# 05 January 2023

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

2020 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.

# Following a review by Fife Council in 2020 (See section 1.2) the group was reconstituted as the Mossmorran and Braefoot Bay Expert Advisory Group on Air Quality. Whilst the report was commissioning and information in relation to the air quality in the area was reviewed by the Review Group, this report has been produced by the Expert Advisory Group.

# Related URLs:

# Fife Council Annual Air Quality Progress Report 2021

# https://www.fife.gov.uk/\_\_data/assets/pdf\_file/0030/288165/Fife\_Annual\_Progress\_Report\_2021\_Issue\_1.pdf

# 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 air quality monitoring and related health impacts arising from operations at the Mossmorran Complex 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) Plant and the ExxonMobil Fife Ethylene Plant (FEP) in this report. The Review Group reviews air quality data collected from various sources, including air monitoring data from Fife Council, SEPA, INEOS, and emissions monitoring by ExxonMobil and Shell, as required by their permit. The Review Group also considers the potential impact that any major plant changes could have on air quality and liaises with representatives from community councils and the local health service.

Some people in the communities around the Mossmorran area are concerned over flaring from the two plants. Flaring is undertaken to protect the plant safety during planned and unplanned maintenance work and varying events occur throughout the year. Both companies make efforts to minimise the flaring required.

Six significant flaring events occurred during 2020. During early 2020, the ExxonMobil plant restarted after a period of shutdown in 2019, requiring a period of flaring. Unplanned flaring events occurred due to power losses from a storm in August, and plant process upsets. Other planned activities such as maintenance also resulted in flaring.

Air monitoring by SEPA around the Mossmorran Complex, along with other sources of air quality data from Fife Council and INEOS did not indicate any adverse effects on air pollutants concentrations from the flaring events or at any other time in 2020. The primary air pollution source for the community is traffic emissions.

SEPA’s monitoring sites were chosen to reflect the location of residential communities, and included a downwind site, expected to represent the most impacted direction from the Mossmorran Complex. None of the SEPA monitoring data indicated that air pollutants measured reached levels that exceeded air quality standards, with the Daily Air Quality Index (DAQI), which provide an indicator of health risk, remaining low throughout the year.

Overall, the Review Group concluded that, based on the available data reviewed in 2020, 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. Although some data at one monitoring site was lost to a cyber-attack, available data from several other sites provides good confidence in these conclusions.

The group recommends that Fife Council’s air quality network and SEPA’s local monitoring activities 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 or data provision if deemed appropriate by the Expert Advisory Group, which, going forward, will replace the Review Group, in response to concerns.

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 Complex and Braefoot Bay terminal facilities, this process includes taking account of the Review Group findings. Both facilities are also regulated by the Health and Safety Executive (HSE) who ensure health and safety risks are managed effectively.

# Background

## What are the Mossmorran & Braefoot Bay terminal facilities?

Shell UK Limited (Shell) operates the 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. These products are key raw materials for a range of everyday items. 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, processes and ‘cracks’ the molecules to create ethylene, a much higher value product used to manufacture many plastics. FEP is permitted to produce 820,000 tonnes of ethylene per year and is one of approximately 40 ethylene crackers within the whole of Europe.

## 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[[1]](#footnote-2) 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. In 2020, at a meeting of the Environment and Protective Services Subcommittee of the Fife Council (17 September 2020), the recommendation was made that the Mossmorran and Braefoot Bay Community and Safety Liaison Committee would be the recognised forum for community oversight. This would be an umbrella committee where issues or concerns from the community could be raised. Three Expert Advisory Groups (EAGs) would be formed under this committee – one on air quality (which will continue to undertake the same role as this Review group), one on noise and light and vibration, and one on communications. These groups would carry out tasks assigned by the Safety Liaison Committee.These tasks include the generation of this report, which is completed independently. The final report is then sent to the Safety Liaison Committee.

Full details of the constitution and terms of reference of the current Review Group responsible for this report are provided in Appendix 2.

## Who pays for the Review Group’s work?

The Institute of Occupational Medicine (IOM) is financed by the operators to independently develop this report, as required under the planning permits for FEP and FNGL. 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.

## 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 any potential to 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
* Review other information about local air quality, including monitoring data from the area
* Continue to review whether installed and planned wind turbines in the vicinity of the Mossmorran site have an impact on pollution in the area.
* Detail any advice or recommendations the group proposes

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

## 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.

## 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 were declared during the reporting period. Minutes are taken at each Review Group meeting, with copies of these being publicly available on the Fife Council website ([www.fife.gov.uk/airquality](http://www.fife.gov.uk/airquality)).

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 Review Group has engaged IOM as an independent consultant to gather information, evaluate, and produce the air quality report. IOM works with the Review Group on the final content of the report. ExxonMobil and Shell provide information from their facilities and provide feedback on the report prior to finalisation. IOM declares that there were no conflicts of interest in the preparation of this report.

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

## What meetings did the Review Group particpate in during 2020?

Table 1‑1 provides details of when the Review Group formally met during the calendar year 2020.

The minutes of these meetings are available on the Fife Council Air Quality website at [www.fife.gov.uk/airquality](http://www.fife.gov.uk/airquality)

Table 1‑1: Schedule of meetings in 2020

|  |  |
| --- | --- |
| **Meeting** | **Date(s)** |
| Mossmorran and Braefoot Bay Independent Air Quality Monitoring Review Group Meeting | 28th February 2020 |
| Mossmorran and Braefoot Bay Expert Advisory Group - Air Quality - Meeting | 26th November 2020 |

# substantive changes in the facilities that may impact on local air quality

## 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 2020 that would be anticipated to adversely affect local air quality. The issues regarding flaring and the period when ExxonMobil was taken offline are discussed in Section 4.2.

## 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 any potential they might have to impact on local air quality.

# Air quality indicators reviewed

## What are the pollutants reviewed?

Burning of fuel results in a number of pollutants released, which are described in this section. For more information on air pollutants, please see <http://www.scottishairquality.scot/air-quality/pollutants>.

