Peer review of SEPA's Regulation of the PPC Permit for the ExxonMobil Chemical Ltd Fife Ethylene Installation

Office of Environmental Enforcement

1 Contents

1. Introduction

The Scottish Environment Protection Agency (SEPA) requested the Irish Environmental Protection Agency (EPA) to carry out an external desk top peer review to share best practice and advice on further actions that may be taken to drive compliance at the ExxonMobil Chemical Ltd Fife Ethylene Plant (PPC/A/1013494). The focus of the peer review is to be a forward-looking analysis which identifies further actions that could be considered by SEPA. The objectives and scope of the review are in Appendix 1.

The main objectives of this review are:

1. To identify what further interventions SEPA could consider in light of SEPA's policies and guidance, industry guidelines, actions taken to date and industry best practice.
2. To identify if there are any further actions SEPA could consider to improve engagement with the community in light of SEPA's engagement with the community to date.
3. To identify other monitoring approaches SEPA could consider in light of SEPA's and the company's approach to monitoring to date.

This report describes the key process activities, the main issues from an environment and public perspective, SEPA's regulatory approach and, finally, it identifies the key recommendations for the three objectives highlighted above. The review team spoke with a number of the key stakeholders as part of this project. It should be noted that the review team requested to meet representatives of ExxonMobil Chemical Ltd Fife Ethylene Plant on a number of occasions, however, the review team were informed by ExxonMobil Chemical Ltd Fife Ethylene Plant that its staff were unavailable to participate.

1.1 Methodology

In order to meet the objectives as outlined above, the review team carried out a desk-based assessment of the recent compliance history and associated regulatory actions having regard to the PPC permit for the ExxonMobil Chemical Ltd Fife Ethylene Plant installation (PPC/A/1013494). Due to time constraints and Covid 19 restrictions, the review team were restricted to a review of the information on the SEPA website and information forwarded to the review team by SEPA in addition to online meetings with SEPA, Shell UK Ltd and local community representatives. It should be noted that, as this was designed to be a desk-top study, no site visit was undertaken by the review team to the ExxonMobil Chemical Ltd Fife Ethylene Plant installation, the adjacent industries or the surrounding areas. In addition, any alleged or potential health impacts from the ExxonMobil Chemical Ltd Fife Ethylene Plant facility are outside the scope of this review. The roles of the different regulatory authorities at the Mossmorran complex are included in Appendix 2.

1.2 Summary of key recommendations

The Mossmorran complex has the potential to have a significant impact on the environment and the local community. It is clear from this desk top peer review that SEPA enforcement efforts have resulted in improvements on the site and has enhanced and implemented additional positive initiatives in the communication of its regulatory activities, monitoring approaches by the provision of a dedicated web portal (https://www.sepa.org.uk/regulations/air/air-quality/mossmorran-and-braefoot-bay-complexes/). The EPA has made a number of recommendations that SEPA should consider to drive compliance at the ExxonMobil Chemical Ltd Fife Ethylene Plant. These recommendations are set out in detail in Section 5. The main recommendations of this review are:

1. In order to reduce the potential for significant flaring and associated off-site impacts, an assessment of the current ethylene production throughput at the facility should be carried out and proposals should be provided by ExxonMobil Chemical Ltd Fife Ethylene Plant to minimise the intake of gas during significant flaring events.

2. The deployment of a dedicated site agent at the ExxonMobil Chemical Ltd Fife Ethylene Plant should be considered as an additional measure in the regulation of the PPC permit for the installation. The dedicated site agent should be a suitably qualified and experienced expert(s). The selection and appointment of the site expert(s) would be undertaken by SEPA and would enable it to have a key regulatory presence on the site while at the same time liaising and assisting the general public on key issues of concern.
3. It is recognised that SEPA has expanded significant resources in the regulation of the ExxonMobil Chemical Ltd Fife Ethylene Plant, however, not all of this is documented in a format that is easily available to the public. SEPA should prepare detailed records of all its regulation activities (e.g. site visits, compliance and enforcement actions, monitoring) and make them available to the public on the SEPA website.
4. Implement an enhanced monitoring programme to include air and noise emissions monitoring at and in the vicinity of the Mossmorran complex. In addition, an assessment of the impact of the key emissions to atmosphere under different scenarios would assist in determining the impact of the facility on the surrounding environment.

2. Description of the activities

Mossmorran is the name of an area in Fife near Cowdenbeath, 20 km north of Edinburgh, Scotland where Shell UK Ltd and ExxonMobil Chemical Ltd. operate two separate processing facilities known as the Mossmorran Complex. Both facilities were commissioned in 1985 and a brief description of both facilities is provided below. The two plants are located adjacent to each other and are fed with natural gas liquids from the North Sea via a pipeline from the St. Fergus Gas Terminal. While Shell UK Ltd were consulted as part of the review, the review was focused solely on the ExxonMobil Chemical Ltd Fife Ethylene Plant installation as per the Terms of Reference.

