

October 2019

Mossmorran & Braefoot Bay Independent Air Quality Monitoring Review Group

2018 Annual Report

Mossmorran & Braefoot Bay Independent Air Quality Monitoring Review Group

We provide advice and recommendations to Fife Council 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 (Shell) and ExxonMobil Chemical Limited (ExxonMobil)). We do this by independently reviewing air quality data collected from a number of sources as well as considering the potential impact that any major plant changes could have on air quality. We produce annual reports to present our findings of the review and any recommendations we may have.

URL: www.fifedirect.org.uk

ABBREVIATIONS

µg/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.
BAT	Best Available Techniques
BREF	Best Available Techniques Reference Document
BTEX	Benzene, Toluene, Ethylbenzene and Xylene
CO	carbon monoxide
COMAH	Control of Major Accident Hazard
DAQI	Daily Air Quality Index
DEFRA	Department of environment, food and rural affairs
ELV	Emission Limit Value
EU ETS	European Union Emissions Trading Scheme
ExxonMobil	ExxonMobil Chemical Limited
FEP	Fife Ethylene Plant - ExxonMobil Chemical Limited (ExxonMobil)'s production facility at Mossmorran
FNGL	Fife Natural Gas Liquids - comprises Shell UK Limited (Shell)'s production facility at Mossmorran for the fractionation of liquefied natural gas
FPS	Forties Pipeline System
HSE	Health and Safety Executive
IED	Industrial Emissions Directive
IPPC	Integrated Pollution Prevention and Control
K	Kelvin
mg/m ³ :	milligram per cubic metre, mass concentration unit for particulates and gases, 1 mg/m ³ = 1,000 µg/m ³ .
Mossmorran Defined Area	This 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, Kelty East. In addition interzones Ketly West and Balingry have been included as these are surrounded on two or more sides by interzones that are within the 5km radius.
NO ₂	Nitrogen dioxide
NO ₂	Nitrogen dioxide
NO _x	Nitrogen oxides
NPL	National Physical Laboratory
O ₃	Ozone
PM	particulate matter
PM ₁₀	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 PM ₁₀ 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 _{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.
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.
PPC	Pollution Prevention and Control
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.
Review Group	Mossmorran & Braefoot Bay Independent Air Quality Monitoring Review Group
SEPA	Scottish Environment Protection Agency
SEPA	Scottish Environmental Protection Agency
Shell	Shell UK Limited
SO _x	sulphur oxides
VCU	Vapour control unit
VOCs	volatile organic compounds

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SUMMARY

The Mossmorran & Braefoot Bay Independent Air Quality Monitoring Review Group (Review Group) advises Fife Council regarding the monitoring of air emissions arising from operations at the Mossmorran plants and the Braefoot Bay Marine terminal facilities. Shell UK Limited (Shell) and ExxonMobil Chemical Limited (ExxonMobil) operate these facilities. The Review Group do this by reviewing air quality data collected from a number of sources, as well as considering the potential impact that any major plant changes could have on air quality. The Review Group liaises with representatives from community councils and the local health service.

The facilities at Mossmorran and the ExxonMobil facility at Braefoot Bay operate under Pollution Prevention and Control permits issued by the Scottish Environment Protection Agency (SEPA). These permits specify the conditions for protection of the environment under which the facilities must operate. Fife Council is required to periodically review and assess air quality in its area to ensure air quality standards and objectives for prescribed pollutants are not exceeded. For the Mossmorran plants and Braefoot Bay terminal facilities, this process includes taking account of the Review Group findings.

During 2018, there were no plant changes at the Mossmorran and Braefoot Bay facilities that would be anticipated to adversely affect local air quality.

Flaring is undertaken to protect the plant safety during planned and unplanned maintenance work. The overall quantities flared at the Mossmorran plants were lower in 2018 than those reported in 2017. There is no evidence of a longer-term trend towards increased flaring. Following a thorough investigation, final warning letters were served on both companies by SEPA in April 2018 relating to unplanned flaring incidents during June 2017.

Concentrations of pollutants in air monitored along the Fife coastline were low and there has been an overall reduction in their levels over the last decade. No air quality issues in the vicinity of Mossmorran or Braefoot Bay were identified in Fife Council's 2018 Air Quality Annual Progress Report. A 3-month monitoring air quality study conducted by SEPA in 2019 reported no breaches of any air quality objectives and all measurements were in the low band of Defras daily air quality index except for particulate matter on one day, which coincided with a period of elevated particulate matter across Scotland.

Overall, the Review Group concluded that, based on the available data reviewed in 2018, 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.

1 BACKGROUND

1.1 WHAT ARE THE MOSSMORRAN & BRAEFOOT BAY TERMINAL FACILITIES?

Shell UK Limited (Shell) operates the Mossmorran Fife Natural Gas Liquids (FNGL) 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. Underground pipelines supply these products to the Braefoot Bay deep-water loading facility, where they are loaded on to tankers. The Shell FNGL 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 neighbouring Fife Ethylene Plant (FEP) operated by ExxonMobil Chemical Limited (ExxonMobil)) was the first plant to use natural gas liquids from the North Sea as feedstock. It takes the ethane gas, which would otherwise be left as a component of natural gas used in homes, and processes, or 'cracks' it into ethylene, a much higher value product used to manufacture automotive, packaging and sporting products. FEP has the capacity to produce 830,000 tonnes of ethylene per year and is one of approximately 40 ethylene crackers within the whole of Europe.

1.2 WHO ARE THE MOSSMORRAN & BRAEFOOT BAY INDEPENDENT AIR QUALITY MONITORING REVIEW GROUP?

The Mossmorran & Braefoot Bay Independent Air Quality Monitoring Review Group (Review Group) was formed to provide advice and recommendations to Fife Council¹ regarding the monitoring of air emissions arising from the operations at the Mossmorran plants and the Braefoot Bay terminal facilities. The Review Group liaise with local communities, via representatives from community councils and representatives of the local health service. Review Group members are appointed by Fife Council (Table 1).

Table 1: Current Review Group members

Name	Organisation
Prof. Wilson Sibbett	Independent Chair
Mary Stewart	Major Business & Customer Service Fife Council
Kenny Bisset	Fife Council (Enterprise, Planning and Protective Services)
Dr Karen Galea	Institute of Occupational Medicine (IOM)
Ian Brocklebank	Scottish Environment Protection Agency (SEPA)
Dr Chris McGuigan	NHS Fife (Public Health)
Elizabeth Beattie	Crossgates & Mossgreen Community Council
William Dryburgh	Aberdour Community Council
Alexander Macdonald	Burntisland Community Council

¹ Formerly Fife Regional Council and Dunfermline and Kirkcaldy District Councils

Full details of the constitution and terms of reference of the review group are provided in Appendix 1, with details of the Review Groups membership (as at December 2018) being provided in Appendix 2.