Smoke (or soot) occurs when there is incomplete combustion (not enough oxygen to burn the fuel completely). Smoke is a collection of these tiny, unburned particles. Smoke has regulated consent limits during normal operation at the Mossmorran complex, measured as PM10.

*Particulate Matter (PM)*: is the term used to describe solid or liquid particles suspended in the atmosphere[[2]](#footnote-3). Particle size affects how deep a particle can penetrate into the lungs and be absorbed. 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.

* *PM10*: This is particulate matter with a diameter of less than 10 µm. PM10 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 or household activities (e.g. domestic wood-burning, cooking).
* PM2.5: This is particulate matter with a diameter of less than 2.5 µm. These particles can penetrate even deeper into the lung than PM10. 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 heart and lung diseases and impair lung development in children. In addition, fine particles may carry surface-absorbed carcinogenic compounds into the lungs. There are many sources, including road traffic, agriculture, industry and personal activities.

*Nitrogen dioxide (NO2):* 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 NO2 is formed. The two gases together are known as oxides of nitrogen, sometimes described in shorthand form as NOx. NO2 may have adverse effects on the health of the lung. NO2 can irritate the lungs and lower resistance to respiratory infections such as influenza.

*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.

*Sulphur Oxides (SOx):* Sulphur oxides are a group of chemicals that can be found in the air as gases and particles. SOx are produced when a fuel containing sulphur is burned. Sulphur dioxide (SO2) is the sulphur oxide which is of greatest concern to health. 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. SO2 can cause irritation of the lungs and mucous membranes. 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 also 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 health effects that may result from long-term exposure to benzene include cancer, central nervous system disorders, liver and kidney damage, reproductive disorders, and birth defects.

*Volatile organic compounds (VOCs):* Carbon-based (or organic) chemicals that readily evaporate and are sometimes referred to as vapours. Many hydrocarbons, including benzene, butane, pentane and hexane are VOCs. Different VOCs are associated with different health effects, however, not all VOCs have known health effects.

## How do we assess Air Quality?

Air quality is measured by comparing against a range of health-effects based objectives. Objectives indicate the allowable exceedances of a standard. An air quality standard is the concentration recorded over a specified time period which are considered acceptable with respect to health. In Table 3‑1, the standard value is the ‘Limit concentration’ collected over the amount of time given in the Time period column. The objectives are noted as the allowed number of exceedances in the ‘Limit concentration’ column. Further information on these can be found at <http://www.scottishairquality.scot/air-quality/standards>.

Table 3‑1: Air quality objectives in Scotland (from Summary of Objectives of the National Air Quality Strategy, <http://www.scottishairquality.scot/air-quality/standards>)

| **Pollutant** | **Limit concentration** | **Time period** |
| --- | --- | --- |
| PM10 | 50 µg m-3 (not to be exceeded more than 7 times a year) | 24 hour mean |
| 18 µg m-3 | Annual mean |
| PM2.5 | 10 µg m-3 | Annual mean |
| Nitrogen dioxide (NO2) | 200 µg m-3 (not to be exceeded more than 18 times a year) | 1 hour mean |
| 40 µg m-3 | Annual mean |
| Carbon monoxide (CO) | 10 mg m-3 | Running 8 hour mean |
| Sulphur dioxide (SO2) | 350 µg m-3, not to be exceeded more than 24 times a year | 1 hour mean |
| 125 µg m-3, not to be exceeded more than 3 times a year | 24 hour mean |
| 266 µg m-3, not to be exceeded more than 35 times a year | 15 minute mean |
| Benzene | 3.25 µg m-3 | Running annual mean |
| 1,3-Butadiene | 2.25 µg m-3 | Running annual mean |
| VOCs | No specific limit |  |

To provide information and advice to groups who may be affected by air pollution, in the UK most air pollution information services use the index and banding system approved by the Committee on Medical Effects of Air Pollution Episodes[[3]](#footnote-4) (COMEAP) called the Daily Air Quality Index (DAQI). The system uses a 1-10 index divided into four bands to provide more detail about the health risks of air pollution levels in a simple way, similar to the sun index or pollen index.

* **1-3 (Low)**
* **4-6 (Moderate)**
* **7-9 (High)**
* **10 (Very High)**

Usually, the overall air pollution index for a site or region is calculated from the highest concentration of five pollutants:

* Nitrogen Dioxide
* Sulphur Dioxide
* Ozone
* PM2.5
* PM10

However, where only limited pollutant concentrations are available (e.g. if only PM monitoring is available) the concentration boundaries for individual pollutants (PM2.5 or PM10) have been used to generate a DAQI.

Further information on how to use the DAQI along with health messages for at-risk groups and the general population can be found at https://www.scottishairquality.scot/air-quality/daqi .

## What data are reviewed and who provides this?

Table 3‑2 provides a summary of the data typically considered and the providers of this information for the 2020 Annual Report.

Table 3‑2: Source of information considered by the Review Group

|  |  |
| --- | --- |
| **Data considered** | **Data provider** |
| Carbon monoxide (CO) emissions | Shell and ExxonMobil |
| Sulphur oxides (SOx) emissions | Shell and ExxonMobil |
| Nitrogen oxides (NOx) 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 |
| Air quality monitoring | SEPA, Fife Council |

INEOS Forties Pipeline System (FPS) Ltd. provide data as they voluntarily 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 the Review Group consider their annual Air Quality Annual Progress Report[[4]](#footnote-5). The report provides the results of NO2, PM10 and PM2.5 monitoring undertaken at four automatic stations in Cupar, Kirkcaldy, Dunfermline and Rosyth and non-automatic monitoring using diffusion tubes at 55 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 (NO2) and Particulate Matter (PM10 & PM2.5) being the pollutants of concern. To date (2020) the review and assessment process has identified two air quality management areas (AQMAs) in the Fife area, one at Bonnygate, Cupar and the other in Appin Crescent, Dunfermline, where the relevant air quality objectives have been identified at risk of not being met; albeit significant improvements in air quality have been achieved through the action planning process (see Fife Council Annual Air Quality Progress Report 2021 at <https://www.fife.gov.uk/__data/assets/pdf_file/0030/288165/Fife_Annual_Progress_Report_2021_Issue_1.pdf>

## 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 (NOx). 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 NOx 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[[5]](#footnote-6).