There are a number of densely populated agglomerations within 5km of the Mossmorran complex, the main areas being Lochgelly and Cowdenbeath. There are more than 25,000 people living within a 5km radius of the Mossmorran complex. The main impacts and community reaction to activities from the Mossmorran complex appear to be centered around the Lochgelly area.

Map 1 Location of Mossmorran Complex and Braefoot Bay terminal.

Map 2 – Location of Mossmorran Complex in relation to incoming gas feed.

2.1 Shell UK Ltd – Fife Natural Gas Liquids (SHELL)

The Shell UK installation operates on a continuous basis processing natural gas liquid (NGL) which is fed into the plant from the North Sea via the St. Fergus gas terminal which is approximately 190km North West of Mossmorran. The processes at the Shell UK installation result in the separation of the incoming natural gas liquid stream into propane, ethane, butane and natural gasoline. Ethane is sent to the adjoining ExxonMobil Chemical Ltd Fife Ethylene Plant plant for processing whilst the other products are sent off-site via pipeline to the Braefoot Bay Marine terminal or via road tanker.

The main processes at the facility involve the heating, chilling and distillation of the of natural gas liquid in order to separate out the different products. As well as the main NGL processing activities at the facility there is also associated infrastructure for the reception of the NGL from the St. Fergus gas terminal, the storage of product on-site and the export of product from the site to Braefoot Bay.

There are high and low pressure, elevated and ground level flare systems in place on the Shell UK facility.

Photo 1: Photo of one of the Ground flares at the Shell UK site.

2.2 ExxonMobil Chemical Ltd Fife Ethylene Plant – Fife Ethylene Plant

The primary purpose of the ExxonMobil Chemical Ltd Fife Ethylene Plant facility is to produce ethylene from ethane. The ethane is supplied to the ExxonMobil Chemical Ltd Fife Ethylene Plant installation from the above mentioned Shell UK installation and is brought into the ExxonMobil Chemical Ltd Fife Ethylene Plant installation via a pipeline directly from Shell UK where it undergoes a process known as "thermal or steam cracking" in order to produce the ethylene. "Steam Cracking" involves heating ethane until it breaks down (or "cracks") to form a mixture of ethylene and small amounts of other gases, including hydrogen. This is then distilled further, in a series of processes, to give pure ethylene. The ExxonMobil Chemical Ltd Fife Ethylene Plant installation has seven process furnaces (Furnace K-F-1 to K-F-7) fired by fuel gas, three combustion plants for the generation of steam and one gas turbine to produce power at the facility. Ethylene is either exported by ship via the Braefoot Bay Marine Terminal or to other consumers in the UK via the cross country ethylene distribution system.

In addition to the main production areas there is also an elevated flare at the ExxonMobil Chemical Ltd Fife Ethylene Plant installation and it has also access to and utilises the two ground flares at the adjoining Shell UK installation.

2.3 Flaring at Shell UK Ltd and ExxonMobil Chemical Ltd Fife Ethylene Plant Facilities

Flaring at facilities that process hydrocarbons such as the ones at the Mossmorran complex is necessary for both safety and process control. In all gas refining and processing installations flaring is a necessary component of the overall process in order to ensure the overall safety and to prevent gas ignition and/or

over pressurisation within the process. Flaring, when carried out correctly, ensures that the gas is burned off in a safe and controlled manner. In the majority of gas refining/processing installations any gas being flared is usually a valuable asset and it is not in the operator's interest to carry out prolonged periods of flaring. Flaring can and does occur on a frequent basis at most gas refining/processing installations however it is usually short in duration and should be directed to a ground flare where possible. In the case of the ExxonMobil Chemical Ltd Fife Ethylene Plant installation the flaring events that have caused the most disruption and upset in the local community have been prolonged periods of elevated flaring.

Due to the complex nature of the process at the ExxonMobil Chemical Ltd. installation, it can take long periods of time for the plant to start up or shut down. During these periods, the ethane gas may have to be flared rather than processed for export. The current configuration at the Mossmorran complex means that there is a lag time of up to four days to shut off incoming gas from the North Sea and this too can be a contributory factor to prolonged flaring if there are upset process conditions which mean the incoming ethane gas cannot be processed to the required standard.