1.3 WHO PAYS FOR THE REVIEW GROUP'S WORK?

ExxonMobil and Shell finance the operating costs associated with the Review Group's activities.

1.4 WHAT ARE THE AIMS OF THE REVIEW GROUP ANNUAL REPORT?

The aims of 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 2018
- Review other information about local air quality
- Continue to review the potential impact of installed and planned wind turbines in the vicinity of the Mossmorran site on pollutant dispersion.

A summary of relevant ongoing initiatives and plant updates that have occurred during 2019 up to the publication of this report are also included.

1.5 HOW DOES THE REVIEW GROUP UNDERTAKE THEIR ROLE?

The constitution and terms of reference (Appendix 1) outlines the approach taken to the Review Group's work.

1.6 HOW DOES THE REVIEW GROUP MAINTAIN THEIR INDEPENDENCE?

The Review Group provides advice and recommendations to Fife Council. At each Review Group meeting members are requested to declare any conflicts of interest. None was declared during the reporting period. Each Review Group meeting is minuted, with copies of these being publically available.

Representatives from ExxonMobil and Shell are invited to attend Review Group meetings and have the opportunity to provide comment on draft versions of the Review Group report. However, the Review Group reserves the right to take these comments into account (or otherwise) when finalising their report.

The responsibility for the content of the Review Group annual report lies solely with the Review Group.

1.7 WHAT MEETINGS DID THE REVIEW GROUP PARTICPATE IN DURING 2018?

Table 1 provides details of when the Review Group formally met during 2018, as well as details of other meetings where they were represented.

Meeting	Date(s)
Mossmorran and Braefoot May independent air quality review group	29 th Mar. 2018 6 th Nov. 2018
Mossmorran working group	Initial roundtable 12 th Jan. 2018 First official meeting 20 th Apr. 2018 2 nd official meeting 8 th Jun. 2018 3 rd official meeting 31 st Aug. 2018
Mossmorran and Braefoot Bay Community & Safety Liaison Committee	8 th Mar. 2018 13 th Sept. 2018 13 th Dec. 2018

The Mossmorran working group meetings were Chaired by Lesley Laird (Member of Parliament for Kirkcaldy and Cowdenbeath) and Professor Wilson Sibbett (Chair of the Review Group) in 2018-2019. These meetings sought to identify community concerns about the plant's flaring events and activities and identify solutions to improve communication of information to relevant communities.

1.8 HOW DOES THIS REPORT DIFFER FROM PREVIOUS YEARS?

The Review Group has listened to stakeholder feedback provided during the Mossmorran working group and Mossmorran and Braefoot Bay Community and Safety Liaison Committee meetings. As way of response to some of the feedback, the 2018 report has been restructured and streamlined to help improve transparency, clarity in the Review Group's work, as well as facilitate better understanding of the air quality issues, and the data considered.

Under the European Union Emissions Trading Scheme (EU ETS) companies operating in Scotland have to declare to SEPA how much carbon dioxide (CO₂) is emitted each year. Once emissions are verified by a third-party, operators must surrender allowances for every tonne of CO₂ they emit during a year. As CO₂ is a greenhouse gas and has no direct effects on human health at environmental concentrations, details of ExxonMobil and Shell submissions for 2018 have not been included in this report.

2 AIR QUALITY INDICATORS REVIEWED

2.1 WHAT ARE THE POLLUTANTS REVIEWED?

A number of air pollutants are reviewed and these are detailed below.

- *Particulate Matter (PM)*: is the term used to describe solid or liquid particles suspended in the atmosphere². Particle size determines how deep a particle can penetrate into the lungs. Some ultrafine particles may pass into the blood stream from the lungs.
 - *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 personal activities. It includes particles that are approximately less than 10 µm in diameter.
- *Nitrogen dioxide (NO₂)*: This gas is produced by the reaction of oxygen and nitrogen during combustion. Vehicle emissions are a major source. Nitric oxide always occurs when NO₂ is formed. The two gases together are known as *oxides of nitrogen*, sometimes described in shorthand form as *NO_x*.
- *Carbon monoxide (CO)*: This is a colourless, odourless poisonous gas produced by incomplete, or inefficient, combustion of fuel. It is predominantly produced by road transport, in particular petrol-engine vehicles.
- *Sulphur Oxides (SO_x)*: Sulphur dioxide (SO₂) is produced when a material, or fuel, containing sulphur is burned. In the UK, the predominant source of SO₂ is power stations burning fossil fuels, principally coal and heavy oils. Widespread domestic use of coal can also lead to high local concentrations of SO₂.
- *Benzene*: This aromatic hydrocarbon is a minor component of petrol. Fuel distribution and car exhausts are the major contributors to benzene levels in the air. It is present in cigarette smoke, some foods and drinks and widely in nature.
- *VOCs or volatile organic compounds*: Carbon-based (or organic) chemicals that readily evaporate. Many hydrocarbons, including benzene, butane, pentane and hexane are VOCs.

² Air Quality (PM_{2.5} 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>

Air quality is measured by comparing against a range of health-effects based standards. Further information on these can be found at <http://www.scottishairquality.scot/air-quality/standards>.

DEFRA (Department of Food, Environment and Rural Affairs) has developed a daily air quality index (DAQI). The index is numbered 1-10 and divided into four bands, low (1) to very high (10), to provide detail about air pollution levels in a simple way. Further information on these can be found at <https://uk-air.defra.gov.uk/air-pollution/daq>

2.2 WHAT DATA ARE REVIEWED AND WHO PROVIDES THIS?

Table 2 provides a summary of the data typically considered and the providers of this information for the 2018 Annual Report.

Table 2: Source of information considered by the Review Group

Data considered	Data provider
Carbon monoxide (CO) emissions	Shell and ExxonMobil
Sulphur oxides (SO _x) emissions	Shell and ExxonMobil
Nitrogen oxides (NO _x) emissions	Shell and ExxonMobil
PM10 emissions	Shell and ExxonMobil
iso-butane, n-butane, iso-pentane, n-pentane, n-hexane, n-heptane, benzene, toluene, xylene and total hydrocarbons (C4-C10)	INEOS Forties Pipeline System (FPS)
Flaring events (tonnage)	Shell and ExxonMobil

INEOS Forties Pipeline System (FPS) Ltd. provide data as they commission the National Physical Laboratory (NPL) on an annual basis to monitor the ambient air hydrocarbon levels at 12 locations on the Forth Estuary coastline.

In addition, Fife Council annually review and assess air quality in the Fife area and their annual Air Quality Annual Progress Report is considered³. The report provides the results of NO₂ monitoring undertaken in at four automatic stations in Cupar, Kirkcaldy, Dunfermline and Rosyth and non-automatic monitoring using diffusion tubes at 62 sites.