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 necessary as it is unlikely that emissions of NOx 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.

## 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 (a) all the appropriate preventative measures are taken against pollution, in particular through application of the best available techniques, and (b) no significant pollution is caused.

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 commission their own testing to verify results where required.

For airborne emissions from Mossmorran, the Shell and ExxonMobil permits require that the emissions from 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.

**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.

**Health and safety regulations**

These regulations apply to workplaces and are aimed at protecting the health of those on site, primarily workers.

**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[[6]](#footnote-7) 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.

# flaring

## Why is flaring needed?

The flares at the Mossmorran complex are part of the safety system. Because the gas is constantly flowing to the complex, it is necessary to send gas that is being sent to the site and cannot be processed to the flare for combustion. 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. However, it is not always possible to avoid use of the elevated flare, and this may occur if the ground flares are in use by the other operator or restricted in capacity relative to the amount of gas needed to be flared.

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.

## What flaring took place during 2020?

In 2020, a number of planned and unplanned flaring events occurred at the Mossmorran Complex. Planned flaring events were primarily related to maintenance activities, while unplanned flaring was due to unexpected events. In 2020, the ExxonMobil plant restarted after an extended period of closure for equipment repair, and flaring was anticipated during this process. In January 2020, the ExxonMobil plant began the restart process, which resulted in ground and elevated flaring at various times throughout February 2020. Additional flaring events throughout the year were due to compressor trips (March and October) and power loss due to weather (August). These are explained in further detail in Table 4‑1 and Table 4‑2.

Table 4‑1: Quantities flared by Shell FNGL in 2020. Purge gas is needed to prevent the creation of a potentially combustible mixture in the system and pilot gas is to provide a supply of fuel gas to keep the pilots lit.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Month** | **Ground (tonnes)** | **Elevated** | **Purge & Pilots** | **Total** | **Reason for significant flaring events** |
| **(tonnes)** | **(tonnes)** | **(tonnes)** |
| **Jan** | 4,422\* | 33 | 243 | 4,698 | Flaring associated with FEP plant shutdown and unavailability to accept ethane product |
| **Feb** | 0 | 66 | 151 | 217 |  |
| **Mar** | 0 | 23 | 168 | 191 |  |
| **Apr** | 0 | 8 | 144 | 152 |  |
| **May** | 30 | 42 | 173 | 245 |  |
| **Jun** | 0 | 18 | 166 | 184 |  |
| **Jul** | 0 | 34 | 172 | 206 |  |
| **Aug** | 104 | 90 | 172 | 366 | Elevated flare: Loss of power supply due to storm which resulted in the use of the elevated flare. |
|  |
| Ground flare: Planned use to empty one of the plant’s modules of hydrocarbons ahead of routine maintenance work |
| **Sep** | 23 | 4 | 172 | 199 |  |
| **Oct** | 0 | 28 | 172 | 200 |  |
| **Nov** | 0 | 11 | 166 | 177 |  |
| **Dec** | 0 | 40 | 172 | 212 |  |
| **Total** | **4,579** | **398** | **2071** | **7,047** |  |

\* Flaring increased due to FEP plant shutdown for a period during 2020

Table 4‑2: Quantities flared by ExxonMobil FEP in 2020. Pilot gas is to provide a supply of fuel gas to keep the pilots lit.

|  | **Ground**  **(tonnes)** | **Elevated**  **(tonnes)** | **Pilot**  **(tonnes)** | **Total**  **(tonnes)** | **Reasons for Significant Flaring Events** |
| --- | --- | --- | --- | --- | --- |
| **Jan** | 12,119 | 241 | 10 | 12,370 | Plant shutdown. Ethane from Shell FNGL routed to ground flares. |
| **Feb** | 13,903 | 2,622 | 30 | 16,555 | Ethane from Shell FNGL routed to ground flares while FEP plant shutdown. Plant restarted 14th February requiring elevated flaring. |
| **Mar** | 1,694 | 721 | 28 | 2,443 | Plant process upset (trip of major compressor) resulted in use of flare system to combust gas until plant back online |
| **Apr** | 471 | 1 | 24 | 497 |  |
| **May** | 604 | 30 | 26 | 660 |  |
| **Jun** | 572 | 111 | 26 | 709 |  |
| **Jul** | 627 | 0 | 21 | 648 |  |
| **Aug** | 1,199 | 2,472 | 24 | 3,694 | Grid power loss during storm caused plant process upset and resulted in use of flare system to combust gas until plant back online |
| **Sep** | 436 | 41 | 25 | 502 |  |
| **Oct** | 2,745 | 2,327 | 24 | 5,097 | Plant process upset (trip of major compressor) resulted in use of flare system to combust gas until plant back online |
| **Nov** | 435 | 0 | 25 | 461 |  |
| **Dec** | 482 | 3 | 23 | 508 |  |
| **Total** | 35,287 | 8,571 | 287 | 44,145 |  |

## Are the quantities flared increasing over time?

Ground and elevated flare totals for both plants are shown in Figures 1 and 2. There appears to be an increasing trend but the quantity flared varies from year to year depending on circumstances.

Figure 1: Total quantities (tonnes) flared annually at Shell FNGL

For more information on flaring from ExxonMobil FEP, Figure 2 shows the split of total flaring quantities between base flaring (associated with normal operations) and event flaring (associated with events such as planned shutdown and start-up of equipment). These types of flaring are defined in ExxonMobil FEP’s permit (see APPENDIX 2 for further information on definitions). For the last two years, total flaring at ExxonMobil FEP includes information on the amount flared due to planned flaring and forces outside of the FEP’s control (Figure 2). The Shell FNGL emissions were much higher in 2019 due to the need for the plant to process more ethane than normal due to FEP’s shutdown, and 2020 flare emissions were closer to past levels. The ExxonMobil FEP 2019 and 2020 total emissions were higher overall, due to the boiler (2019) and compressor (2020) issues, in addition to the storm-related power loss in 2020.