SEPA has varied the permit to require ExxonMobil Chemical Ltd Fife Ethylene Plant to develop a project plan for bringing into operation fully enclosed ground flare systems at the ExxonMobil Chemical Ltd Fife Ethylene Plant installation. A ground flare can typically provide for the flaring of gas at a relatively lower capacity and lower pressure variations than an elevated flare. It is important to note that the proposed provision of a new ground flare at the ExxonMobil Chemical Ltd Fife Ethylene Plant installation will not negate the need for the use of the elevated flare.

As mentioned above there are a total of four flares at the Mossmorran complex, three on the Shell UK installation and one on the ExxonMobil Chemical Ltd Fife Ethylene Plant installation.

The current ground flares are owned, operated and maintained by Shell UK and utilised by ExxonMobil Chemical Ltd Fife Ethylene Plant via an operating agreement. The Best Available Techniques (BAT) assessment[1] conducted by ExxonMobil Chemical Ltd Fife Ethylene Plant identified 4 key areas which do not meet BAT mainly because the ground flares were outdated, not reliable, had limited smokeless capacity and do not employ adequate noise control[1].

Whilst both ground flares and elevated flares carry out the same function in that they provide for combustion of gas coming from the various processes, the potential impacts of the use of both flare types are significantly different. The elevated flares provide for the combustion of gas of varying velocity, pressure and volume and are visually a much more intrusive feature of the Mossmorran complex in that light, noise and vibration can be experienced as a result of high-pressure flaring.

It is important to note that the potential for light, noise and vibration impacts from the elevated flares is not unique to the Mossmorran complex and that any elevated high-pressure flares at similar sites pose similar risks in terms of potential impacts on the local environment. The key aspect to minimising the impacts from elevated high-pressure flares are to ensure the use of the flare is minimised and that low noise and vibration flare tips are installed and maintained.

The enclosed ground level flares will generally be used for lower pressure steady state combustion and are often used for maintenance at the facilities when parts of the plant need to be cleared of hydrocarbons.

[1] ExxonMobil Fife Ethylene Plant Flaring Evaluation BAT 30 April 2019

The operation of the ground flares is less intrusive in terms of light, noise and vibration however they cannot be used in all circumstances when flaring is required.

3 Regulatory regime

Both the Shell UK and the ExxonMobil Chemical Ltd Fife Ethylene Plant installations at Mossmorran are regulated under the Pollution Prevention and Control (PPC) (Scotland) Regulations (PPC). The requirements of the Industrial Emissions Directive (IED) were transposed into Scottish law using the PPC Regulations. The PPC Permits typically include a range of both general and specific conditions related to operations at the permitted installation.

The Shell UK and the ExxonMobil Chemical Ltd Fife Ethylene Plant installations at Mossmorran also fall under the Control of Major Accident Hazards (COMAH) Regulations which are jointly regulated by the Health and Safety Executive (HSE) and SEPA. In addition to carrying out routine regular inspections under both PPC and COMAH, SEPA has a duty to carry out investigations into incidents under both regulatory regimes. SEPA focus on the environmental aspects of incidents although there is often an overlap with safety aspects considered under COMAH by the HSE. The division of functions with regard to environmental, health and safety regulation at the Mossmorran sites is provided in Appendix 2.

3.1 Permitted Activities

The PPC Permits for the Shell UK (PPC/A/1013495) and ExxonMobil Chemical Ltd Fife Ethylene Plant sites (PPC/A/1013494) were issued by SEPA on 29th October 2007. The permits cover the following activities:

1. The burning of any fuel in a combustion appliance with a net rated thermal input of 50 MW or more
2. The production of ethylene through the cracking of ethane and propane and
3. The processing of natural gas liquids into ethane, propane, butane and pentane (plus heavier components).

Both the Shell UK and ExxonMobil Chemical Ltd Fife Ethylene Plant sites are regarded as one 'installation' (Ref Industrial Emissions Directive) but have separate PPC permits.

Nine 'Permit Variations' of the ExxonMobil Chemical Ltd Fife Ethylene Plant permit have been issued by SEPA since 2007 with the most recent Permit Variation issued on 22nd September 2020 in relation to the elevated flare tip.

3.2 SEPA's Enforcement Policy[2] and Enforcement Measures

The principles behind SEPAs regulation of environment permits is broadly outlined in its Enforcement Policy which aims to:

- secure compliance and change behaviour
- stop or reduce the risk of harm arising from the non-compliance to an acceptable level
- ensure restoration and remediation of the environment

[2] The Scottish Environmental Protection Agency's Enforcement Policy

SEPAs approach to regulation is underpinned by the five principles of better regulation i.e. **proportionality, accountability, consistency, transparency and targeting** plus a sixth principle of taking a **timely** approach.

The form of regulation, or combination of regulatory actions, which SEPA uses to achieve its enforcement outcomes, will differ depending on the nature of the non-compliance, the harm caused and the compliance history of the responsible person in question, including any wider criminality. SEPA also considers what immediate action is needed to protect the environment.

