

15 June 2021

# **Mossmorran & Braefoot Bay Independent Air Quality Monitoring Review Group**

2019 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.

Related URLs:

Fife Council Air Quality

<https://www.fife.gov.uk/kb/docs/articles/environment2/environmental-health/air-quality#6009-accordion7>

Scottish Environment Protection Agency (SEPA) Mossmorran Website

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

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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, which are named the Shell Fife Natural Gas Liquids (FNGL) and the ExxonMobil Fife Ethylene Plant (FEP) in this report. The Review Group reviews air quality data collected from a number of sources, and considers 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 2019, there were a number of flaring events, as well as equipment failures resulting in the ExxonMobil plant needing to be shut down from August 2019 until the beginning of 2020. In addition, both plants continue to progress towards achieving Best Available Techniques (BAT) based on previous assessments.

Flaring is undertaken to protect the plant safety during planned and unplanned maintenance work. The overall quantities flared at both Mossmorran plants were higher in 2019 than in previous years, although, at Shell FNGL, this applies only to the ground flares. With the ExxonMobil FEP shut down from August, between the 15th August and 18th September FEP was off-line but was still receiving ethane and therefore this excess amount had to be flared. From 18th September onwards the Fife NGL ground flares were in use to burn a smaller than usual volume of ethane arriving at the plant. Shell took measures to lower the amount of ethane piped to Mossmorran by managing North Sea gas volumes carefully and sending as much ethane as permitted to the National Grid at the St Fergus gas plant near Peterhead.

Concentrations of hydrocarbon pollutants in air monitored along the Fife coastline by INEOS were below air quality standards for relevant hydrocarbons 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 for 2019 were identified in Fife Council's 2020 Air Quality Annual Progress Report. Air quality monitoring by SEPA was done January to April 2019 and then again from August 2019 to March 2020, as well as around several flaring incidents between the two monitoring periods. Monitoring found all measurements were in the low band of Defra's Daily Air Quality Index. The monitoring sites were chosen to reflect levels experienced by the surrounding communities, and included a downwind site, expected to represent the most impacted direction from the Mossmorran Complex. A study commissioned by ExxonMobil by Wood PLC estimates that emission from elevated

flaring are unlikely to result in levels of air pollution that exceed air quality objectives in nearby communities, even under 'worst-case' scenario estimates, due to the stack height and the way emitted pollutants then disperse through the atmosphere.

Overall, the Review Group concluded that, based on the available data reviewed in 2019, emissions from the Shell and ExxonMobil plants at Mossmorran and Braefoot Bay continue to pose no significant risk from air pollution to the health of members of the local community. The supplementary monitoring around the Mossmorran site conducted by SEPA was agreed upon by the Review group. No data gaps which would change the conclusions regarding air quality and health impacts locally have been found. The group recommends that Fife Council's air quality network continue to be examined with respect to any events at the Mossmorran Complex. In response to community concerns around air quality, there should be consideration as to what further actions may be taken, including engagement activities, communications material, and further monitoring if deemed appropriate in response to concerns.

# 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 Council<sup>1</sup> 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. Shell and ExxonMobil representatives are invited to attend Review Group meetings as guests. Review Group members are appointed by Fife Council (Table 1-1). In 2019, Prof. Wilson Sibbett retired from the position of Chair.

*Table 1-1: 2019 Review Group Members*

<b>Name</b>	<b>Organisation</b>
Prof. Wilson Sibbett	University of St. Andrews
Mary Stewart	Major Business & Customer Service Fife Council
Kenny Bisset	Fife Council (Protective Services)
Dr Karen Galea <sup>2</sup>	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

<sup>1</sup> Formerly Fife Regional Council and Dunfermline and Kirkcaldy District Councils

<sup>2</sup> Dr Galea was part of 2019 Review Group, however this report was prepared by Dr Miranda Loh, who has taken Dr Galea's place as of 2020.

Full details of the constitution and terms of reference of the review group are 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. This includes the cost of time spent by IOM to review data and other information and IOM's activities related to producing the report and varies from year to year.

### **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 possible emissions from the plants
- Comment on the emissions from the facilities
- Summarise the available data on flaring during 2019
- Review other information about local air quality, including monitoring data from the area
- Continue to review the potential impact of installed and planned wind turbines in the vicinity of the Mossmorran site on pollutant dispersion.
- Detail any advice and/or recommendations the group proposes

A summary of relevant ongoing initiatives and plant updates that have occurred are also included.

### **1.5 HOW DOES THE REVIEW GROUP UNDERTAKE THEIR ROLE?**

The constitution and terms of reference (Appendix 2) 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. Minutes are taken at each Review Group meeting, with copies of these being publically available on the Fife Council website ([www.fife.gov.uk](http://www.fife.gov.uk)).

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 2019?

Table 1-2 provides details of when the Review Group formally met during the calendar year 2019.

*Table 1-2: Schedule of meetings in 2019*

<b>Meeting</b>	<b>Date(s)</b>
Mossmorran and Braefoot May independent air quality review group	19 July 2019
Mossmorran Working Group	11 October 2019
Mossmorran and Braefoot Bay Community & Safety Liaison Committee	14 March 2019 13 June 2019 12 September 2019

## 2 AIR QUALITY INDICATORS REVIEWED

### 2.1 WHAT ARE THE POLLUTANTS REVIEWED?

A number of air pollutants are reviewed and these are detailed below. For more information on air pollutants, please see <http://www.scottishairquality.scot/air-quality/pollutants>.

*Particulate Matter (PM)*: is the term used to describe solid or liquid particles suspended in the atmosphere<sup>3</sup>. Particle size determines how deep a particle can penetrate into the lungs. Some ultrafine particles (particles with aerodynamic diameter <100 nm) may pass into the blood stream from the lungs. The aerodynamic diameter refers to the diameter of particles if they were a perfect sphere. Particles can be generated mechanically (e.g. dust from vehicle tyres driving over roads), through combustion (e.g. burning wood or fuel) or through chemical reactions. Particles may also be made up of or carry substances which can affect health.