Figure 2: Total unplanned and base flaring quantities, including planned and external flaring (tonnes/year) at ExxonMobil FEP between 2006 and 2020. For definitions of flaring types, see APPENDIX 2, Glossary.

## What additional actions occurred in 2020?

Actions are underway at ExxonMobil and Shell to achieve ‘Best Available Techniques as soon as possible per the BAT Evaluations submitted by the operators to SEPA in April 2019 (available on the Mossmorran Hub). Progress continues on the development and construction of the enclosed ground flare. Installation of improved elevated flare tips, were delayed and there has been a variation issued to extend the deadline to install a noise-reducing flare tip. Additional measures to prevent and, where that is not possible, minimise flaring are ongoing at these facilities.

## What are the Review Group’s comments and recommendations (where relevant)?

There is evidence of an increasing trend in emissions from 2005 onwards at both FEP and FNGL, however, this did not result in any air quality standard exceedances (see Section 6). It is not clear whether the emissions trend will continue into the future.

In 2019, Shell FNGL’s emissions were unusually high, due to the closure of ExxonMobil FEP for part of the year. The issues leading to FEP’s closure also contributed to emissions in 2019.

In 2020 ExxonMobil FEP needed to restart several times, including a planned restart after a prolonged period offline for equipment repair, and two additional restarts after a compressor trip. Additional flaring occurred due to poor weather, which resulted in a major power dip affecting both FEP and FNGL.

In the future, the Review Group recommends that the data reported from FEP and FNGL are harmonised for this report. This will allow for better comparability and understanding of the amounts of gas flared, and the purposes of the flaring.

Plans for facility upgrade are underway, particularly for ExxonMobil. Both facilities submitted Best Available Techniques (BAT) assessments to SEPA in 2019. The assessments were required to review if the Operators were using BAT to prevent and, where that is not practicable, to reduce the amount of flaring and its impact on communities & the environment and identify any improvements that may be required. These assessments identified improvements that could be made to the existing technology and processes at the plants to minimise the need for and impact of flaring, implementation of these improvements should reduce the volume of gas flared. Progress towards achieving these are underway.

# Emissions Data

## What are the emission data results for 2020?

The emissions monitoring measurements for 2020 submitted to SEPA are summarised for each regulated Shell FNGL and ExxonMobil FEP source at Mossmorran in Table 5‑1 (Shell), Table 5‑2, and Table 4-3 (ExxonMobil).  The emission limit values (ELVs) set by SEPA for each emission source (see Section 3.5), are also shown. Emissions from the sources at the Mossmorran Complex described in this section are diluted in the air as they disperse away from the facilities. The air quality impacts measured in the surrounding areas are described in Section 6.

Table 5‑1: Emissions from Furnaces at Shell FNGL plant during 2020 (mg m-3 at 3% O2, 273 K dry). Readings are taken monthly and the mean, maximum and minimum are shown. Values below the detection limit of the measurement instrument are indicated as < detection limit value.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Furnace** | **CO Concentration (mg/m3)** | | | | **NOx Concentration (mg/m3)** | | | | **SO2 Concentration (mg/m3)** | | | |
| **ELV** | **Mean** | **Max.** | **Min.** | **ELV** | **Mean** | **Max.** | **Min.** | **ELV** | **Mean** | **Max.** | **Min.** |
| 1 | 100 | <6 | <6 | <6 | 150 | 104.2 | 112 | 91.6 | 10 | <10 | <10 | <10 |
| 2 | 100 | 17.4 | 86.1 | <6 | 150 | 78.1 | 97.1 | 57.8 | 10 | <10 | <10 | <10 |
| 3 | 100 | <6 | <6 | <6 | 150 | 109.3 | 135 | 78.7 | 10 | <10 | <10 | <10 |

Table 5‑2: Emissions from Furnaces 1-7 and Gas Turbine Exhaust Stack at ExxonMobil Mossmorran during 2020 (mg m-3 at 3% O2, 273 K Dry). The furnace exhaust readings are taken quarterly and the mean, maximum and minimum are shown. The gas turbine exhaust readings are taken monthly and the mean, maximum and minimum are shown. Values below the detection limit of the measurement instrument are indicated as < detection limit value.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Furnace** | **CO Concentration (mg m-3)\*** | | | | **NOx Concentration as NO2**  **(mg m-3)** | | | | **SO2 Concentration**  **(mg m-3)\*** | | | | |
| **ELV** | **Mean** | **Max** | **Min** | **ELV** | **Mean** | **Max.** | **Min.** | | **ELV** | **Mean** | **Max** | **Min** | |
| **1** | N/A | 3.6 | 11.1 | <3 | 350 | 269.3 | 363.8 | 205.5 | | N/A | <14 | <14 | <14 | |
| **2** | N/A | 8.2 | 13.8 | 5.0 | 350 | 256.2 | 319.9 | 217.5 | | N/A | 9.4 | 16.8 | 4.3 | |
| **3** | N/A | 0.3 | 1.1 | <3 | 350 | 297.5 | 379.8 | 218.1 | | N/A | <14 | <14 | <14 | |
| **4** | N/A | <3 | <3 | <3 | 350 | 286.7 | 322.0 | 238.3 | | N/A | <14 | <14 | <14 | |
| **5** | N/A | 1.0 | 2.7 | <3 | 350 | 244.5 | 373.1 | 184.1 | | N/A | 0.7 | 1.9 | <14 | |
| **6** | N/A | 16.0 | 64.0 | <3 | 350 | 257.1 | 332.1 | 219.3 | | N/A | <14 | <14 | <14 | |
| **7** | N/A | <3 | <3 | <3 | 350 | 300.5 | 353.5 | 258.0 | | N/A | 1.5 | 5.9 | <14 | |
| **Gas Turbine Stack** | N/A | <3 | <3 | <3 | 550 | 428 | 475 | 386.8 | | N/A | 0.2 | 0.9 | <14 | |

\*No limit: no emission limit applied by SEPA

On 25 March 2020, four of FEP’s furnaces exceeded the NOx emission limits, for a brief period of time (14 minutes), which can be seen in the maximum levels for furnaces 1, 3, 5, and 7 exceeding the limit value (Table 5‑2). Investigation indicated that it was possible to reduce the NOx concentrations to below the ELVs by adjusting furnace operation. This change in operation was made, and FEP is taking action to prevent this from occurring again.

