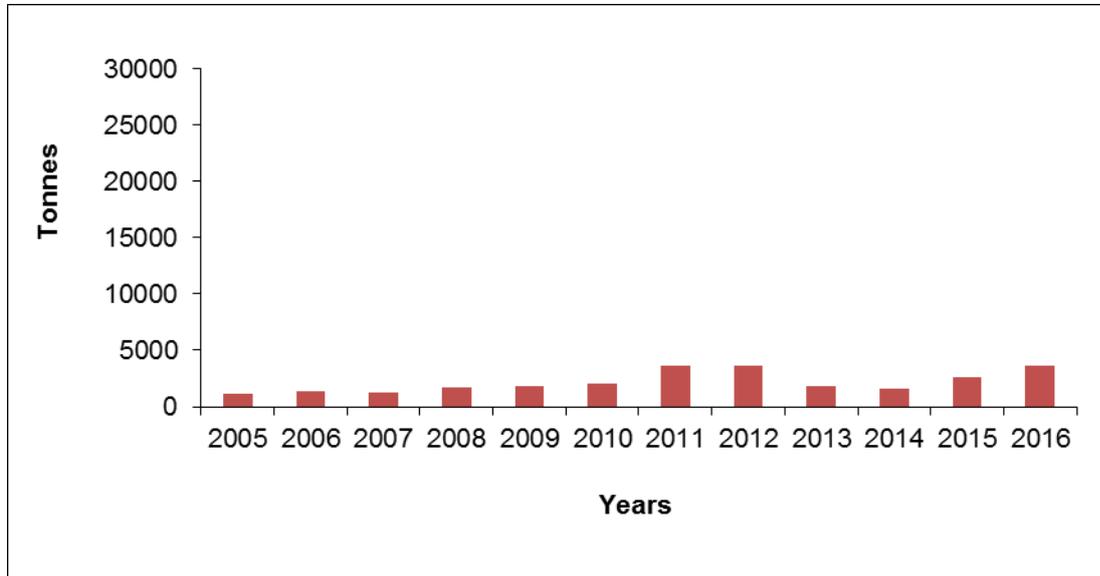
The 'B' Ground Flare will be undergoing routine maintenance through March/April but otherwise the ground flare availability is expected to remain high through 2017 with associated consumption of fuel gas for pilots.

The planned replacement of the thermocouples on the flare pilots has been delayed and will now occur in 2017. This will then contribute to a reduction in the required use of fuel gas as a purge gas.

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, Shell Mossmorran completed the ground-flare refurbishment programme in 2015. As a result the availability of the ground flare was increased considerably with the pilots requiring a greater consumption of fuel gas. This availability has continued through 2017 which has led to continued usage of fuel gas for pilots but enabled greater use of the ground flares in preference to elevated flaring. Routine maintenance of the ground flares is scheduled in 2017 which will ensure continued access to the ground flares.

The planned commissioning of a replacement Nitrogen Generator (Pressure Swing Absorber, utilising membrane technology) in April/May 2016, has led to a slight reduction in fuel usage for purging the flares. The planned replacement of the thermocouples on the flare pilots that was scheduled for late 2016 was not completed for a number of technical reasons but will be completed in 2017 and this should further reduce flaring totals going forward.

**Figure A5.3: Total tonnes flared at Shell Fife Nature Gas Liquids plant**



## Appendix 6: EU ETS CO<sub>2</sub> Submissions

Table A6.1 shows the ExxonMobil EU ETS submissions for CO<sub>2</sub> emissions from the Fife Ethylene Plant for the period 2005-16. The reporting of CO<sub>2</sub> emissions changed with the implementation of EU ETS Phase III. Phase III in addition to that reported in Phase II also now includes CO<sub>2</sub> 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. CO<sub>2</sub> emissions were higher in 2016 than previous years due to higher plant throughput and a planned maintenance period spanning 16<sup>th</sup> September – 3<sup>rd</sup> October which resulted in increased flaring. CO<sub>2</sub> emissions are a combustion product and are proportional to the plants throughput and planned maintenance. In addition to increased production, the unplanned flaring events which occurred through the year also contributed to the higher CO<sub>2</sub> emission reported.

**Table A6.1: ExxonMobil EU ETS returns for CO<sub>2</sub> emissions from 2005-16**

Year	Emissions Trading Scheme	Phase
	CO <sub>2</sub> 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
2016	885,853	Phase III

Phase I - CO<sub>2</sub> emissions from Boilers and Gas Turbine Exhaust

Phase II - CO<sub>2</sub> emissions from all emissions sources excluding flaring

Phase III - CO<sub>2</sub> emissions from all emissions sources

Table A6.2 overleaf shows the Shell UK Ltd Fife Nature Gas Liquids EU ETS submissions for CO<sub>2</sub> emissions from 2005-16.

**Table A6.2: Shell UK Ltd. Fife Nature Gas Liquids plant EU ETS returns for CO<sub>2</sub> emissions from 2005-16**

Year	Emissions Trading Scheme	Phase
	CO <sub>2</sub> tonnes	
2005	0	Phase I
2006	0	
2007	154,270	
2008	176,834	Phase II
2009	156,212	
2010	154,189	
2011	138,891	
2012	127,481	
2013	132,100	
2014	139,513	Phase III
2015	150,158	
2016	196,106*	

\*Submitted to verifier – administrative delay pending full verification

Phase I - CO<sub>2</sub> emissions from Boilers and Gas Turbine exhaust  
Phase II - CO<sub>2</sub> emissions from all emissions sources excluding flaring  
Phase III - CO<sub>2</sub> 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.

$\text{mg}/\text{m}^3$ : 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

*Particulate Matter (PM)*: is the term used to describe solid or liquid particles suspended in the atmosphere<sup>5</sup>. Particle size determines how deep a particle can penetrate into the lungs. Some ultrafine particles may pass into the blood stream from the lungs.

*PM<sub>10</sub>*: 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  $\mu\text{m}$  in diameter.

*PM<sub>2.5</sub>*: This is a subfraction of PM<sub>10</sub> 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. PM<sub>2.5</sub> 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 has been classified as a cancer causing chemical<sup>6</sup>.

*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. 1,3-Butadiene is *probably carcinogenic to humans (Group 2A)*<sup>7</sup>.

Carbon dioxide (CO<sub>2</sub>): 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.

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<sup>5</sup> Air Quality (PM<sub>2.5</sub> particulate air pollution) and Mortality in Scotland. : A Briefing Paper, HPS April 2014. <http://www.documents.hps.scot.nhs.uk/environmental/briefing-notes/air-quality-and-mortality-2014-04.pdf>

<sup>6</sup> Benzene: General Information , Public Health England [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/561046/benzene\\_general\\_information.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/561046/benzene_general_information.pdf)

<sup>7</sup> International Agency for Research on Cancer (IARC). (1999) IARC monographs on the evaluation of carcinogenic risks to humans. Vol. 71. 1,3-Butadiene. Re-evaluation of some organic chemicals, hydrazine and hydrogen peroxide (part one). Lyon, France: International Agency for Research on Cancer, pp. 109-225.

*Nitrogen dioxide* (NO<sub>2</sub>): 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 to the respiratory system 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<sub>x</sub>*.

*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