- *PM<sub>10</sub>*: This is particulate matter with a diameter of less than 10 µm. PM<sub>10</sub> are defined by international convention as being able to be deposited in the lung. Because it has the potential to cause effects on health, it is regulated in the UK and must meet a certain level. There are many sources, including road traffic, agriculture, industry and personal activities.
- *PM<sub>2.5</sub>*: This is particulate matter with an aerodynamic diameter of less than 2.5 µm. These particles can penetrate even deeper into the lung than PM<sub>10</sub>. This is also sometimes called 'fine particulate matter' and has been associated with various health impacts, especially with regards to lung and heart health. Fine particles 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. There are many sources, including road traffic, agriculture, industry and personal activities.
- *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, especially in cities. Nitric oxide always occurs when NO<sub>2</sub> is formed. The two gases together are known as oxides of nitrogen, sometimes described in shorthand form as NO<sub>x</sub>. NO<sub>2</sub> may have adverse effects on the health of the lung for some people. NO<sub>2</sub> 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.
- *Carbon monoxide (CO)*: This is a colourless, odourless gas produced by incomplete, or inefficient, combustion of fuel. It is predominantly produced by road transport, in particular petrol-engine vehicles. CO prevents the normal transport of oxygen by the blood. CO prevents the normal transport of

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<sup>3</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>

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.

- *Sulphur Oxides (SO<sub>x</sub>)*: Sulphur dioxide (SO<sub>2</sub>) is produced when a material, or fuel, containing sulphur is burned. In the UK, the predominant source of SO<sub>2</sub> is power stations burning fossil fuels, principally coal and heavy oils. Widespread domestic use of coal can also lead to high local concentrations of SO<sub>2</sub>. SO<sub>2</sub> can cause irritation to the lungs and mucous membranes. Moderate concentrations of SO<sub>2</sub> 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. SO<sub>2</sub> pollution is considered more harmful when particulate and other pollution concentrations are high.
- *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. Benzene is a carcinogen, and air quality objectives are established to minimise this risk. Possible chronic health effects of benzene include cancer, central nervous system disorders, liver and kidney damage, reproductive disorders, and birth defects.
- *VOCs or volatile organic compounds*: Carbon-based (or organic) chemicals that readily evaporate. Many hydrocarbons, including benzene, butane, pentane and hexane are VOCs. Different VOCs are associated with different health effects.

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>.

Table 2-1: Air quality standards in Scotland (from <http://www.scottishairquality.scot/air-quality/standards>)

<b>Pollutant</b>	<b>Limit concentration</b>	<b>Type of value</b>
PM <sub>10</sub>	50 µg m <sup>-3</sup> (not to be exceeded more than 35 times a year)	24 hour mean
	18 µg m <sup>-3</sup>	Annual mean
PM <sub>2.5</sub>	10 µg m <sup>-3</sup>	Annual mean
Nitrogen dioxide (NO <sub>2</sub> )	200 µg m <sup>-3</sup> (not to be exceeded more than 18 times a year)	1 hour mean
	40 µg m <sup>-3</sup>	Annual mean
Carbon monoxide (CO)	10 mg m <sup>-3</sup>	Running 8 hour mean
Sulphur dioxide (SO <sub>2</sub> )	350 µg m <sup>-3</sup> , not to be exceeded more than 24 times a year	1 hour mean
	125 µg m <sup>-3</sup> , not to be exceeded more than 3 times a year	24 hour mean
	266 µg m <sup>-3</sup> , not to be exceeded more than 35 times a year	15 minute mean
Benzene	3.25 µg m <sup>-3</sup>	Running annual mean
1,3-Butadiene	2.25 µg m <sup>-3</sup>	Running annual mean
VOCs	No specific limit	

DEFRA (Department of Food, Environment and Rural Affairs) has developed a daily air quality index (DAQI) as a way of communicating the level of health concern of the air pollution measured each day. The index is numbered 1-10 and divided into four bands, low (1-3), moderate (4-6), high (7-9), 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 2-2 provides a summary of the data typically considered and the providers of this information for the 2019 Annual Report.

*Table 2-2: Source of information considered by the Review Group*

<b>Data considered</b>	<b>Data provider</b>
Carbon monoxide (CO) emissions	Shell and ExxonMobil
Sulphur oxides (SO <sub>x</sub> ) emissions	Shell and ExxonMobil
Nitrogen oxides (NO <sub>x</sub> ) emissions	Shell and ExxonMobil
PM <sub>10</sub> 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
Air pollution monitoring	SEPA

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 considered<sup>4</sup>. The report provides the results of NO<sub>2</sub> monitoring undertaken at four automatic stations in Cupar, Kirkcaldy, Dunfermline and Rosyth and non-automatic monitoring using diffusion tubes at 62 sites. Any air quality management areas identified (i.e. areas where action was identified as needing to take place due to exceedances of air quality standards) were attributed to traffic-related pollution. Pollution from road vehicle emissions is the key air quality issue in Fife, with Nitrogen Dioxide (NO<sub>2</sub>) and Particulate Matter (PM<sub>10</sub> & PM<sub>2.5</sub>) being the pollutants of concern. To date the review and assessment process has identified two air quality management areas (AQMA) in the Fife area, one at Bonnygate, Cupar and the other in Appin Crescent, Dunfermline, where the relevant air quality objectives had been identified at risk of being exceeded.

In addition, during 2019 other activities took place which are included in this 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.

<sup>4</sup> <https://www.fifedirect.org.uk>

- Wood PLC 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-line<sup>5</sup>. A representative of Wood PLC attended a meeting (30 July 2019) to answer questions and to allow the Review group to assure themselves of the technical content of this report.

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

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

Ozone (O<sub>3</sub>) is not emitted directly from any man-made source in any significant quantities. In the lower atmosphere, O<sub>3</sub> 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<sub>x</sub>). 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<sub>x</sub> 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 diseases<sup>6</sup>.

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 as it is unlikely that emissions of NO<sub>x</sub> and VOCs arising from the operations at the Mossmorran plants and the Braefoot Bay terminal facilities would contribute to formation of ozone in the local area. Rather, ozone formation is more likely to be related to emissions from areas further away.

### **2.4 WHO HAS A REGULATORY ROLE IN RELATION TO THE MOSSMORRAN AND BRAEFOOT BAY FACILITIES?**

The Mossmorran Complex and the Braefoot Bay Marine Terminal need to comply with a number of regulations which cover emissions that might affect air quality.

#### **Pollution Prevention and Control (Scotland) Regulations 2012 ('the PPC Regulations')**

Both sites at the Mossmorran Complex and ExxonMobil at Braefoot Bay are permitted by SEPA under the Pollution Prevention and Control (Scotland) Regulations 2012 ('the PPC Regulations').