In addition, during 2019 other activities took place, which are considered in the 2018 Review Group report:

- The Scottish Environment Protection Agency (SEPA) completed an air monitoring survey in the vicinity of the Mossmorran complex and further details of this exercise are provided in Section 5.2.
- Wood. investigated how flaring at the FEP might impact local air quality. Further details of this are provided in Section 5.3, with the non-technical summary being available on-line⁴.

³ <https://www.fifedirect.org.uk>

⁴ Wood (2019) Air quality assessment of flaring activities at Fife Ethylene Plant: non-technical summary <https://cdn.exxonmobil.com/~media/unitedkingdom/files/community/flaring/air-quality-analysis.pdf>

2.3 OZONE – IS THIS MONITORED AND IS IT A CONCERN?

The Review Group understands that stakeholders have expressed concern about ozone.

Ozone (O₃) is not emitted directly from any man-made source in any significant quantities. In the lower atmosphere, O₃ is primarily formed by a complicated series of chemical reactions initiated by sunlight. These reactions can be summarised as the sunlight-initiated oxidation of VOCs in the presence of nitrogen oxides (NO_x). The chemical reactions do not take place instantaneously, but can take hours or days, therefore ozone measured at a particular location may have arisen from VOC and NO_x emissions many hundreds or even thousands of miles away. Ozone irritates the airways of the lungs, increasing the symptoms of those suffering from asthma and lung diseases⁵.

The Review Group does not receive any data pertaining to ozone as this is not routinely monitored by the facilities, INEOS FPS or Fife Council.

The Review Group does not consider that monitoring of ozone is helpful or necessary in relation to air emissions arising from the operations at the Mossmorran plants and the Braefoot Bay terminal facilities.

2.4 WHO HAS A REGULATORY ROLE IN RELATION TO THE MOSSMORRAN AND BRAEFoot BAY FACILITIES?

SEPA's regulatory role in relation to the Mossmorran Complex and Braefoot Bay is to enforce the Pollution Prevention and Control (Scotland) Regulations 2012 ('the PPC Regulations'), and the Control of Major Accident Hazard Regulations 2015 (the COMAH Regulations), where they apply. COMAH is regulated jointly with the Health and Safety Executive (HSE) and SEPA as the Competent Authority.

The PPC Regulations focus on emissions from the facility and use of Best Available Techniques ('BAT') by the operator. They require the operator to operate their installation in such a way that all preventative measures are taken against pollution and no significant pollution is caused by using BAT for preventing or, where that is not practicable, reducing emissions from the installation.

Permit conditions including Emission Limit Values (ELVs) are set to reflect BAT and to protect the environment and public health. Such conditions are set following consultation with the Local Authority and the relevant Health Board to ensure that any air quality or public health aspects have been included. SEPA's role thereafter is to ensure compliance with the permit conditions. Both Shell and ExxonMobil are required to provide monitoring data to demonstrate that ELVs are being met. Testing of emissions must conform

⁵ <http://www.scottishairquality.scot/air-quality/pollutants#ozone>

to required standards and SEPA performs periodic compliance inspections to verify the quality and source of the data and can perform their own testing to verify results where required.

For airborne emissions from Mossmorran, the Shell and ExxonMobil permits require that the stacks (or chimneys) from furnaces, boilers and gas turbines are tested and analysed. The results of the periodic analysis are checked against defined emission limits, and the results and outcomes are reported to SEPA. If the results are within the consented limits it indicates the plant is operating as designed. SEPA periodically reviews the emission limits to ensure alignment with BAT as required by legislation. If an emission limit is exceeded the cause is investigated and follow-up initiated to prevent reoccurrence.

Testing of emissions must also conform to required standards. SEPA performs periodic compliance inspections to verify the quality and source of the data and can perform their own testing to verify results where required.

3 FLARING

3.1 WHY IS FLARING NEEDED?

The flares at the Mossmorran complex are part of the safety system and are used to burn off gas that cannot be processed due to the volumes involved or the gas being off specification. This might be due to scheduled maintenance requiring the plant to be 'gas free' prior to entry; or, following an unplanned interruption in production. The flare systems include two 80 metre high flares at Shell FNGL; one 100 metre high flare at ExxonMobil FEP; and two ground flares operated by Shell FNGL, used by both sites as required.

The ground-level flares, owned and operated by Shell, are used in preference to the high-level flares to minimise noise and light impacts for local residents.

During flaring, excess gas is combined with steam and air before being burnt off. This is accepted as industry best practice, producing water vapour and CO₂ when combustion is optimised. During a process upset, the ability to continue operating and the time it takes to start up and shut down are key elements that impact whether flaring occurs and for how long. Feed rates have to be managed through the whole supply network up to the offshore platforms in the North Sea, and upsets could have an impact on the natural gas supply for the whole of Scotland.

3.2 WHAT FLARING TOOK PLACE DURING 2018?

Table 3 provides details of the quantities flared (tonnes) during 2018.

Table 3: Quantities Flared from ExxonMobil FEP and Shell FNGL in 2018

Month	ExxonMobil FEP (tonnes)			Shell FNGL (tonnes)			
	Ground Flaring	Elevated Flaring	Total	Ground Flaring ⁶	Elevated Flaring	Purge & Pilot (Ground & Elevated flares)	Total
January	603	12	615	0	9	213	221
February	551	55	606	0	53	147	200
March	1539	4519	6058	0	28	169	197
April	600	48	647	0	32	163	194
May	2665	2142	4807	0	15	165	180
June	657	20	677	0	53	164	216
July	431	275	706	0	66	169	235
August	426	184	609	80	50	188	317
September	406	71	477	0	20	242	263
October	265	505	770	0	12	236	247
November	550	128	679	0	6	206	212
December	390	0	390	0	40	211	251
Total	9,083	7,959	17,042	0	463	2,271	2,734

*values rounded to nearest tonne

3.3 ARE THE QUANTITIES FLARED INCREASING OVER TIME?

As shown in Figures 1-3, the quantity flared varies from year to year depending on circumstances. The temporal data does not indicate any trend (either increase or decrease) in flaring rates. Overall, the quantity of gas flared in 2018 by ExxonMobil and Shell was lower than that in 2017.

⁶ While Shell FNGL owns, operates and maintains the ground flares, the installation has always operated under an agreement that allows both facilities to utilise the ground flares. Only one facility is able to access the ground flares at one time for safety reasons. Normal practise is to have the ground flare set to accept flare gas from the Exxon plant so as to minimise their elevated flaring. To change the setup requires manual valves to be re-positioned. In 2018, the ground flare was re-aligned once in August to accept gas from the Shell plant. The gas each facility sent to the ground flares is metered, recorded and reported separately in accordance with site operational permits.