3.3 Regulation of ExxonMobil

3.3.1 Introduction

SEPA monitors compliance at the ExxonMobil Chemical Ltd Fife Ethylene Plant in a variety of ways including:

- Assessment of reports submitted by the operator under the information reporting requirements set out in the Permit.
- Site and desk based inspections and meetings with the site operator.
- Monitoring (noise, air and water)
- Incident and complaint investigations

Where SEPA identifies any non compliance or potential non compliance verbal and written feedback is provided to the site operator setting out any improvements required. SEPA expects operators to act on such advice and rectify any areas of non-compliance.

Additional compliance work is carried out with the Health and Safety Executive as the joint competent Authority under the Control of Major Accident Hazard Regulations.

3.3.2 Compliance Assessment Scheme Rating

The compliance level of licensees with their PPC permits is assessed on an annual basis using the SEPA **Compliance Assessment Scheme (CAS)** and the results published on the SEPA website. The **Compliance Assessment Scheme** rates the compliance of licensees into 6 different categories – Excellent, Good, Broadly Compliant, At Risk, Poor and Very Poor.

The CAS rating for the ExxonMobil Chemical Ltd Fife Ethylene Plant site in the period 2014 to 2018 is highlighted below. It can be seen that the CAS rating for the 2 most recent years has been categorised as 'Poor'. The CAS rating for the ExxonMobil Chemical Ltd Fife Ethylene Plant site for 2019 has not yet been determined.

Year	CAS rating
2014	Excellent
2015	Good
2016	Excellent
2017	Poor
2018	Poor

3.3.3 Site inspections

SEPA use a risk based system to identify which sites get a site based inspection in any given year. The highest risk sites and poorly performing sites receive multiple site based inspections per year and the lowest risk sites receive a site based inspection every five years.

The review team noted that inspections were carried out and recorded in the Compliance Assessment Scheme for 2017, 2018 and 2019. However, this does not cover all the regulatory activity and assessment that has been undertaken in relation to the ExxonMobil Chemical Ltd Fife Ethylene Plant. A range of other compliance and regulatory activities are undertaken (e.g. site visits) that are recorded by SEPA in different ways but may not be logged as inspections. Based on a review of the data and information on the SEPA website, it is not clear how many site visits are carried out by SEPA each year at the ExxonMobil Chemical Ltd Fife Ethylene Plant site.

3.3.4 Complaints

It is evident from the discussions with the local representatives that a large number of people are aware of the plant and the impact of its operations and have complained about it. Complaints are brought forward in many ways – with SEPA, with the operators, via the Action Groups and to the local Fife Council.

The Table below highlights the number of complaints received by SEPA in relation to the Mossmorran Complex for the years 2017 to 2020 (YTD). Whilst the local residents were aware of how to make a complaint to SEPA, it was unclear to the review team as to how the complaint handling procedures deal with follow up of complaints.

Year	No. of Complaints
2017	109
2018	60
2019	1352
2020 (YTD)	1550

3.3.5 Flaring Incidents reported to SEPA by ExxonMobil Chemical Limited

Condition 4.3.1 of the ExxonMobil Chemical Ltd Fife Ethylene Plant permit requires the licensee to submit details of flaring events to SEPA. A review of the incident reports submitted by ExxonMobil Chemical Ltd Fife Ethylene Plant in relation to flaring was carried out for the years 2017 to 2019 and the **most significant** flaring events can be summarised as follows:

Date*	Estimated Duration of Flaring (days)	Quantity of Hydrocarbons Flared (Tonnes)	Reason for Flaring Event
October 2017	3.5	6,089	Ethylene release
June 2017	1.5	2,321	Loss of feed
June 2017	5.5	9,803	Pump failure
March 2018	3	5,448	Process upset, Process gas compressor
May 2018	4	4,233	Process upset, Pump outage
April 2019	5.5	14,435	Process upset, Boiler trip
August 2019	2.5	5,859	Process upset, Boiler trip
August 2020	2.0	3,200	Power dip causing disruption of steam balance and process gas compressor trip
October 2020	2.5	4,600	Process gas compressor trip

*it should be noted that there were other dates when flaring took place (e.g. 500 tonnes and 750 tonnes of hydrocarbon flared on specific dates in November and December 2019) and the reason given was that Shell had restricted access to its ground flares (in use).

3.3.6 Final Warning Letters

SEPA issued a Final Warning letter[3] to the ExxonMobil Chemical Ltd Fife Ethylene Plant operators on 24th April 2018 and this related to flaring events which took place in June 2017. SEPA considered that there were failures in maintenance practices at the site which lead to extended periods of flaring at that time. SEPA have indicated that the maintenance issues referenced in the final warning letters were dealt with by the site operator.