Table 5‑3: Emissions from ExxonMobil Boilers at Mossmorran during 2020. Measured NOx, SOx and CO Values (mg m-3@ 3% O2, 273K Dry) from Boiler stacks A, B and C. Readings are taken every six months and averaged.

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Boiler** | **CO Concentration**  **(mg m-3)** | | **NOx Concentration as NO2**  **(mg m-3)** | | | **SOx Concentration**  **(mg m-3)** | | | **PM10 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 | n/a | Limit is fuel weighted (450 on liquid fuel, 300 on gas) | n/a | n/a | Limit is fuel weighted (350 on liquid fuel, 35 on gas). | n/a | n/a | Limit is fuel weighted (50 on liquid fuel, 5 on gas). | n/a | n/a |
| 3.3 | 300.0 | 159.0 | 35.0 | 0.5 | 5.0 | 0.2 |
| B | 200 | 3.6 | 392.6 | 138.3 | 229.4 | 59.9 | 32.8 | 0.3 |
| 3.2 | 393.6 | 147.0 | 231.6 | 65.1 | 33.1 | 4.3 |
| C | 200 | 0.9 | 300.0 | 225.3 | 35.0 | 2.0 | 5.0 | 0.3 |
| 2.3 | 300.0 | 216.0 | 35.0 | 1.5 | 5.0 | 0.4 |

\*Not sampled in first half of 2020 as it was not operating.

## What are the Review Group’s comments and recommendations (where relevant)?

In 2020 the emission monitoring results were within the limits set by SEPA, except for brief exceedances by ExxonMobil FEP of NOx limit values. These were thought to be due to the moisture content of the intake air combined with marginally higher than usual excess oxygen and action has been taken to prevent this from recurring. 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 exceeding any health based objectives (see Section 22).

# air quality

## What are the results of the air quality data typically reviewed by the Review Group for 2020?

The air quality data reviewed include Fife Council air quality monitoring data, hydrocarbon monitoring done voluntarily by INEOS along the coastline and monitoring around the Mossmorran Complex done by SEPA. The first two sources are discussed here and SEPA’s monitoring is described in the following section.

Fife Council’s Air Quality team did not identify any new issues in the vicinity of Mossmorran or Braefoot Bay in their 2021 Air Quality Annual Progress Report. None of the automatic monitoring sites at Cupar, Dunfermline, Kirkcaldy, and Rosyth reported exceedances of the annual mean air quality objectives for PM2.5, PM10 or NO2. There were no exceedances of the daily PM2.5 or PM10 objectives (see Table 3‑1) by the automatic monitoring stations, but there were exceedances of both the daily mean (12 times) and annual mean objectives at Bonnygate Cupar’s AQMesh monitor. The AQMesh is not certified under MCERTS or any other scheme for compliance monitoring and is used as indicative only. While some air pollutant levels were lower in 2020, particularly NO2, one should note that the great reduction in traffic activity due to the COVID-19 pandemic restrictions resulted in lower air pollution in many cities[[7]](#footnote-8). Particulate matter levels did not change relatively by much in Scotland during the COVID-19 restrictions period in 2020 and seemed to slightly increase across Scotland. PM2.5 and PM10 concentrations are greatly influenced by many non-local sources, compared to NO2, and this explains the different patterns seen in 2020 for these pollutants. Particulate matter also has many natural sources (e.g. sea salt, pollen) along with man-made sources (e.g. vehicles, heating, industry), and can be formed due to chemical reactions in the air (e.g. due to emissions from agriculture).

Any air quality management areas (AQMAs) where greater control for PM10 or NO2 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 NO2 diffusion tubes, primarily aimed at assessing traffic-related NO2.

INEOS FPS Ltd. commissioned the National Physical Laboratory (NPL) to monitor the ambient air hydrocarbon levels at 12 locations on the Forth Estuary coastline during 2020 (2nd January 2020 to 1st January 2021). Nine locations on the Estuary North shore between North Queensferry and West Wemyss (including 4 locations between Dalgety Bay and Burntisland) were used, and 3 locations on the Estuary South shore between South Queensferry and Whitehouse Point were used. The ambient air samples were collected over 2 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 other industrial sites such as the operations of ExxonMobil and Shell at Braefoot Bay and Mossmorran. Monitored concentrations of propane, n-butane, iso-butane, n-pentane, hexane, heptane, octane, nonane, decane, propylene, toluene, o-xylene, m & p-xylene, styrene and total C4 to C10 hydrocarbons are measured by INEOS as part of their annual reporting requirements at Grangemouth and Houndpoint.

* The results of this monitoring indicate that the average concentrations of benzene over the 12-month period had annual means at each location ranging from 0.1 to 0.2 parts per billion (ppb). This is below the current annual air quality (Scotland) objective of 1 ppb[[8]](#footnote-9).
* There are no Air Quality (Scotland) Strategy objectives for other hydrocarbons except for 1,3,-butadiene. This compound was not specifically reported by INEOS.
* The substance present in the greatest concentrations at all locations was n-butane for which annual mean concentrations ranged from 2.1 to 10.2 ppb. Concentrations of n-heptane, toluene and xylene were all below the limit of detection (LOD) of <0.3ppb.
* Other annual mean concentrations (iso-butane, iso-pentane, n-pentane, n-hexane) range from <0.3 ppb to 3.4ppb.
* Annual mean total C4-C10 hydrocarbons concentrations range from 6-18 ppb.