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.

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<sup>5</sup> Wood (2019) Air quality assessment of flaring activities at Fife Ethylene Plant: non-technical summary <https://www.exxonmobil.co.uk/-/media/UnitedKingdom/Files/Fife/Environmental-Docs/WOOD-Report.pdf?la=en-GB&hash=BC5FF8CC05DBF226AD3E100235B4DBBBFD396171>

<sup>6</sup> <http://www.scottishairquality.scot/air-quality/pollutants#ozone>

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 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.

### **Control of Major Accident Hazard Regulations 2015 (the COMAH Regulations)**

The Control of Major Accident Hazard Regulations 2015 (the COMAH Regulations) are regulated jointly by the Health and Safety Executive (HSE) and SEPA as the Competent Authority.

### **Local Air Quality**

Fife Council is required by Part IV of the Environment Act (1995) and the relevant Policy and Technical Guidance documents to undertake a review and assessment of local air quality in their area to ensure prescribed air quality objectives and standards for Scotland<sup>7</sup> are not being exceeded.

### **Statutory nuisance**

Fife Council is responsible for regulating statutory nuisance, including light (in practice, for odour and noise, where these are not covered by permit conditions enforced and issued by SEPA).

SEPA, Fife Council, NHS Fife and Public Health Scotland meet regularly and keep each other informed on what is happening at Mossmorran and share the results of air quality monitoring, including running joint working groups when required. This:

- Supports Fife Council Local Air Quality Reviews;
- Combined with sharing information on community health concerns, allows NHS Fife to assess and report on the health impacts of flaring.

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<sup>7</sup><https://www.legislation.gov.uk/ukpga/1995/25/part/IV>  
<http://www.scottishairquality.scot/air-quality/standards>

## **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 one 80 metre high flare stack with up to three flare tips 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 CO<sub>2</sub> 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 2019?**

In 2019, the ExxonMobil plant experienced boiler failure resulting in the need to close plant operations for an extended period of time, from August 2019 until January 2020. A planned maintenance event occurred in July requiring flaring. Three process upset events (January, April, June) and a plant shutdown in August resulted in unplanned flaring. There was a prolonged period of ground flaring from production at the Fife Natural Gas Liquids (Fife NGL) plant during a temporary shutdown of the neighbouring Fife Ethylene Plant (FEP) from August 2019 (see Table 3-1 and Figure 2: Total quantities (tonnes) flared annually at Shell FNGL). While FEP was not available to take ethane feedstock from Fife NGL as it normally does, it was necessary to flare a proportion of product that could not be re-directed elsewhere. Table 3-1 and Table 3-2 provide details of the quantities flared (tonnes) during 2019 at the two Mossmorran facilities. In January 2020, the ExxonMobil plant began a restart process, which resulted in ground and elevated flaring at various times until February 2020.

Table 3-1: Quantities flared by Shell FNG in 2019

Month	Shell FNGL (tonnes)			Total
	Ground flaring	Elevated flaring	Purge & Pilot (Ground & Elevated flares)	
January	-	12	244	256
February	-	53	255	308
March	-	39	247	286
April	-	18	236	254
May	-	30	243	273
June	-	87	231	318
July	-	37	244	281
August	0	64	226	290
September	6,015*	22	232	6,271
October	14,321	-	0	14,321
November	11,552	-	0	11,552
December	4,592	-	0	4,592
Total	36,480	362	2,157	39,001

\* Flaring increased from Sep 2019 due to FEP plant prolonged shutdown period

Table 3-2: Quantities flared by ExxonMobil FEP in 2019

Month	ExxonMobil FEP (tonnes)			Reasons for Significant Flaring Events
	Ground flaring	Elevated flaring	Total	
January	557	103	660	9th Jan PSV lift (35T to elevated flare)
February	579	6	585	
March	541	8	549	
April	6,709	8,458	15,167	21st Apr 'B' Boiler Trip (8,228T to elevated flare)
May	878	24	902	
June	881	269	1,149	14th Jun Methanator Trip (249T to elevated flare )
July	2,930	715	3,645	
August	14,095	3,075	17,170	12 <sup>th</sup> -15 <sup>th</sup> Aug Plant Shutdown (2,801T to elevated flare) Ethane from FNGL routed to flare as plant offline
September	8,983	307	9,290	Ethane from FNGL routed to flare as plant offline
October	-	485	485	Plant shutdown during this period. Tank vapours routed to elevated as ground flare not accessible (in use by FNGL)
November	-	503	503	
December	2	754	757	
Total	36,156	14,706	50,862	



### 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. Data for both plants are shown in Figures 1 and 2 from 2005 onwards. Figure 3 shows, for FEP, the split of total flaring quantities between base flaring (associated normal operations) and event flaring (associated with events such as planned shutdown and start-up of equipment or temporary lack of access to outlets/buyers resulting in excess product which needs to be flared). The temporal data does not indicate any trend (either increase or decrease) in flaring rates. In 2019, overall emissions from the Mossmorran complex were down as the ExxonMobil FEP boilers and furnace were not operational during the shutdown period from August 2019 to January 2020<sup>8</sup>. On the other hand, the quantities flared at both plants was greater than in 2018, and are the highest in the time series from 2005. At the ExxonMobil plant, April and August had much higher levels of flaring than the other months, with the first coinciding with issues regarding one of the boilers, and the second with the plant shutdown. There was an increase of ground flaring at the Fife NGL plant during the temporary shutdown of Fife Ethylene Plant (FEP) from August 2019 mentioned above (3.2). These increased flaring quantities from event flaring at FEP in 2019 are also reflected in the relatively larger event flaring quantities over base load flaring in Figure 3. 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.