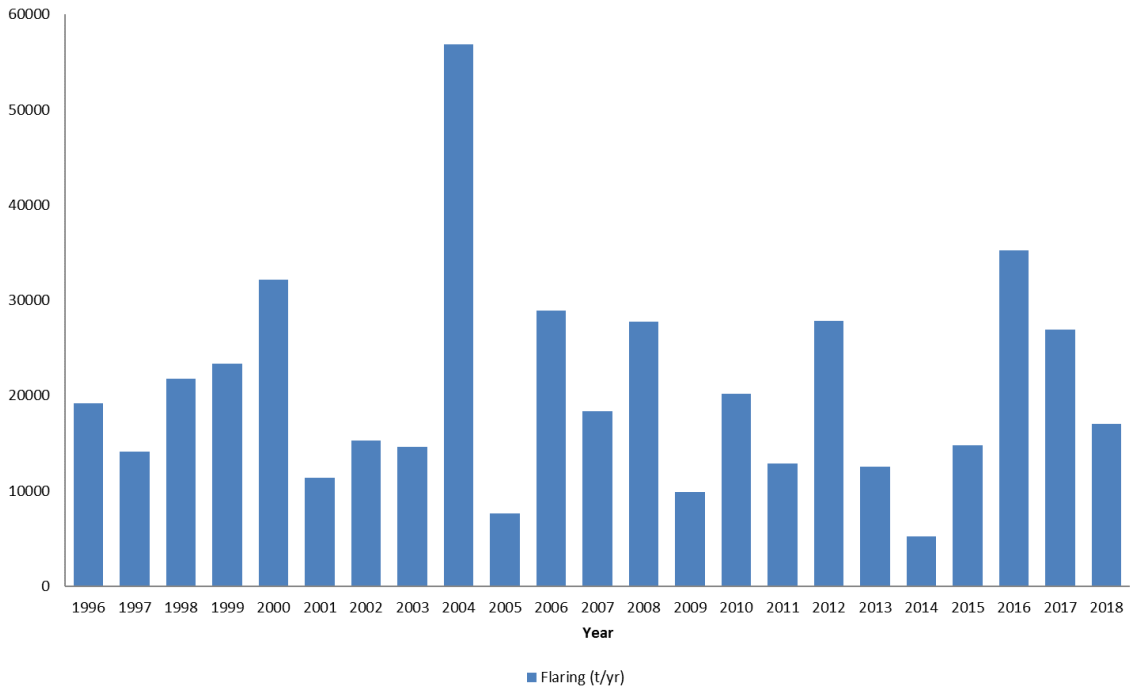


Figure 1: Temporal trends of total quantities (tonnes) flared annually at ExxonMobil FEP