The concentration levels of hydrocarbons reported by INEOS are unlikely to have health impacts, based on the available evidence. Air quality objectives are indicated for the hydrocarbons where a health risk standard has been defined, but these have not been exceeded.

## SEPA air quality monitoring in 2020 – what did they do and what were the results?

The locations of SEPA’s air monitoring equipment are shown in Figure 3. SEPA undertook air quality monitoring starting from the time of the ExxonMobil shutdown in August 2019 until March 2020, covering the re-start period after the shutdown[[9]](#footnote-10). During this time, automatic (i.e. continuous) monitoring for particulate matter and various combustion-related gases was done at the sites in Figure 4. Additionally, volatile organic compounds (VOCs) primarily composed of hydrocarbons, were measured using diffusion tubes at the sites noted in Figure 4.



Figure 3: Map of SEPA monitoring sites. During August 2019-March 2020 monitoring took place at Donibristle, Cowdenbeath, Lochgelly, Little Raith and Auchtertool. Source: SEPA, Air Quality Monitoring Report Mossmorran, August 2019-March 2020.



Figure 4: Monitoring methods and time periods at each site (THCs = total hydrocarbons). Little Raith data was lost due to cyberattack from April onwards (grey boxes).

During the 23 January to 20 February 2020 period, hydrocarbon average values over each 2 week monitoring session were below the detection limits for most of the measured hydrocarbons. Benzene and 1,3-butadiene were well below the air quality standards. Benzene levels were similar or lower than those measured by INEOS, as are total hydrocarbons (Section 6.1).

Benzene, toluene, ethylbenzene, and xylene (BTEX) are often measured together, and the values measured by SEPA are similar to or lower than levels that have been found at urban roadsides.

The Daily Air Quality Index (DAQI) is used in reporting by SEPA for the continuously monitored pollutants, because the DAQI provides a way of indicating whether levels measured may pose a health risk (low, moderate, high, very high) and incorporate short-term standards. The DAQI is normally based on the highest concentration of these five pollutants – nitrogen dioxide, sulphur dioxide, ozone, PM2.5 and PM10, if available. In this case the DAQI is based the available pollutants measured. The DAQI’s moderate band generally begins at the short-term air quality standard levels, e.g. the 24-hour mean for PM10, one-hour mean for NO2 (see Table 3‑1 for complete details).

Particulate matter levels were not high enough to be of health concern (DAQI always in low band), with PM10 on average below 10 µg/m3 and PM2.5 around 5 µg/m3. A few slightly higher than normal fluctuations (where levels rose slightly above 10 µg/m3 for PM10 but still well below the PM10 short-term limit) were observed.

The NO2 concentrations measured by diffusion tubes at each site from October 2019 to February 2020 are well within air quality objectives. The continuous monitor at Little Raith did not exceed the short-term standard for NO2 at any time between December 2019 and early March 2020, even in the presence of flaring events.

After March, although automatic gas analysers at Little Raith were still deployed and no exceedances were noted, a cyberattack on SEPA caused these data to be lost before they could be processed and made publicly available. PM10 and PM2.5 data are available for the rest of 2020 from the monitors at Auchtertool, Donibristle and Lochgelly, as these were not lost due to the cyber-attack.

Wind speed and direction was also continuously monitored over the measurement period at Lochgelly during the January to March 2020 period.

The continuous monitors used by SEPA are certified according to the Environment Agency’s Monitoring Certification Scheme (MCERTS). They are either equivalent methods for continuous ambient air-quality monitoring systems (CAMS), which means they can be used in compliance monitoring for UK objectives[[10]](#footnote-11), or indicative methods, which means they cannot be used in compliance monitoring but are officially recognised for trend analysis, source identification, or other similar types of analysis[[11]](#footnote-12). These certifications specify the testing conditions and objectives the instruments must meet compared to a reference monitor.

The automatic gas monitoring systems (NO2, SO2, CO) used at Little Raith used equipment certified under MCERTS and the procedures for monitoring and data processing are based on the relevant BS EN standards. Data quality objectives for these gases are 15% expanded uncertainty for CAMS and 25% for indicative methods.

The FIDAS is a CAMS equivalent method, but the Turnkey Osiris (used at Auchertool and Donibristle) is certified as an ‘Indicative Ambient Particulate Monitor’ for PM10. Osiris PM2.5 data is not covered by MCERTS above 100 µg m-3, however values never reached this concentration. Indicative data quality objectives are 25% expanded uncertainty for CAMS and 50% for indicative methods.

Data capture requirements at all sites were higher than the requirements set out for the UK’s AURN data (85%)[[12]](#footnote-13), 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.

Diffusion tube data for VOCs and NO2 were analysed using certified standard methods (except for total hydrocarbons) by external laboratories. QA/QC was performed for each field deployment, and uncertainty associated with the benzene, toluene, ethylbenzene, xylene, and 1,3-butadiene measurements was ±30%, and±25% for NO2. As a comparison, diffusion tubes for NO2 were co-located with the NO2 analyser at Little Raith just over the end of 2019/ start of 2020 period. The overall mean of NO2 at Little Raith was similar between the continuous analyser and the diffusion tubes (10.9 µg m-3 for analyser compared with 13.2 µg m-3 for the tubes).

The site at Little Raith has been identified as the primary downwind site and has the potential to be impacted the most by emissions from the Mossmorran Complex. It is expected that the air pollution measured at Little Raith would also be affected by farming activities, which can generate particulate matter. The other sites are considered to represent the community, and similarly would be influenced by nearby sources such as traffic.

## Has there been any air quality monitoring undertaken during flaring events?

The automatic PM analysers have been deployed continuously throughout 2020. No additional routine air quality monitoring is undertaken during flaring events. Combustion-related gases are also monitored at one site, but unreported due to the cyberattack. VOCs are not routinely monitored in the area.