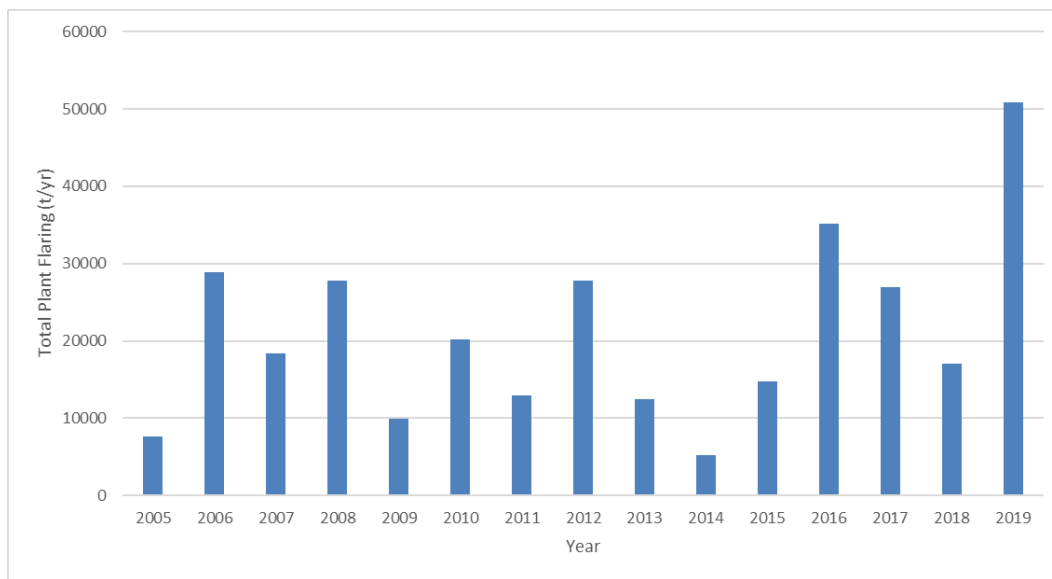


Figure 1: Temporal trends of total quantities (tonnes) flared annually at ExxonMobil FEP

<sup>8</sup> SEPA, 2019 Emissions from the Mossmorran Complex in 2019. <https://www.sepa.org.uk/media/527589/emissions-from-the-mossmorran-complex-2019.pdf>

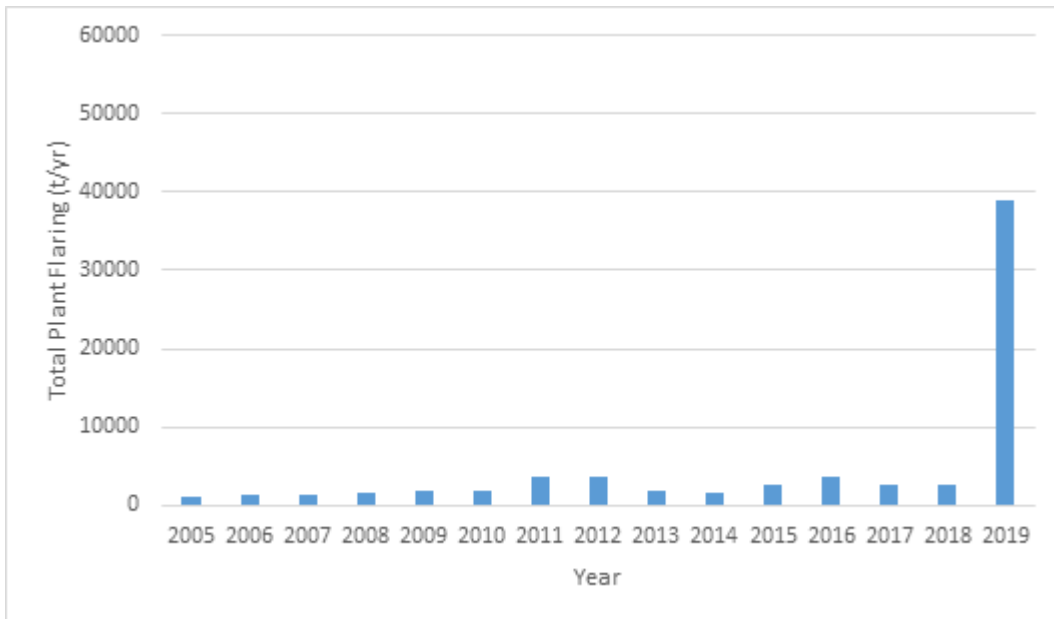


Figure 2: Total quantities (tonnes) flared annually at Shell FNGL

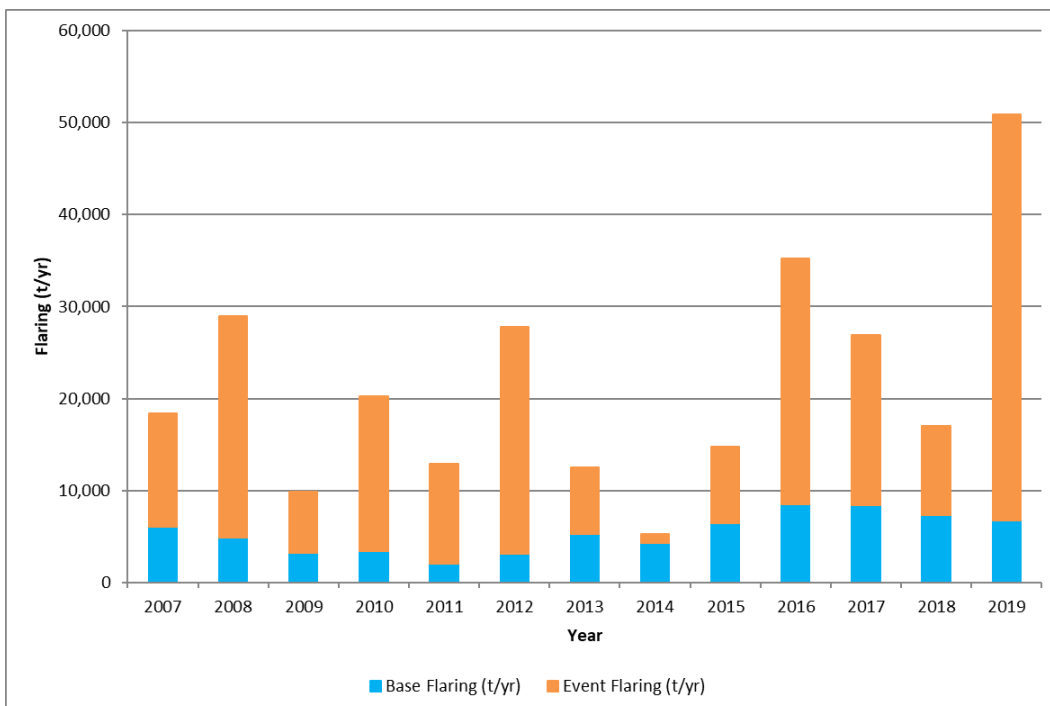


Figure 3: Total event and base flaring quantities (tonnes) at ExxonMobil FEP between 2007 and 2019

### 3.4 WHAT ADDITIONAL ACTIONS OCCURRED IN 2019?

Actions are underway at ExxonMobil and Shell to achieve 'Best Available Technologies' as soon as possible<sup>9</sup> per the BAT Evaluations submitted by the operators to SEPA in April 2019 (available on the Mossmorran Hub). Improved elevated flare tips are to be installed at both facilities in 2020 (ExxonMobil) and

<sup>9</sup> <https://www.sepa.org.uk/regulations/air/air-quality/previous-updates>

2021 (Shell). An enclosed ground flare is to be built at the FEP for ExxonMobil, with an expected delivery date of 2022. Additional measures to prevent and where that is not possible, minimise flaring are ongoing at these facilities.