3.3.7 Permit variations

SEPA has issued a series of permit variations for the ExxonMobil Chemical Ltd Fife Ethylene Plant which are intended to reduce significant flaring impacts. These require both operators to ensure that all appropriate preventative measures are taken against noise and vibration emissions through the application of 'Best Available Techniques' (BAT), including BAT for preventing and minimising flaring, with progress to be reported through an annual Flaring Prevention and minimisation review report.

The variations also require the companies to invest in new equipment that reduces the impacts of flaring (when flaring is necessary) on local communities including:

- The installation of noise-reducing flare tips in 2021;
- Developing a project plan for bringing into operation fully enclosed ground flare systems that meet specific design requirements, with timescales for implementation still to be set out.

3.3.8 Prosecution

SEPA submitted a report to the Crown Office and Procurator Fiscal Service in July 2020 for consideration of prosecution in relation to the flaring at the Mossmorran complex during April 2019 but as outlined in the introduction the circumstances surrounding this incident are outside the scope of this peer review and were not investigated by the review team.

[3] Final warning letters may be used where SEPA consider that the threat of further enforcement action is needed (SEPAs Guidance on the use of enforcement action June 2016)

4 Environmental impacts

It is evident that that the differentiation between the Shell UK Ltd operations and the ExxonMobil Chemical Ltd Fife Ethylene Plant plant is not clear to many and the local community see the Mossmorran complex as one entity that poses a risk to their health and the environment. The main concerns and issues are based on both (i) planned and unplanned flaring events and (ii)"routine" operation of the facilities. There is a high level of concern among the local community with regard to the impact of the flaring events. The ground flares at the Shell UK Ltd installation which are used by ExxonMobil Chemical Ltd Fife Ethylene Plant are first generation units (approx 35 yrs old).

The existing PPC permit for the ExxonMobil Chemical Ltd Fife Ethylene Plant installation includes a number of monitoring requirements and emission limit values for emissions from point sources (e.g. boilers). It is noted that the PPC Permit Variation 5 (PPC/A/1013494/VN05) also includes a requirement to assess and quantify fugitive emissions from the ExxonMobil Chemical Ltd Fife Ethylene Plant installation.

The following sections summarize the main concerns identified by the review team and having consulted with the local representatives.

4.1 Noise, light & vibration

The concerns amongst the local community with regard to noise and vibration refer primarily to the operation of the elevated flares at the ExxonMobil Chemical Ltd Fife Ethylene Plant installation. Local residents have said that the noise from elevated flaring at the complex is clearly audible up to 3km away. SEPA has undertaken approximately 20 attended noise monitoring visits since 2015, in response to flaring events and to gather data when there is no flaring. New equipment (that allowed continuous monitoring) became available in March 2020 and was deployed to a site near Lochgelly. SEPA continues to monitor sound levels at this location, with short sound recordings each hour to aid assessment of unattended noise measurements.

Whenever a significant flaring event occurs SEPA endeavours to provide night-time attended noise monitoring in the vicinity of the Mossmorran complex, with the chosen locations being dependent on weather conditions.

Whilst SEPA has done some noise monitoring in the past there was little information available to the review team in terms of the recorded noise levels at off-site noise sensitive locations during flaring events as SEPA stated that it is part of an ongoing investigation. The local public also referred to background noise during normal operations and noise from the nearby motorway and windfarm are also considered to be potential contributors to increased noise levels in the community.

Light from the elevated flares is considered to be very intrusive in the locality and in particular around the residential areas of Lochgelly and Cowdenbeath. The issue of the light pollution appears to be two fold in that i) the flickering of the flare at night is a distraction and interferes with people lives in their homes and ii) the sight of the elevated flares gives a perception of danger and is a sign of significant malfunction at the Mossmorran complex. The issue of light pollution is not within the remit of SEPA (Ref Appendix 2).

4.2 Air quality

Based on feedback from SEPA staff and community representatives, the issue of air quality is a significant concern for members of the local community during normal operations and also during flaring events. The

PPC permit for the ExxonMobil Chemical Ltd Fife Ethylene Plant specifies the emissions points to be monitored along with the parameters and frequency of monitoring.