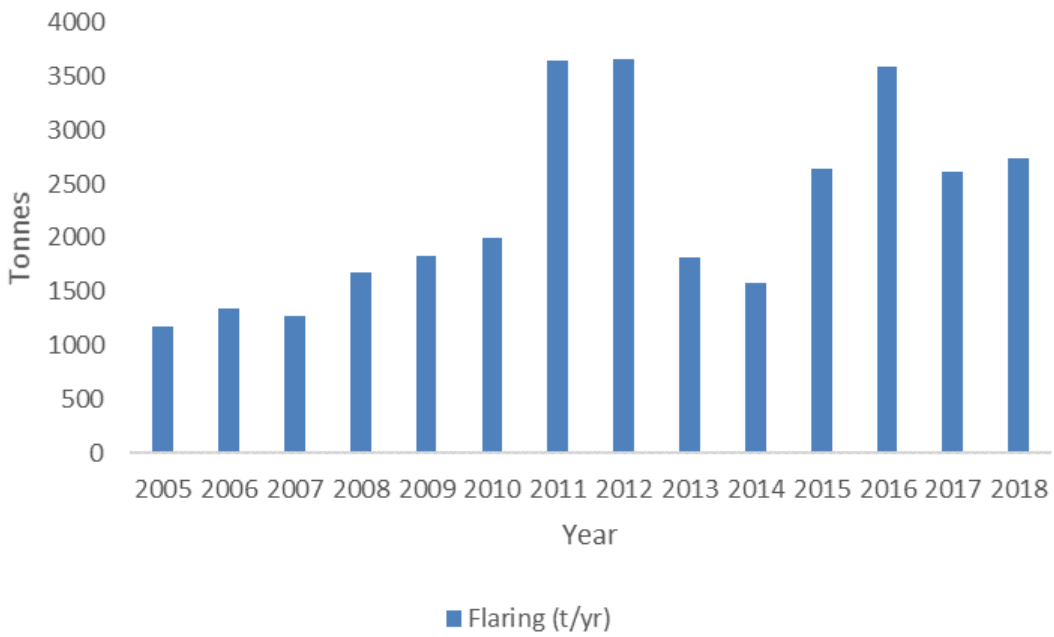


Figure 2: Total quantities (tonnes) flared annually at Shell FNGL plant

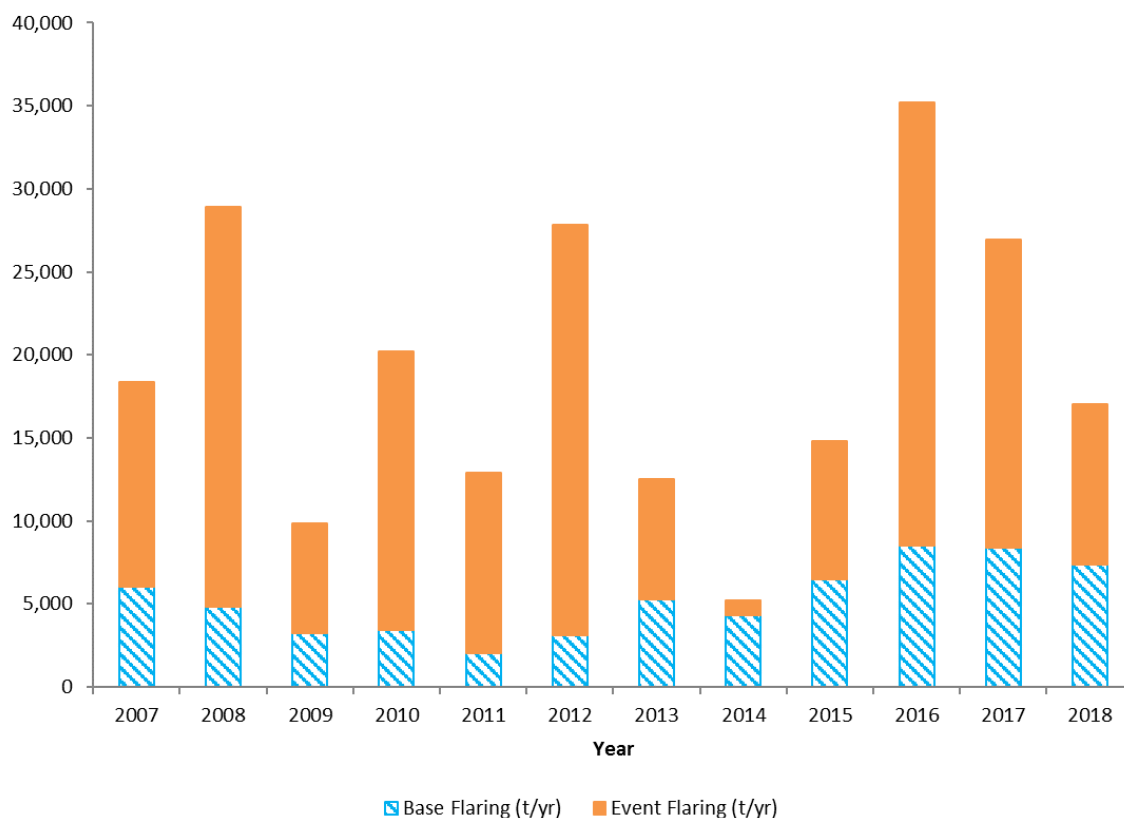


Figure 3: Total event and base flaring quantities (tonnes) annually at the ExxonMobil FEP between 2007 and 2018

Whilst the ExxonMobil data extends back to 1995 (Figure 1), Shell flaring data is only available from 2005 (Figure 2). Pre-2007 flaring data is not included in Figure 3 as the metering system used was different to that used from 2007 onwards and so would not allow for a similar comparison.

3.4 WHY DID SEPA ISSUE FINAL WARNING LETTERS TO EXXONMOBIL AND SHELL IN 2018?

Final Warning Letters were served on both companies by SEPA in April 2018 relating to the unplanned flaring incidents during June 2017⁷. This was the result of SEPA's investigation that identified that both Shell and ExxonMobil had breached a condition of their PPC permit relating to smoke from flaring, as a result of lack of available steam. In addition, ExxonMobil failed to implement BAT with respect to management and maintenance which could have reduced the emissions from the installation.

⁷ https://www.sepa.org.uk/media/351882/fwl-2018-1610-exxonmobil-chemical-limited-18_04-24-sent-r.pdf, <https://www.sepa.org.uk/media/351883/fwl-2018-1609-shell-uk-limited-r.pdf>

3.5 WHAT ARE THE REVIEW GROUP'S COMMENTS AND RECOMMENDATIONS (WHERE RELEVANT)?

For both facilities, there are no obvious trends towards more or less flaring events over time. The total quantities of gas flared in 2018 at the ExxonMobil and Shell facilities were lower than in 2017.

The Review Group is aware that a joint ExxonMobil and Shell BAT study was undertaken following the investigation of the 2017 unplanned flaring events and was reported in 2019^{8,9}. This study covered the combined operations of the Mossmorran complex to provide the following information:

- A review of globally available flaring technology, assessing similar facilities, regulatory agencies, industry organisations and flare equipment vendors;
- An assessment of the current Mossmorran complex flare systems.

A number of improvements were identified by Shell and are being progressed including:

- Ground flare upgrades to improve operability and reliability.
- Feasibility study to upgrade steam control on the elevated flare.
- Plans to install another new elevated flare tip to reduce noise and improve combustion efficiency.

ExxonMobil also identified a number of improvements, which are detailed in Table 4, along with their target dates.

Table 4: Summary of improvements identified by ExxonMobil and target dates for completion

BAT Aspect	Action	Target Date
Use of Ground Flares	Continue targeted noise monitoring per agreed action plan with Specialist Consultant	Ongoing as Required
Prevent/minimise flaring	Update start-up procedures to add specificity to rate/speed of start-up progression for key equipment (C-R-51, PGC, C-T-51/52 etc.)	31-Dec-19
Prevent/minimise flaring	Apply new technology and conduct trial to improve and sustain cold flare vaporiser performance	31-Dec-19
Prevent/minimise flaring	Develop and implement a post-safepark flare minimisation procedure including associated training and implementation reviews	31-Dec-19

⁸ Fife Ethylene Plant Flaring BAT Evaluation. 30th April 2019. <https://publicregister.sepa.org.uk/Weblink/0/doc/2532407/Page1.aspx>

⁹ Flaring implementation plan for the Fife NGL plant 30th April 2019. <https://publicregister.sepa.org.uk/Weblink/0/doc/2532439/Page1.aspx>

BAT Aspect	Action	Target Date
Prevent/ minimise flaring	Conduct a technical review of R-C-01 and R-C-02 surge margins to determine minimum operating points. Implement if appropriate.	31-Dec-19
Prevent/ minimise flaring	Install jumpover line from demethaniser bottoms line to reboiler inlet line to reduce reboiler start-up time	31-Dec-20
Prevent/ minimise flaring	Undertake test of utilising H2 supply to reduce converter start-up to determine effectiveness	31-Dec-20
Flare design	Replace elevated flare tip technology with best-available at the next feasible opportunity	31-Dec-20
Prevent/ minimise flaring	Implement sustainable training program using cold end console dynamic simulator	31-Dec-21
Prevent/ minimise flaring	Pursue existing Steam Team strategy including targeted 2020 repair program to increase leak responsiveness	31-Dec-22
Prevent/ minimise flaring	Conduct technical review to determine requirements for reinstating boiler air preheaters	31-Dec-22
Prevent/ minimise flaring	Conduct technical review to determine feasibility of re-routing PGC discharge to fuel	31-Dec-23
Prevent/ minimise flaring	Conduct technical review to determine feasibility of re-routing ejector from Q-T-01 overheads to fuel	31-Dec-23
Flare design	Increase capacity of, and accessibility to, ground flare technology that minimises amenity impact	31-Dec-24

The Review Group will continue to engage with the sites to establish how the implementation of the identified improvements is progressing, as well as the impact that these may have on air quality. The Review Group will make recommendations where appropriate and within their remit.

4 EMISSIONS DATA

4.1 WHAT ARE THE EMISSION DATA RESULTS FOR 2018?

The emissions monitoring measurements for 2018 submitted to SEPA are summarised for each regulated Shell and ExxonMobil source at Mossmorran in Tables 5-7. The ELVs set by SEPA for each emission source, are also shown. Smoke (or soot) occurs when there is incomplete combustion (not enough oxygen to burn the fuel completely). During complete combustion, everything is burned, producing just water and carbon dioxide. When incomplete combustion occurs, not everything is burned. Smoke is a collection of these tiny unburned particles. Smoke has regulated consent limits during normal operation at the Mossmorran complex. This is commonly measured as 'particulate matter' and results for these emissions tests are summarised in Table 7.