In August 2019, the FEP was shut down by ExxonMobil temporarily in response to boiler failure. The plant was restarted in January 2020. SEPA undertook an air monitoring campaign from August 2019 to March 2020 to evaluate any impacts from the plant restart process, results of which are discussed in Section 5.

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

Although there is no clear trend of increasing flaring over the years, 2019 was a year of relatively higher flaring, however circumstances were unusual given boiler failure and the subsequent need to take ExxonMobil operations offline. Plans for facility upgrade are underway, particularly for ExxonMobil. Both facilities submitted Best Available Technologies (BAT) assessments to SEPA in 2019. These identified improvements that could be made to the existing technology and processes at the plants to minimise the need for and impact of flaring. Progress towards achieving these are underway.

## 4 EMISSIONS DATA

### 4.1 WHAT ARE THE EMISSION DATA RESULTS FOR 2019?

The emissions monitoring measurements for 2019 submitted to SEPA are summarised for each regulated Shell and ExxonMobil source at Mossmorran in Table 4-1 and Table 4-2. 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 4-3 as PM<sub>10</sub> (particulate matter of size 10 µm in diameter).

Table 4-1: Emissions from Regulated Sources at Shell FNGL plant during 2019 (mg m<sup>-3</sup> at 3% O<sub>2</sub>, 273K dry)

Furnace	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	Mean	Max.	Min.	ELV	Mean	Max.	Min.	ELV	Mean	Max.	Min.
1	100	<6	<6	<6	150	103.6	117.7	70.7	10	<10	<10	<10
2	100	<6	<6	<6	150	92.3	120.8	68.2	10	<10	<10	<10
3	100	<6	<6	<6	150	142	156*	117.8	10	<10	<10	<10

\*NO<sub>x</sub> exceeded twice, short period of furnace run on higher excess air causing higher Nox emissions than usual.

Table 4-2: Emissions from Regulated Sources at ExxonMobil Mossmorran during 2019 (mg m<sup>-3</sup> at 3% O<sub>2</sub>, 273K Dry) from Furnaces 1-7 and Gas Turbine Exhaust Stack. Note that no sampling was undertaken in the fourth quarter of 2019 as the plant was shut down from August. Levels indicated as zeros were measured but below the limit of detection of the measurement instrument.

Furnace	CO Concentration (mg m <sup>-3</sup> )*			NO <sub>x</sub> Concentration as NO <sub>2</sub> (mg m <sup>-3</sup> )**			SO <sub>2</sub> Concentration (mg m <sup>-3</sup> )*		
	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.
1	0.1	0.3	0.0	276.3	329.9	246.3	0.0	0.0	0.0
2	8.6	9.0	8.1	226.2	237.3	210.5	0.0	0.0	0.0
3	19.6	58.3	0.0	239.5	269.6	205.2	0.0	0.0	0.0
4	0.0	0.0	0.0	265.1	287.8	223.3	0.0	0.0	0.0
5	0.9	2.7	0.0	226.9	277.3	195.0	0.0	0.0	0.0
6	28.4	82.6	0.0	234.0	286.5	193.8	0.0	0.0	0.0
7	0.0	0.0	0.0	255.0	278.7	226.2	0.0	0.0	0.0
Gas Turbine Stack	1.0	2.0	0.3	391.2	427.4	365.4	0.0	0.0	0.0

\*No limit: no emission limit applied by SEPA

\*\*Authorised PPP Emissions Limit is 350 mg m<sup>-3</sup> for the furnaces and 550 mg m<sup>-3</sup> for the gas turbine stack

Table 4-3: Emissions from Regulated ExxonMobil Sources at Mossmorran during 2019 –Measured NO<sub>x</sub>, SO<sub>x</sub> and CO Values (mg m<sup>-3</sup>@ 3% O<sub>2</sub>, 273K Dry) from Boiler stacks A, B and C. Note that no sampling was undertaken in the second half of 2019 as the plant was shut down from August

Boiler	CO Concentration (mg m <sup>-3</sup> )		NO <sub>x</sub> Concentration as NO <sub>2</sub> (mg m <sup>-3</sup> )			SO <sub>x</sub> Concentration (mg m <sup>-3</sup> )			PM <sub>10</sub> Concentration (mg m <sup>-3</sup> )		
	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	4.2		300.0	193.0		35.0	1.2		5.0	0.5
		n/a			n/a			n/a			n/a
B	200	2.6	Limit is fuel weighted (450 on liquid fuel, 300 on gas)	300	232.0	Limit is fuel weighted (350 on liquid fuel, 35 on gas).	35.0	1.5	Limit is fuel weighted (50 on liquid fuel, 5 on gas).	5.0	0.4
		n/a			n/a			n/a			n/a
C	200	5.1		300.0	246.0		35.0	2.5		5.0	1.6
		n/a			n/a			n/a			n/a

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

In 2019 the emission monitoring results, including particulate emissions, were within the limits set by SEPA, except for two small exceedances by Shell FNGL of NO<sub>x</sub> limit values. These were acknowledged to be due to short periods of the furnace being run on excess air to ensure the furnace's safe operation. In the next sections, local air quality monitored in areas surrounding the Mossmorran Complex and any related health impacts will be discussed. The Review Group notes that the air quality results do not indicate that the emissions have led to levels of air pollutants nearby that exceed any health based standards.