The review team noted that there is ongoing air quality monitoring being undertaken by SEPA in the vicinity of the Mossmorran complex and SEPA publishes air quality reports on a regular basis on a dedicated 'Mossmorran Hub' to which there is a link on the homepage of the SEPA website. The monitoring specifically focuses on particulates in the ambient air (PM10 and PM2.5) and it indicates that there is no adverse impact on particulate matter levels from the Mossmorran complex. The review team noted that VOC and Nitrogen Oxide monitoring was carried out by SEPA in early 2019 and during March 2020. The results of the 2019 VOC monitoring did not indicate any breaches of air quality standards as a result of activities at the ExxonMobil Chemical Ltd Fife Ethylene Plant, however it is also noted that there was no prolonged period of flaring during the 2019 monitoring period. The March 2020 monitoring data had not been published at the time of writing. The review team consider that ambient monitoring for VOC and other target compounds is very important in determining any potential impacts from the ExxonMobil Chemical Ltd Fife Ethylene Plant installation. The review team also noted that there was no monitoring of the ground level flares (e.g. combustion efficiency) at the Shell UK installation.

4.3 Odour

The review team were made aware from consultations with local community representatives of frequent instances when they considered offensive odours from the Mossmorran complex were evident in the local community during periods of routine operation and flaring events.

Condition 3.2 of the PPC permit for the ExxonMobil Chemical Ltd Fife Ethylene Plant specifies a number of conditions which the operator must comply with in relation to odour (e.g. installation shall be free from offensive odour, requirement for operator to complete an odour assessment every four years). It is noted that SEPA has published a guidance document entitled "Odour Guidance 2010" and this provides very useful and practical information with regard to the management, detection and regulation of occurrences of offensive odours. However, the review team noted that the assessment of compliance with odour related conditions in the permit were not being formally recorded in a manner that was easily available or accessible and as such were unable to confirm how SEPA assesses compliance with the specific odour conditions in the permit. Also, ExxonMobil Chemical Ltd Fife Ethylene Plant were required to complete a fugitive emissions assessment at the ExxonMobil Chemical Ltd Fife Ethylene Plant by February 2020, however this assessment was not available to the review team at time of writing.

4.4 Health and Safety concerns

Many of the issues noted by the review team also had a safety aspect to them, specifically the issue of flaring and vibration had created a sense of fear amongst some of the local community. The issue of the safety at the Mossmorran complex is not within the terms of reference of this report as it is outside the scope of SEPA's remit.

5. Key recommendations

The management of the unplanned flaring events has presented significant challenges to SEPA in terms of the deployment of resources in the regulation of the site, community liaison and impact assessment. It is noted that SEPA enforcement efforts have resulted in improvements on the site and has enhanced and implemented additional positive initiatives in the communication of its regulatory activities, monitoring approaches by the provision of a dedicated web portal (https://www.sepa.org.uk/regulations/air/air-quality/mossmorran-and-braefoot-bay-complexes/). The review team acknowledge that the regulation of industries like the ExxonMobil Chemical Ltd Fife Ethylene Plant installation is complex and requires a broad range of technical expertise and personnel to be deployed by SEPA on an ongoing basis.

As outlined in the Terms of Reference for the project, the focus of the peer review is a forward looking analysis which identifies further actions that could be considered by SEPA. The recommendations below will help SEPA get a better insight into the operation of the plant, a greater handle on the risks, and provide for better community liaison.

The key findings and recommendations, which are discussed in more detail in Sections 5.1 to 5.3 below, can be summarised as follows:

1. In order to reduce the potential for significant flaring and associated off-site impacts, an assessment of the current ethylene production throughput at the facility should be carried out and proposals should be provided by ExxonMobil Chemical Ltd Fife Ethylene Plant to minimise the intake of gas during significant flaring events.
2. The deployment of a dedicated site agent at the ExxonMobil Chemical Ltd Fife Ethylene Plant should be considered as an additional measure in the regulation of the PPC permit for the installation. The dedicated site agent should be a suitably qualified and experienced expert(s). The selection and appointment of the site expert(s) would be undertaken by SEPA and would enable it to have a key regulatory presence on the site while at the same time liaising and assisting the general public on key issues of concern.
3. It is recognised that SEPA has expanded significant resources in the regulation of the ExxonMobil Chemical Ltd Fife Ethylene Plant, however, not all of this is documented in a format that is easily available to the public. SEPA should prepare detailed records of all its regulation activities (e.g. site visits, compliance and enforcement actions, monitoring) and make them available to the public on the SEPA website.
4. Implement an enhanced monitoring programme to include air and noise emissions monitoring at and in the vicinity of the Mossmorran complex. In addition, an assessment of the impact of the key emissions to atmosphere under different scenarios would assist in determining the impact of the facility on the surrounding environment.

5.1 Further interventions SEPA could consider in light of SEPA's policies and guidance, industry guidelines, actions taken to date and industry best practice.