## What impact do wind farms have on air quality?

There has been concern that nearby wind farms might affect the dispersion of emissions from the Mossmorran complex in a way that might increase pollutant exposure to the local population. Past surveys have found no evidence to indicate that the turbines would have an adverse impact on local concentrations of benzene[[13]](#footnote-14). 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 potential contribution of the turbines on long-term (annual mean) PM10 pollution resulting from the complex is 6% of the contribution without wind-turbines, which is relatively low when considering measured concentrations in the area.

A non-material permit variation was granted in 2020 for the Little Raith to extend its operational period from 24.5 years to 25 years. There do not appear to be any additional turbines planned. No additional impact is expected from this variation.

## What are the Review Groups comments and recommendations (where relevant)?

Based on the available data, the ExxonMobil and Shell FNGL plants at the Mossmorran complex, including the flaring events, remained within low DAQI levels, and are below all applicable 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 2020 related to the Mossmorran Complex. Although the site likely contributes some amount to 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. Particulate matter was continuously monitored in 2020 at three sites near the Complex. Any flaring events that did occur during the monitoring periods did not appear to have an adverse impact on local air quality. One site continuously also monitored NO2, CO, and SO2, but the data is not available due to circumstances out of SEPA’s control (cyberattack). Data from previous monitoring during flaring do not indicate that concentrations of these gases in the community would have been raised to concerning levels. Monitoring of hydrocarbons was not continued in 2020 after the ExxonMobil FEP restart in the first quarter of 2020 as levels monitored since the second half of 2019 did not show any adverse concentrations.

The monitoring stations and programme were chosen by SEPA to reflect community exposures and agreed with Review Group. The positions of the monitors were informed by community locations and air modelling predictions.

Air monitoring undertaken 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.

There is a suggestion for the group to consider engagement activities with the community to provide information about the relationship between emissions from the facilities and local air quality. Further stakeholder engagement will also help the Review Group better answer communities’ concerns. This would need to include discussion of the type of activities to be conducted and responsibilities for these activities. Advice from the communications advisory group would be useful in this respect.

# Health effects

## 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.

A report conducted by NHS Fife as of 2019 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.[[14]](#footnote-15)

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. NHS Fife have no new evidence of an association between air pollution in the vicinity and cancer19. Local cancer rates have not been found to be higher than expected after taking account of deprivation as measured by the Scottish Index of Multiple Deprivation[[15]](#footnote-16).

## 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.

# CONCLUSIONS

Flaring occurs as a safety mechanism for FEP and FNGL, and in 2020, both planned flaring (due to known maintenance) and unplanned flaring (due to unexpected circumstances) occurred.

Flaring emissions have been increasing over time, although the amount of gas flared fluctuates from year-to-year. It is not clear that this trend will continue to the future. Events requiring FEP to shut down in the last two years may contribute to recent increases.

Air quality monitoring in the area does not indicate that air pollution in the region reached levels that would have been hazardous for the community.

The emissions from the facilities at Mossmorran and Braefoot Bay did not result in air pollution levels that pose a significant health risk to members of the local community.

1. ABBREVIATIONS

|  |  |
| --- | --- |
| µg m-3 | Microgram per cubic metre, mass concentration unit for particulates and gases. There are 1,000,000 micrograms in a gram. |
| mg m-3 | Milligram per cubic metre, mass concentration unit for particulates and gases. There are 1,000 micrograms in a gram. |
| µm | Micrometre (there are one million micrometres in a metre) |
| AQMAs | Air Quality Management Areas |
| AURN | Automatic Urban and Rural Network |
| BAT | Best Available Techniques |
| BTEX | Benzene, Toluene, Ethylbenzene and Xylene |
| CO | carbon monoxide |
| COMAH | Control of Major Accident Hazard |
| COMEAP | Committee on Medical Effects of Air Pollution Episodes |
| DAQI | Daily Air Quality Index |
| DEFRA | Department of environment, food and rural affairs |
| ELV | Emission Limit Value |
| 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 |
| IPPC | Integrated Pollution Prevention and Control |
| K | Kelvin, a unit of temperature. 273 K is approximately 0°C. 1 K = 1°C |
| MBBEAGAQ | Mossmorran and Braefoot Bay Expert Advisory Group on Air Quality |
| MBBIAQMRG | Mossmorran and Braefoot Bay Independent Air Quality Monitoring Review Group |
| MCERTS | Monitoring Certification Scheme |
| NO2 | Nitrogen dioxide |
| NOx | Nitrogen oxides |
| NPL | National Physical Laboratory |
| O3 | Ozone |
| PM | Particulate matter |
| PM10 | Air pollution particles that are approximately less than 10 μm in diameter |
| PM2.5 | Air pollution particles that are approximately less than 2.5 μm in diameter and are therefore a subset of PM10. |
| 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 |
| Shell | Shell UK Limited |
| SOx | Sulphur oxides |
| SO2 | Sulphur dioxide |
| TOR | Terms of reference |
| THCs | Total hydrocarbons |
| VOCs | Volatile organic compounds |

# 

1. Glossary

Air quality standard – the concentration recorded and averaged over a specified time period which is considered acceptable with respect to health.

Air quality objective - the allowable exceedances of a standard in a defined time period.

From ExxonMobil Permit, a “flaring event” is any flaring of hydrocarbon at a rate greater than 5t/h for longer than 30mins, to either the ground or elevated flare.

The following types of flaring are defined for ExxonMobil:

Base Flaring – <5 tonnes/hour flaring to either ground or elevated flare that is required for normal plant operation (purging of process equipment, use of safety facilities (pressure control valves etc.).

Unplanned (also called event) Flaring – Unplanned flaring greater than 5 tonnes/hour to either the ground or elevated flare i.e. during a process upset

Planned Flaring – Planned flaring greater than 5 tonnes/hour, for which SEPA & communities will have been given notice ahead of time

External Flaring – Any planned/unplanned flaring due to factors outside FEPs control (i.e. – ethane from FNGL routed to ground flares during the FEP shutdown). However, this does not include flaring due to a process upset as a result of weather.