## 5 AIR QUALITY

### 5.1 WHAT ARE THE RESULTS OF THE AIR QUALITY DATA TYPICALLY REVIEWED BY THE REVIEW GROUP FOR 2019?

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. Various changes to the facilities at Mossmorran were noted, as was the ExxonMobil shutdown in August and flaring, but none of these were noted as causing any changes in air quality. None of the automatic monitoring sites at Cupar, Dunfermline, Kirkcaldy, and Rosyth reported exceedances of the annual mean air quality objectives for PM<sub>2.5</sub>, PM<sub>10</sub> or NO<sub>2</sub>. Any air quality management areas where greater control for PM<sub>10</sub> or NO<sub>2</sub> are needed are not associated with emissions from the facilities at Mossmorran or Braefoot Bay. Road traffic is the main contributor to air quality issues in these areas. In addition to the automatic monitoring sites, Fife Council includes a network of NO<sub>2</sub> diffusion tubes, primarily aimed at assessing traffic-related NO<sub>2</sub>. This report is published on the Fife Council website at <https://www.fife.gov.uk/kb/docs/articles/environment2/environmental-health/air-quality#6009-accordion7>.

INEOS FPS Ltd. commissioned NPL to monitor the ambient air hydrocarbon levels at 12 locations on the Forth Estuary coastline during 2019 (3rd January 2019 to 2nd January 2020). 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. This monitoring is done voluntarily by INEOS as assurance that operations at Hound Point Marine Terminal are not resulting in any air quality impacts.

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 such as the operations of ExxonMobil and Shell at Braefoot Bay and Mossmorran.

The results of this monitoring were reported by INEOS to indicate that the annual average concentration of benzene at each location ranged from 0.2 to 0.3 parts per billion volume to volume (ppb v/v). This is below the current annual Air Quality (Scotland) Strategy objective of 1 ppb v/v<sup>10</sup>. The measured values are similar to those measured at urban monitoring sites.

There are no Air Quality (Scotland) Strategy objectives for the other measured hydrocarbons and other than benzene, are not currently measured regularly by monitoring networks in the UK.

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

- The substance present in the greatest concentrations at most locations was n-butane for which annual mean concentrations ranged from 1.8 to 9.4 ppb v/v.
- The annual mean concentrations of the other individual substances measured ranged from <0.3 to 4.2 ppb v/v.
- The annual mean concentration of total hydrocarbons (C4 to C10) at different locations ranged from 7 to 26 ppb v/v.

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 2019 indicate that concentrations of most of the monitored substances have reduced when compared to those measured in 2018 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 and summary reports are publically available<sup>11</sup>. These were discussed in the MMBBIAQG report from 2019, and will be summarised briefly here. SEPA further undertook monitoring starting from the time of the ExxonMobil shutdown in August 2019 until March 2020, covering the re-start period after the shutdown<sup>12</sup>.

Air quality objectives are primarily set for annual average values and, for some pollutants, shorter term objectives. It is not appropriate to compare measured concentrations to annual average objectives as monitoring is not done continuously over 12 months. Instead, using the Daily Air Quality Index (DAQI) provides a way of indicating whether levels measured may pose a health risk. Most of the time the DAQI values were in the low band. There was a day in February 2019 where PM<sub>2.5</sub> and PM<sub>10</sub> values reached the moderate band of the DAQI, but this is not linked to activities at the Mossmorran Complex. Rather, particulate matter levels were high across Scotland, including at Auchencorth Moss, a rural site which is not affected by any local sources. This indicates that the episode occurred due to pollution transported to Scotland from elsewhere. This also meant that PM<sub>10</sub> levels exceeded the 24-hour air quality objective of 50 µg m<sup>-3</sup> at that time. No other short-term objectives were exceeded. Given that the DAQI was primarily in the low band, the population, including sensitive groups, are unlikely to be adversely affected by the levels measured in the area.

<sup>11</sup> <https://www.sepa.org.uk/regulations/air/air-quality/mossmorran-and-braefoot-bay-complexes/#documents>

<sup>12</sup> <https://www.sepa.org.uk/media/558658/air-quality-monitoring-mossmorran-pdf.pdf>



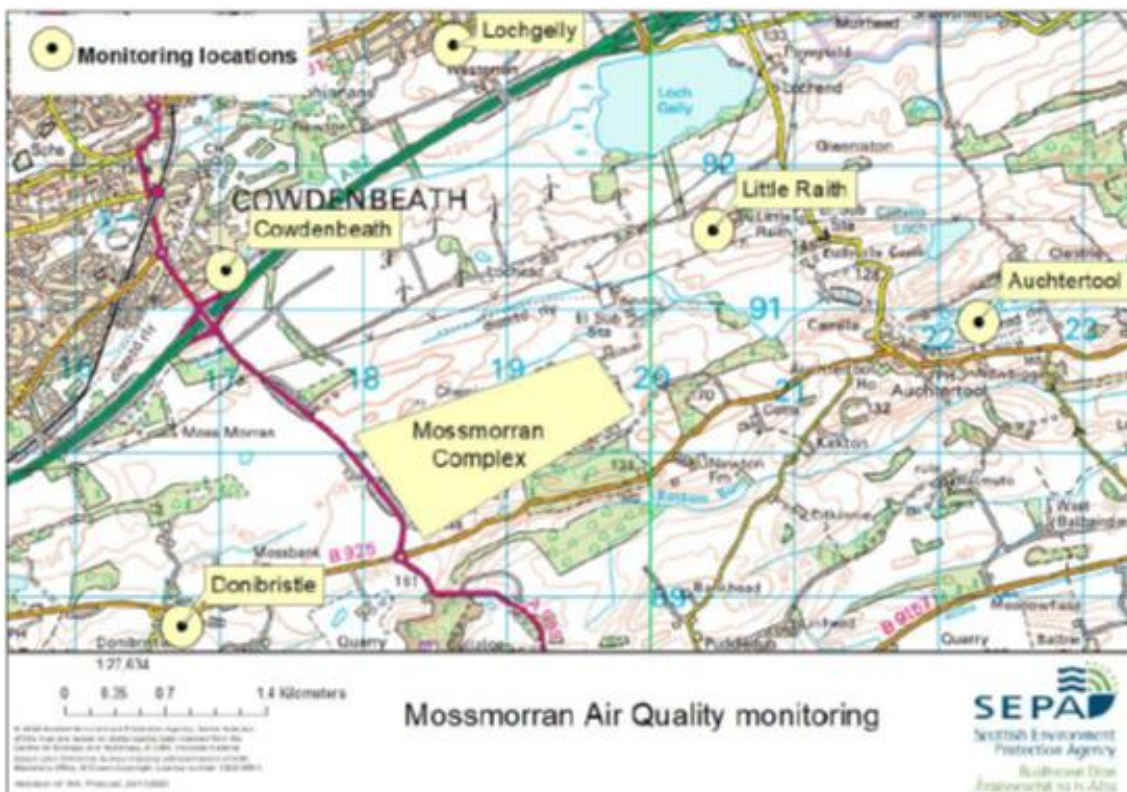


Figure 4: Map of SEPA monitoring sites. During January-April 2019, monitoring took place at Donibristle, Cowdenbeath, Lochgelly, and Little Raith Farm. During August 2019-March 2020. Monitoring took place at these sites plus Auchtertool. Source: SEPA, Air Quality Monitoring Report Mossmorran, August 2019-March 2020.