Table 5: Emissions from Regulated Sources at Shell FNGL plant during 2018 (mg/m³ at 3% O₂, 273K Dry)

Furnace	CO Concentration (mg/m ³)				NO _x Concentration (mg/m ³)				SO ₂ Concentration (mg/m ³)			
	ELV	Mean	Max.	Min.	ELV	Mean	Max.	Min.	ELV	Mean	Max.	Min.
1	100	<6	<6	<6	150	105.0	118.0	83.0	10	<10	<10	<10
2	100	<6	<6	<6	150	114.2	142.6	92.0	10	<10	<10	<10
3	100	<6	<6	<6	150	117.1	148.8	99.2	10	<10	<10	<10

Table 6: Emissions from Regulated Sources at ExxonMobil Mossmorran during 2018 (mg/m³ at 3% O₂, 273K Dry) from Furnaces 1-7 and Gas Turbine Exhaust Stack

Furnace	CO Concentration (mg/m ³)*			NO _x Concentration as NO ₂ (mg/m ³)**			SO ₂ Concentration (mg/m ³)*		
	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.
1	0.1	0.2	0.0	265.7	298.0	217.1	0.0	0.0	0.0
2	13.1	16.7	9.9	219.3	247.8	196.3	0.3	1.2	0.0
3	23.4	82.2	0.0	227.1	244.9	194.6	0.0	0.0	0.0
4	84.6	276.0	0.0	223.7	256.2	201.3	0.0	0.0	0.0
5	0.4	1.5	0.0	234.2	255.3	208.8	0.2	1.0	0.0
6	0.8	1.3	0.0	257.3	333.2	195.5	0.0	0.0	0.0
7	0.0	0.0	0.0	263.4	320.2	207.0	0.4	1.5	0.0
Gas Turbine Stack	0.8	2.0	0.0	372.2	389.6	324.7	0.0	0.0	0.0

*No limit: no emission limit applied by SEPA

** Authorised PPP Emissions Limit is 350 mg/m³ for the furnaces and 550 mg/m³ for the gas turbine stack

Table 7: Emissions from Regulated ExxonMobil Sources at Mossmorran during 2018 –Measured NOx, SOx and CO Values (mg/m³ @ 3% O₂, 273K Dry) from Boiler stacks A, B and C.

Boiler	CO Concentration (mg/m ³)		NOx Concentration as NO ₂ (mg/m ³)			SOx Concentration (mg/m ³)			PM ₁₀ Concentration (mg/m ³)		
	Authorised PPC Emissions Limit	Result	Authorised PPC/LCPD Emissions Limit	LCPD fuel weighted consent	Result	Authorised PPC/LCPD Emissions Limit	LCPD fuel weighted consent	Result	Authorised PPC/LCPD Emissions Limit	LCPD fuel weighted consent	Result
A	200	0.8	Limit is fuel weighted (450 on liquid fuel, 300 on gas)	300.0	187.1	Limit is fuel weighted (350 on liquid fuel, 35 on gas).	35.0	0.7	Limit is fuel weighted (50 on liquid fuel, 5 on gas).	5.0	2.2
		0.3			202.6			0.8			0.6
B	200	2.1		416.3	108.4		279.2	90.1		39.9	3.3
		1.2		308.6	169.8		63.1	0.5		7.6	0.5
C	200	7.1		365.6	140.8		172.7	29.8		24.7	13.3
		0.7		300.0	157.0		35.0	0.1		5.0	4.3

4.2 WHAT ARE THE REVIEW GROUP'S COMMENTS AND RECOMMENDATIONS (WHERE RELEVANT)?

Monitoring by ExxonMobil of their boiler and flare stacks is being carried out in a manner to provide additional information to support a BAT assessment.

In 2018 all the emission monitoring results, including particulate emissions, were within the limits set by SEPA.

The Review Group is aware that a number of flaring technology improvements were identified following the joint BAT study and will assess the impact that these may have on air quality when implemented and provide any recommendations (where relevant).

5 AIR QUALITY

5.1 WHAT ARE THE RESULTS OF THE AIR QUALITY DATA TYPICALLY REVIEWED BY THE REVIEW GROUP FOR 2018?

Fife Council's Air Quality team did not identify any new issues in the vicinity of Mossmorran or Braefoot Bay in their 2019 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 NO₂ and particulates (as PM₁₀). This report is to be submitted to the relevant Council Committee for approval later in 2019 and following this will be published on the Fife Council website at www.fifedirect.org.uk/airquality.

INEOS FPS Ltd. commissioned NPL to monitor the ambient air hydrocarbon levels at 12 locations on the Forth Estuary coastline during 2018 (5th January 2018 to 3rd January 2019). Nine locations on the Estuary North shore between North Queensferry and West Wemyss (including four locations between Dalgety Bay and Burntisland) were used, and three locations on the Estuary South shore between South Queensferry and Whitehouse Point were used.

The ambient air samples were collected over two-week periods using passive diffusive tubes. These samples were analysed for iso-butane, n-butane, iso-pentane, n-pentane, n-hexane, n-heptane, benzene, toluene, xylene and total hydrocarbons (C4-C10). These hydrocarbons may be emitted from a variety of sources around the Forth Estuary including INEOS operations at Hound Point Terminal, road traffic, and a range of other industrial sites.

The results of this monitoring were reported by INEOS to indicate that the average concentrations of benzene over the 12-month period were low with the annual means at each location ranging from 0.1 to 0.4 parts per billion volume to volume (ppb v/v). This is below the current annual Air Quality (Scotland) Strategy objective of 1 ppb v/v¹⁰.

The concentrations of other hydrocarbons were also low, but there are no Air Quality (Scotland) Strategy objectives for these substances.

- The substance present in the greatest concentrations at most locations was n-butane for which annual mean concentrations ranged from 1.9 to 14.5 ppb v/v.
- The annual mean concentrations of other individual substances ranged from <0.3 to 6.6 ppb v/v.
- The annual mean concentrations of total hydrocarbons (C4 to C10) at different locations ranged from 7 to 33 ppb v/v.

¹⁰ <http://www.scottishairquality.scot/air-quality/standards>

INEOS FPS Ltd., and the previous Hound Point Terminal operator, have commissioned monitoring along the Forth Estuary coastline for many years and they have advised that there has been an overall reduction in the levels of hydrocarbons, including benzene, present in the ambient air over the last decade. The concentrations at any one locality are highly dependent on the weather. The measurements made in 2018 indicate that concentrations of most of the monitored substances were very similar to those measured in 2017 at most of the locations.

5.2 SEPA AIR QUALITY MONITORING IN 2019 – WHAT DID THEY DO AND WHAT WERE THE RESULTS?

In response to community concerns, SEPA assessed the air quality near the Mossmorran complex for a 3-month period between 10 January to 18 April 2019. Their full ¹¹ and summary reports are publically available ¹².