The ExxonMobil Chemical Ltd Fife Ethylene Plant installation was commissioned in 1985 with an annual throughput of 820,000 tonnes of ethylene per annum. It is noted that the frequency and intensity of flaring has increased in recent years and minimising the frequency of flaring events and the quantity of gas flared should be central to operation of the ExxonMobil Chemical Ltd Fife Ethylene Plant installation. Having investigated some of the reported root causes of significant flaring events in recent years, the review team consider that the lack of resilience of the on-site equipment may a significant factor contributing to the occurrence of some of these incidents. A BAT assessment of the flaring was undertaken in April 2019 for the ExxonMobil Chemical Ltd Fife Ethylene Plant installation and a number of key recommendations were proposed. It is imperative that the recommendations are kept under continuous review and implemented in a timely manner.

Separately, the review team note that SEPA has committed significant resources to the regulation of the PPC permit for industries in the Mossmorran complex as well as ambient monitoring, community liaison and public engagement.

The review team propose the following recommendations which SEPA should follow up with ExxonMobil Chemical Ltd Fife Ethylene Plant or carry out itself in relation to Objective 1 of this review:

Recommendations

1. *Site infrastructure/Process/Installation*

   SEPA should require Exxon Mobil Chemical Ltd to:

   a. Assess whether the current ethylene production throughput at the facility is a significant contributory factor to the increased flaring and associated off-site impacts.
   b. Update the inventory of key infrastructure and risk assess each with a view to their replacement/upgrading on an ongoing basis to ensure a proactive approach towards management of the root causes of flaring.
   c. Provide a dedicated plan of works which focuses on the continued deployment of key BAT requirements at the installation. SEPA should consider the use of Article 14(6) of the Industrial Emissions Directive if any production process carried out within the installation is not covered by any of the BAT conclusions or where those conclusions do not address all the potential environmental effects of the activity or process.
   d. Provide proposals to limit/reduce the quantities of gas being fed to the ExxonMobil Chemical Ltd Fife Ethylene Plant installation during periods of prolonged elevated flaring. The potential cessation or reduction in intake of feedstock gas to the ExxonMobil Chemical Ltd Fife Ethylene Plant during periods of process instability / flaring may mitigate prolonged flaring events.
   e. Provide regular (i.e. no less than monthly) written updates regarding progress towards the installation of the low noise and vibration flare tip that has been proposed for the ExxonMobil Chemical Ltd Fife Ethylene Plant installation and is required by Permit.

2. *On-site Technical expertise*

   a. Consider the deployment of a suitably qualified and experienced expert(s) to act as site agent(s) on the ExxonMobil Chemical Ltd Fife Ethylene Plant installation. Their duties would include the observation and assessment of the day to day operation of the installation, to assess compliance with the PPC Permit for the facility and to monitor impacts on the surrounding locality and environment. The selection and appointment of the site agent(s) would be undertaken by SEPA.

3. *Regulatory approach*

   a. Record all visits by SEPA regulatory personnel to the ExxonMobil Chemical Ltd Fife Ethylene Plant installation and its environs (e.g. odour assessments, complaint investigations, etc). Reports of all such visits, including the main findings, should be prepared and published on the SEPA website.
   b. Undertake a review of 'Permit Variations' process and, in particular, whether on-site changes are considered to be substantial or otherwise. This review should clearly establish the criteria for deciding on what warrants a review of the PPC permit for key aspects (e.g. installation of ground flare).

c. Non-Technical summaries should be included in all 'Permit variations' issued by SEPA together with a report from the inspector for each 'Permit variation' and made available to the public on the SEPA website.

5.2 Further actions SEPA could consider to improve engagement with the community in light of SEPA's engagement with the community to date.

In line with international best practice on access to information on the environment, there is a need to ensure a policy of openness and transparency to be kept under continuous review by SEPA and improved where necessary. The review team found the dedicated '*Mossmorran Hub'* on the SEPA website to be useful and contained a lot of information and feedback from those consulted was positive. It was apparent from speaking to local community representatives and, having viewed the SEPA website, the various steps on how a member of the public can lodge an environmental complaint with SEPA is clear and easy to follow.

The provision of key information with regard to the operations at the Mossmorran complex and related environmental data is referred to on numerous occasions in this report. The review team note that community and industry representatives have all acknowledged that information sharing has improved in recent years but there is room for further improvement and enhancement of the communications programmes.

The review team propose the following recommendations which SEPA should follow up with ExxonMobil Chemical Ltd Fife Ethylene Plant or carry out itself in relation to Objective 2 of this review:

Recommendations

4. Community liaison

a. SEPA should undertake a review of the community liaison and communications programme and have regard to the delivery of a more comprehensive and improved programme, including more workshops and meetings chaired by an independent facilitator agreeable to interested parties.

b. The appointment and deployment of community liaison personnel who are sourced from within the community should be considered. This can act as a communication conduit between the ExxonMobil Chemical Ltd Fife Ethylene Plant operators, SEPA and the local communities.