During the January-April 2019 monitoring period and between December 2019 - March 2020, a trailer containing continuous air quality monitoring analysers was located at Little Raith Farm, which measured NO<sub>2</sub>, SO<sub>2</sub>, CO and PM<sub>10</sub> and PM<sub>2.5</sub>. Details on the monitoring periods can be found in Figure 5.

Monitoring method	Site	Month											
		Jan-19	Feb-19	Mar-19	Apr-19	Aug-19	Sep-19	Oct-19	Nov-19	Dec-19	Jan-20	Feb-20	Mar-20
Automatic continuous monitoring: PM10, PM2.5	Auchtertool												
	Cowdenbeath												
	Donibristle												
	Little Raith Farm												
	Lochgelly												
Automatic continuous monitoring: NO <sub>2</sub> , SO <sub>2</sub> , CO	Auchtertool												
	Cowdenbeath												
	Donibristle												
	Little Raith Farm												
Diffusion tubes: BT EX, THCs, 1,3-butadiene, NO <sub>2</sub>	Lochgelly												
	Auchtertool												
	Cowdenbeath												
	Donibristle												
	Little Raith Farm												

Figure 5: Monitoring methods and time periods at each site (THCs = total hydrocarbons)

Wind speed and direction was also continuously monitored over the measurement period at Little Raith farm January-April 2019, and at Lochgelly during the August 2019-March 2020 period. The site at Little Raith Farm would therefore be the primary downwind site and has the potential to be impacted the most by emissions from the Mossmorran Complex. The air pollution measured at Little Raith Farm would be expected to also be affected by farming activities, which can especially generate particulate matter. The other sites are considered to represent the community, and similarly would be influenced by nearby sources such as traffic. The sites are within four kilometres of the Mossmorran complex (Figure 4) and some amount of dispersion will have occurred between the point of emission and the receiving sampling site as well as the local community, thus reducing the pollutant concentrations. The height of an elevated flare also allows for dispersion into the atmosphere rather than the air being trapped close to the ground. The modelling study conducted by Wood PLC<sup>13</sup> reflects this effect, which accounted for both the elevated and ground flares.

The automatic gas monitoring systems (NO<sub>2</sub>, SO<sub>2</sub>, CO) used at the Mossmorran sites use equipment certified by the Environment Agency's Monitoring Certification Scheme (MCERTS) and the procedures for monitoring and data processing are based on the relevant BS EN standards. Particulate matter monitors used are also covered by MCERTS, but the Turnkey Osiris (used at Auchertool and Donibristle) is a less sophisticated analyser which is certified to a less stringent, but still recognised, MCERTS standard. It is certified as an 'Indicative Ambient Particulate Monitor' for PM<sub>10</sub>. Osiris PM<sub>2.5</sub> data is not covered by MCERTS. Data capture requirements at all sites were higher than the requirements set out for the UK's AURN data (85%)<sup>14</sup>, with the exception of carbon monoxide in the August 2019 to March 2020 period. These values were well below any relevant air quality objectives across all monitoring periods and the slightly lower data capture (83%) is unlikely to affect these results.

During the automatic monitoring periods, there were several short periods where data was lost from the continuous monitoring equipment due to instrument or power failures, as detailed in SEPA's report.

*Diffusion tubes:* Diffusion tubes for NO<sub>2</sub> were co-located with the NO<sub>2</sub> analyser at Little Raith. The overall mean of NO<sub>2</sub> at Little Raith was similar between the continuous analyser and the diffusion tubes (10.9 µg m<sup>-3</sup> for analyser compared with 13.2 µg m<sup>-3</sup> for the tubes). Benzene levels were similar or lower than those measured by INEOS, as are total hydrocarbons (Section 5.1).

For both VOCs and NO<sub>2</sub>, levels during the monitoring periods are well within air quality objectives, even in the presence of flaring events. Diffusion tubes

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<sup>13</sup> <https://www.exxonmobil.co.uk/-/media/UnitedKingdom/Files/Fife/Environmental-Docs/WOOD-Report.pdf?la=en-GB&hash=BC5FF8CC05DBF226AD3E100235B4DBBBFD396171>

<sup>14</sup> Ricardo Energy and Environment. QA/QC Operational Report for the Automatic Urban and Rural Network, October-December 2018. Report for the Environment Agency, Environmental Agency Contract number 21316, 8 April 2019.

provide a cost-effective means of measuring pollutants in areas where it is not possible or prohibitively expensive to have automatic monitoring equipment. Additionally for most VOCs there are no equivalent types of automatic monitors as there are for particulate matter and the other gases in this report. The diffusion tubes provide an average over a period of time (in this case two weeks), rather than reflecting daily or minute by minute fluctuations. Therefore they cannot provide information on any of shorter term episodes of higher concentrations in the air.

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

No routine air quality monitoring is undertaken during flaring events, although SEPA deploys monitoring sites as described in Section 5.2 to evaluate periods of time when there is some concern due to events at the Mossmorran complex. Incident-based monitoring occurred in April, June, and July 2019<sup>15</sup>. These coincided with some of the flaring events noted in Section 3. The second monitoring period August 2019-March 2020 was set up to monitor any air quality impacts of restart of the ExxonMobil plant after shutdown. During this time, the Shell FNGL plant used ground flaring to burn off excess ethane. Between 15th August until 18<sup>th</sup> September FEP continued to receive ethane from FNGL which had to be routed directly to the flare as the FEP plant was offline.