In brief, the monitoring undertaken and their locations are summarised in Figure 4.

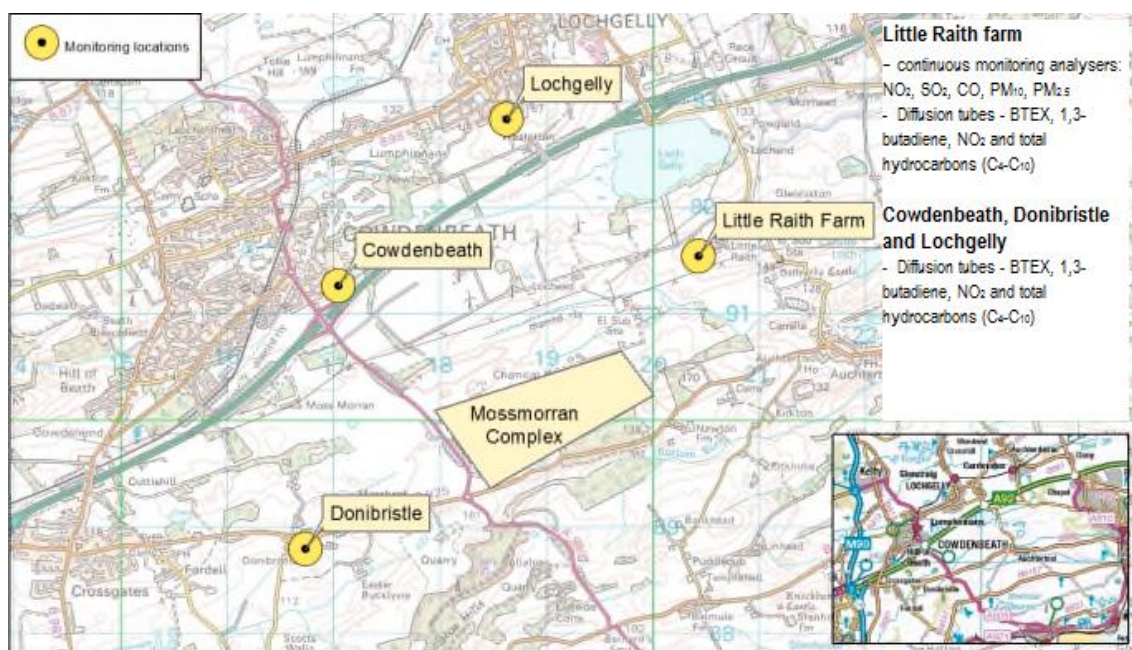


Figure 4: Monitoring locations during January – April 2019 SEPA air quality measurements (annotated Figure 3 from SEPA (2019))

A trailer containing continuous air quality monitoring analysers was located at Little Raith Farm, which measured NO₂, SO₂, CO and PM₁₀ and PM_{2.5}. Diffusion tubes were located at Little Raith Farm and community locations in

¹¹ <https://www.sepa.org.uk/media/475334/air-quality-monitoring-mossmorran-january-april-2019.pdf>

¹² <https://www.sepa.org.uk/media/475347/air-quality-monitoring-summary-report-mossmorran-january-april-2019.pdf>

Cowdenbeath, Donibristle and Lochgelly to determine the levels of benzene, toluene, ethylbenzene, xylene (collectively known as BTEX), 1,3 butadiene, NO₂ and total hydrocarbons (C₄ to C₁₀).

The air quality objectives relate to air quality monitored over the period of a year, partly to account for the seasonal variation in winds. Wind speed and direction was also continuously monitored over the measurement period at Little Raith farm.

During the monitoring period, activities at the Mossmorran site were reported to be normal, with a single unplanned flaring event occurring on 27 January 2019.

Air quality objectives are applicable to air quality monitoring undertaken over a period of a year. This particular monitoring study took place over a period of 3 months. The wind conditions during the monitoring period were found to be representative of the general wind patterns in the area, thus strengthening the comparison between the measured data and the air quality objectives.

In summary, SEPA reported that there were no breaches of any of the air quality objectives and all measurements were in the low band of Defra's DAQI for all applicable pollutants, with the exception of PM₁₀ and PM_{2.5} which were in the moderate DAQI band on the 27 February 2019. SEPA reported that this coincided with a period of elevated PM across Scotland, probably caused by long-range transport of pollution.

5.3 HAS THERE BEEN ANY AIR QUALITY MONITORING UNDERTAKEN DURING FLARING EVENTS?

No routine air quality monitoring is undertaken during flaring events. SEPA responded to two flaring events during 2018 (23 March and 20 May 2018). Equipment failure prevented the collection of data during the first event. SEPA advised that during the second event all measurements were in the low band of the DAQI for all applicable pollutants during the monitoring period.

A single unplanned flaring event occurred on 27 January 2019 during the SEPA air quality 3-month monitoring period. This was reported to result in a higher than normal ground flaring rate for a period of 45 minutes and a concurrent period of elevated flaring which lasted around 29 minutes. There were no breaches of any of the air quality objectives and all measurements were in the low band of the DAQI for all applicable pollutants on this and the immediate days thereafter the flaring event.

During 2019, Wood. reported an investigation into how flaring at the FEP and FNGL plants might impact local air quality. This study used dispersion modelling and calculated associated emissions for two scenarios:

1. Assessment of impacts during normal operation at FEP

2. Assessment of the impacts during a worst case hypothetical scenario that would never occur, this being during a process gas compressor trip assuming flaring occurs at the instantaneous peak rate of 300T/H continuously with no steam assist resulting in black smoke over the course of 1 year

These emissions were compared against the international Air Quality Objectives. In their study, they concluded that, when assuming a worst-case scenario, it is highly unlikely for FEP to impact the local air quality of people in Fife. Based on the worst-case scenario investigation conditions and the low levels found, they conclude that there does not appear to be any scientific merit in undertaking further studies, such as air quality monitoring and that it would be difficult for monitoring equipment to detect many of the values predicted to occur at ground level from the flare emissions.

5.4 WHAT IMPACT DO WIND FARMS HAVE ON AIR QUALITY?

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. 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.

As part of their commissioned work Wood. undertook a modelling study to assess the potential effects of wind turbines on the dispersion of PM₁₀ emissions from FEP. This study considered the 9 turbines at Little Raith Farm and also four others (Mossmorran 1, Mossmorran 2, Goat Hill Quarry and Kirton Farm). In order to assess how the wind turbines may affect emissions from FEP, two models were created; one with the wind turbines included and one with them excluded. The models showed that the maximum predicted annual PM₁₀ process contributions from FEP were 6% higher when wind turbines were included however, there was negligible difference in the maximum predicted 24-hour process contribution was considered. Overall, the findings of this recent programme of work were largely consistent with the conclusion with the previous monitoring survey

5.5 WHAT ARE THE REVIEW GROUPS COMMENTS AND RECOMMENDATIONS (WHERE RELEVANT)?

The Review Group considers that the measurement campaign undertaken by SEPA during January – April 2019 was robust, using recognised sampling, analysis and quality control methodologies.