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 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;

1. 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.

1. Membership of the Review Group

This Appendix contains information provided by Fife Council, membership as at December 2020.

| **Name** | **Designation/**  **Representing** | **Address** |
| --- | --- | --- |
| **A. MEMBERS** | |  |
| Prof. Wilson Sibbett (stepped down) | Independent Chair (retired) | 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 Miranda Loh | 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 Duncan Fortescue-Webb | NHS Fife (Public Health) | Cameron House, Windygates |
| Maureen Cuthbertson | Crossgates & Mossgreen Community Council | Crossgates (Inland) |
| William Dryburgh | Aberdour Community Council | Aberdour (Coastal) |
|  |  |  |
| **B. BY INVITATION** | |  |
|  |  |  |
| Craig Burnett | Shell UK Limited | Fife NGL Plant, Mossmorran |
| Mairi McKay | Shell UK Limited | Aberdeen |
| Lala Gandilova | Shell UK Limited | Fife NGL Plant, Mossmorran |
| Alexander Rhodes | Shell UK Limited | Fife NGL Plant, Mossmorran |
| Kylie Bishop | ExxonMobil Chemical Limited | Fife Ethylene Plant, Mossmorran |
| Aisling Brazel | ExxonMobil Chemical Limited | Fife Ethylene Plant, Mossmorran |
| Kerry Cook | ExxonMobil Chemical Limited | Fife Ethylene Plant, Mossmorran |
| Cllr Linda Erskine | Lochgelly, Cardenden and Benarty Ward | Fife House, Glenrothes |
| Cllr Rosemary Liewald | Lochgelly, Cardenden and Benarty Ward | Fife House, Glenrothes |
| Cllr Mary Bain Lockhart | Lochgelly, Cardenden and Benarty Ward | Fife House, Glenrothes |
| Cllr Lea Mclelland | Lochgelly, Cardenden and Benarty Ward | Fife House, Glenrothes |
| Cllr Lesley Backhouse | Burntisland, Kinghorn and Western Kirkcaldy Ward | Fife House, Glenrothes |
| Cllr Gordon Langlands | Burntisland, Kinghorn and Western Kirkcaldy Ward | Fife House, Glenrothes |
| Cllr Kathleen Leslie | Burntisland, Kinghorn and Western Kirkcaldy Ward | Fife House, Glenrothes |
| Cllr Alistair Bain | Cowdenbeath Ward | Fife House, Glenrothes |
| Cllr Alex Campbell | Cowdenbeath Ward | Fife House, Glenrothes |
| Cllr Gary Guichan | Cowdenbeath Ward | Fife House, Glenrothes |
| Cllr Darren Watt  Cllr Dave Coleman | Cowdenbeath Ward  Inverkeithing and Dalgety Bay Ward | Fife House, Glenrothes  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 | Ineos Forties Pipeline Ltd | Hound Point |
| Rachel Morrell | Ineos Ltd | Grangemouth Petrochemical Complex |
| Iain Fleming  Tom Kinnaird | Auchtertool Community Council  Benarty Community Council | Auchtertool  Benarty |
| Alexander Macdonald | Burntisland Community Council | Burntisland |
| David A. Taylor | Cardenden & Kinglassie Community Council | Cardenden |
| Irene Burt | Cowdenbeath Community Council | Cowdenbeath |
| Peter Franklin  Fred Clarke | Dalgety Bay & Hillend Community Council  Kelty Community Council | Dalgety Bay  Kelty |
| Raymond Wilson | Lochgelly Community Council | Lochgelly |
| Amelia Howie | Lumphinnans Community Council | Lumphinnans |

1. Formerly Fife Regional Council and Dunfermline and Kirkcaldy District Councils [↑](#footnote-ref-2)
2. Air Quality (PM2.5 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 [↑](#footnote-ref-3)
3. http://comeap.org.uk/ [↑](#footnote-ref-4)
4. https://www.fifedirect.org.uk [↑](#footnote-ref-5)
5. <http://www.scottishairquality.scot/air-quality/pollutants#ozone> [↑](#footnote-ref-6)
6. https://www.legislation.gov.uk/ukpga/1995/25/part/IV <http://www.scottishairquality.scot/air-quality/standards> [↑](#footnote-ref-7)
7. https://www.scottishairquality.scot/sites/default/files/publications/2021-07/SAQD\_Covid19\_Technical\_Report\_Issue\_1\_1.pdf [↑](#footnote-ref-8)
8. The air quality standard for benzene is reported here in ppb, rather than µg m-3 for comparability with the measured values. Both ppb and µg m-3 are measures of concentration, ppb is generally used for gas or vapours, and is a measure of volume of gas per volume of air. µg m-3 is a measure of mass of gas per volume of air. There is a conversion factor between the two units. [↑](#footnote-ref-9)
9. <https://www.sepa.org.uk/media/558658/air-quality-monitoring-mossmorran-pdf.pdf> [↑](#footnote-ref-10)
10. <https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/532491/LIT_7050.pdf>; also [↑](#footnote-ref-11)
11. https://uk-air.defra.gov.uk/assets/documents/reports/cat14/1101140842\_Assessment\_of\_UK\_AURN\_PM\_Equipment\_against\_2010\_GDE.pdf and https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\_data/file/642895/LIT\_7070.pdf [↑](#footnote-ref-12)
12. 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. Allowing 5% for maintenance and calibration. [↑](#footnote-ref-13)
13. https://www.sepa.org.uk/media/162888/mossmorran\_air\_quality\_and\_position\_statement.pdf [↑](#footnote-ref-14)
14. 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.nhsfife.org/media/32734/191030-nhs-fife-mossmorran-health-impact-summary-final.pdf) [↑](#footnote-ref-15)
15. 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) [↑](#footnote-ref-16)