### **5.4 WHAT IMPACT DO WIND FARMS HAVE ON AIR QUALITY?**

No new permits were issued in 2019 for wind farms. Past surveys have found no evidence to indicate that the turbines would have an adverse impact on local concentrations of benzene. The impact of wind farms were also taken into consideration with regards to air pollution dispersion in the modelling done by Wood PLC. This was done by comparing two models scenarios – with and without nearby wind turbines. The turbines were found to have negligible impact on short-term (24 hour mean) contribution of emissions from the Mossmorran complex on local air quality. The maximum predicted contribution of the turbines on long-term (annual mean) pollution is 6%.

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

The flaring events and other operations of the ExxonMobil and Shell FNGL plants at the Mossmorran complex do not appear to have resulted in levels of air pollution that lead to moderate or high DAQI levels, and are within any short-term air quality objectives.

Air quality monitoring by SEPA and the monitoring through Fife Council do not indicate any adverse effects on air quality in 2019 related to the Mossmorran Complex. Although the site likely contributes some amount to

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<sup>15</sup> <https://www.sepa.org.uk/regulations/air/air-quality/mossmorran-and-braefoot-bay-complexes/#documents>

the air pollutant levels in the area, these are not easily distinguishable from other sources, either locally or through long-range transport from further away. Monitoring around flaring events do not indicate any exceedances of 24-hour or other short-term air quality limits.

Existing monitoring data do not indicate an air quality problem overall, based on comparison with air quality objectives. To better capture unexpected events within the context of overall air pollution levels over time, it would be necessary to have air quality sites operational on a constant basis, rather than in response to an event, as this sometimes does not capture the entire event nor the time prior to it. However, any flaring events that did occur during the monitoring periods did not appear to have an adverse impact on local air quality. The monitoring stations and programme were chosen by SEPA to reflect community exposures and agreed with MMBBIAQRG. The results are consistent with the air modelling outcomes.

Air monitoring done by SEPA are considered by the Review Group to be done to a rigorous standard, and have been reported in SEPA's reports in a transparent manner. The Review Group considers the monitoring methods, procedures and data quality assurance and control to be robust. If resources allow, it is recommended in the future that field duplicates be included for diffusion tubes to allow for estimation of the precision of the field sampling process.

There is a suggestion for the group to consider engagement activities with the community regarding the relationship between emissions from the facilities and local air quality. This would need to include discussion of the type of activities to be conducted and responsibilities for these activities.

## **6 HEALTH EFFECTS**

### **6.1 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.

A report conducted by NHS Fife at the time concluded that, the overall impact of flaring on people local to Mossmorran in recent years has not been acceptable and could plausibly affect health in the widest sense. NHS Fife would therefore recommend that every reasonable effort to be made to reduce the frequency, duration and intensity of these events.<sup>16</sup>

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 that allows them to draw links between air pollution in the vicinity and cancer<sup>19</sup>. 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 Deprivation<sup>17</sup>.

### **6.2 WHAT ARE THE REVIEW GROUP'S COMMENTS AND RECOMMENDATIONS (WHERE RELEVANT)?**

The Review Group understands through their discussions with stakeholders, that some people in the 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 committed to working with national agencies to explore evidence relating to health concerns that have been raised in the areas surrounding Mossmorran, should new evidence emerge.

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<sup>16</sup> NHS Fife (2019) Reports of the health impact of Flaring at Mossmorran and Historical Cancer Incidence. Available from: [191030-nhs-fife-mossmorran-health-impact-summary-final.pdf \(nhsfife.org\)](https://www.nhs.uk/consult/191030-nhs-fife-mossmorran-health-impact-summary-final.pdf)

<sup>17</sup> 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 FNGL during 2019 that would be anticipated to adversely affect local air quality. The issues regarding flaring and the period when ExxonMobil was taken offline have been discussed previously.

### **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 2019 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. ABBREVIATIONS

$\mu\text{g m}^{-3}$	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.
$\mu\text{m}$	Micrometre (there are one million micrometres in a metre)
AQMAs	Air Quality Management Areas
AURN	Automatic Urban and Rural Network
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
IOM	Institute of Occupational Medicine
IPPC	Integrated Pollution Prevention and Control
K	Kelvin
MCERTS	Monitoring Certification Scheme
$\text{mg m}^{-3}$	milligram per cubic metre, mass concentration unit for particulates and gases, $1 \text{ mg m}^{-3} = 1,000 \mu\text{g m}^{-3}$ .
nm	Nanometres (there are one billion nanometres in a metre)
NO <sub>2</sub>	Nitrogen dioxide
NO <sub>x</sub>	Nitrogen oxides
NPL	National Physical Laboratory
O <sub>3</sub>	Ozone
PM	Particulate matter
PM <sub>10</sub>	Air pollution particles that are approximately less than 10 $\mu\text{m}$ in diameter



PM <sub>2.5</sub>	Air pollution particles that are approximately less than 2.5 µm in diameter and are therefore a subset of PM <sub>10</sub> .
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.
ppb v/v	Parts per billion volume to volume
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
Shell	Shell UK Limited
SO <sub>x</sub>	sulphur oxides
THCs	Total hydrocarbons
VCU	Vapour control unit
VOCs	Volatile organic compounds

## **APPENDIX 2. 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 has stepped down as Independent Chair. There has not been a replacement. Current members include 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 3. MEMBERSHIP OF THE REVIEW GROUP

This Appendix contains information provided by Fife Council, membership as at December 2019.

<b>Name</b>	<b>Designation/ Representing</b>	<b>Address</b>
<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
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	ExxonMobil Chemical Limited	Fife Ethylene Plant, Mossmorran
Gillian Doel	ExxonMobil Chemical Limited	Fife Ethylene Plant, Mossmorran
Catherine Cubitt	ExxonMobil Chemical Limited	Fife Ethylene Plant, Mossmorran
CLlr Linda Erskine	Lochgelly, Cardenden and Benarty Ward	Fife House, Glenrothes

<b>Name</b>	<b>Designation/ Representing</b>	<b>Address</b>
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	Cowdenbeath Community Council	Cowdenbeath
Paul Vincent	Dalgety Bay & Hillend Community Council	Dalgety Bay

<b>Name</b>	<b>Designation/ Representing</b>	<b>Address</b>
Steven Murray	Lochgelly Community Council	Lochgelly
Amelia Howie	Lumphinnans Community Council	Lumphinnans