The Review Group considers that the higher PM₁₀ and PM_{2.5} reported on the 27 February 2019 are highly unlikely to be due to activities at the Mossmorran complex.

The Review Group considers that the results of the SEPA measurement campaign provide good robust background data that can be used for historical or future comparisons.

The Review Group considers that the dispersion modelling study reported by Wood is robust and supports their conclusion that, when assuming a worst-case scenario, it is highly unlikely for FEP to impact the local air quality of people in Fife.

The Review Group considers that the wind farm at Little Raith Farm has no negative impact on the dispersion of air emissions from Mossmorran.

6 HEALTH EFFECTS

6.1 WHAT ARE THE HEALTH EFFECTS ASSOCIATED WITH THE MEASURED POLLUTANTS?

Information on the potential health effects associated with these pollutants has been taken from the Air Quality in Scotland website, <http://www.scottishairquality.scot/air-quality/pollutants>.

Fine particles can be carried deep into the lungs where they can cause inflammation and a worsening of the condition of people with heart and lung diseases. In addition, they may carry surface-absorbed carcinogenic compounds into the lungs.

Possible chronic health effects of benzene include cancer, central nervous system disorders, liver and kidney damage, reproductive disorders, and birth defects.

NO is not considered to be harmful to health. However, once released to the atmosphere, NO is usually very rapidly oxidised to nitrogen dioxide (NO₂), which is harmful to health. NO₂ can irritate the lungs and lower resistance to respiratory infections such as influenza. Continued or frequent exposure to concentrations that are typically much higher than those normally found in the ambient air may cause increased incidence of acute respiratory illness in children.

Moderate concentrations of SO₂ may result in a fall in lung function in asthmatics. Tightness in the chest and coughing occur at high levels, and lung function of asthmatics may be impaired to the extent that medical help is required. SO₂ pollution is considered more harmful when particulate and other pollution concentrations are high.

CO prevents the normal transport of oxygen by the blood. This can lead to a significant reduction in the supply of oxygen to the heart, particularly in people suffering from heart disease.

6.2 ARE PEOPLE LIVING NEAR THE FACILITIES EXPERIENCING ADVERSE HEALTH EFFECTS RELATING TO THEIR AIR QUALITY?

NHS Fife are aware of concerns, expressed to SEPA by members of the public, about disturbing amounts of noise, bright light and occasional black smoke during flaring activity. These are associated by some of those people with sleep disturbance, headaches, breathing difficulty, anxiety and generally reduced well-being at those times.

However, NHS Fife has not received reports from health professionals of adverse community health effects attributed to either the normal operation of the Mossmorran plant or unplanned flaring events there. In particular, NHS Fife have no new evidence on cancer incidence or mortality beyond that

detailed in previous reports. These have consistently found cancer rates to be in line with expected rates after taking account of deprivation as measured by the Scottish Index of Multiple Deprivation¹³.

6.3 WHAT ARE THE REVIEW GROUP'S COMMENTS AND RECOMMENDATIONS (WHERE RELEVANT)?

The Review Group understands through their discussions with stakeholders, that communities have concerns that their health may be adversely affected by the plant operations and flaring events.

Past community health concerns in the Mossmorran area have often focussed on cancer. In response to concerns about cancer clusters, NHS Fife have looked at cancer incidence on several occasions in the recent past. Each time, no evidence was found of cancer rates in the Mossmorran area that differ significantly from those elsewhere in Fife or Scotland, once the socio-economic profile of the areas is taken into account.

NHS Fife is working with national agencies to explore methodologies that could be used to look at past trends and current data relating to health concerns that have been raised in the areas surrounding Mossmorran.

¹³ For all cancers combined, the most deprived areas have incidence rates that are almost a third higher than the least deprived areas. <https://www.isdscotland.org/Health-Topics/Cancer/Publications/2019-04-30/2019-04-30-Cancer-Incidence-Report.pdf> (accessed 29/07/2019)

7 SUBSTANTIVE CHANGES IN THE FACILITIES THAT MAY IMPACT ON LOCAL AIR QUALITY

7.1 WHAT CHANGES HAVE BEEN REPORTED BY THE FACILITIES THAT COULD IMPACT ON LOCAL AIR QUALITY?

There were no major changes to the ExxonMobil FEP or Shell plants during 2018 that would be anticipated to adversely affect local air quality.

7.2 WHAT ARE THE REVIEW GROUPS COMMENTS AND RECOMMENDATIONS (WHERE RELEVANT)?

The Review Group will continue to outline any substantive changes in the facilities at Mossmorran and Braefoot Bay and their likely impact on local air quality.

8 CONCLUSIONS

The work undertaken in 2018 demonstrates that, based on the available data, 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). The 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

This Appendix contains information provided by Fife Council, membership as at December 2018.

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, 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)
<u>B. BY INVITATION</u>		
Norman White	Shell UK Limited	Fife NGL Plant, Mossmorran
Teresa Waddington	Shell UK Limited	Fife NGL Plant, Mossmorran
John Raine	Shell UK Limited	Fife NGL Plant, Mossmorran
Ben Lindsay	Shell UK Limited	Aberdeen
Isabel Matson	Shell UK Limited	Fife NGL Plant, Mossmorran
Jan Prentice	Shell UK Limited	Fife NGL Plant, Mossmorran
Kylie Bishop	Exxon Mobil Chemical Limited	Fife Ethylene Plant, Mossmorran
Gillian Doel	Exxon Mobil Chemical Limited	Fife Ethylene Plant, Mossmorran
Catherine Cubitt	Exxon Mobil Chemical Limited	Fife Ethylene Plant, Mossmorran

Name	Designation/ Representing	Address
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 Backhouse	Burrtisland, Kinghorn and Western Kirkcaldy Ward	Fife House, Glenrothes
CLlr Gordon Langlands	Burrtisland, Kinghorn and Western Kirkcaldy Ward	Fife House, Glenrothes
CLlr Kathleen Leslie	Burrtisland, 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 Lesley Laird	Inverkeithing and Dalgety Bay 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 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	Burrtisland Community Council	Burrtisland
David A. Taylor	Cardenden & Kinglassie Community Council	Cardenden
Secretary Cowdenbeath Community Council c/o Brunton House	Cowdenbeath Community Council	Cowdenbeath

Name	Designation/ Representing	Address
Cowdenbeath		
Paul Vincent	Dalgety Bay & Hillend Community Council	Dalgety Bay
Steven Murray	Lochgelly Community Council	Lochgelly
Amelia Howie	Lumphinnans Community Council	Lumphinnans