5. Communications

a. Maintain appropriate records of all key compliance and regulatory actions in a standardised format and make these available to the public via the SEPA website. Likewise, all key information from ExxonMobil Chemical Ltd Fife Ethylene Plant which is submitted to SEPA should be made available to the public on the SEPA website where appropriate.

b. SEPA should consider an upgrade of its website to allow clear and easy access to different types of information (e.g. permit applications, permit variations, compliance and regulatory information). This will enhance the ability of data to be shared and information to be exchanged with the key stakeholders.

c. While the review team recognise that SEPA have a service charter and instructions on how to make an environmental complaint on the SEPA website, it is recommended that SEPA publish additional details on its complaint handling procedure for investigating and responding to complaints from the public.

5.3 Identify other monitoring approaches SEPA could consider

SEPA currently undertake a significant monitoring programme in the vicinity of the Mossmorran complex and this information is made available to the public via the dedicated Mossmorran and Braefoot Bay Complexes website which is hosted by SEPA. The regular updating of the PM10 and PM2.5 air monitoring data along with associated interpretation and commentary is a positive initiative that should be sustained. The gathering, interpretation and appropriate presentation of monitoring information is in keeping with the spirit and requirements of international best practice and also serves to provide local communities and stakeholders with assurance about the quality of their environment and will help build trust between industry, the community and SEPA.

The review team propose the following recommendations which SEPA should follow up with ExxonMobil Chemical Ltd Fife Ethylene Plant or carry out itself in relation to Objective 3 of this review:

Recommendations

6. *Ambient monitoring*
   a. A continuous noise monitoring network, which provides real-time and historic monitoring data, compliance management and audio playback should be installed in the vicinity of the ExxonMobil Chemical Ltd Fife Ethylene Plant installation. This data should be used to assess compliance with noise limits (at noise sensitive locations) which should be included in the PPC permit for the ExxonMobil Chemical Ltd Fife Ethylene Plant installation.
   b. A network of real time VOC monitors should be installed in the vicinity of the ExxonMobil Chemical Ltd Fife Ethylene Plant installation in order to enhance the air quality monitoring programme around the area.
   c. Continue to undertake field testing and investigations of any alleged off-site odour impact (using SEPAs guidance) at and in the vicinity of the ExxonMobil Chemical Ltd Fife Ethylene Plant installation. The odour assessments should continue to be carried out by ExxonMobil Chemical Ltd Fife Ethylene Plant and SEPA personnel who are specifically trained in the relevant method. Formal records of all such assessments should be maintained and included in inspection reports.

7. *Emissions monitoring*
   a. A detailed assessment of emissions from the ground flare at the Shell UK Ltd installation (that is used by ExxonMobil Chemical Ltd) should be carried out in order to assess the efficiency and capacity of the flare and to quantify the emissions from the flare.
   b. Periodic assessments of the emissions to air from permitted point sources at the ExxonMobil Chemical Ltd Fife Ethylene Plant installation and the ground flare at the Shell UK Ltd installation should be carried out at least annually by SEPA and the reports of the monitoring should be made available on the SEPA website.

8. *Modelling*
   a. Undertake a revised assessment, including appropriate air dispersion modelling, using actual emission data, to predict the impact of emissions from the ExxonMobil Chemical Ltd Fife Ethylene Plant installation from both point and fugitive sources (and including emissions from the ground flare at the Shell UK Ltd installation). Modelling should be used to model a number of different scenarios (e.g. worst case scenario, prolonged flaring impact scenario, etc).

Appendix 1

Introduction

The Scottish Environment Protection Agency (SEPA) requested the Irish Environmental Protection Agency to carry out an external desk top peer review (including telephone or video conversations) to share best practice and advice on further actions that may be taken to drive compliance at the ExxonMobil Chemical Ltd Fife Ethylene Plant (PPC/A/1013494). The focus of the peer review is to be a forward looking analysis which identifies further actions that could be considered by SEPA.

The ExxonMobil Chemical Ltd Fife Ethylene Plant was first opened in 1985 and is one of only four natural gas fed steam crackers in Europe. It takes ethane feedstock from the adjacent Shell National Gas Liquids (NGL) plant producing approximately 830,000 t of ethylene. The plant uses a process called steam cracking to produce ethylene, which involves heating ethane until it breaks down (or "cracks") to form a mixture of ethylene and small amounts of other gases, including hydrogen. This is then distilled further, in a series of processes, to give pure ethylene. Any ethane that doesn't break down is recycled, while by-products of the production process are used as fuel in the furnaces and gas turbine. It has been regulated by SEPA since 1996 and prior to that by SEPA's predecessor bodies.

The site has been the subject of significant local concern and complaints and has been prioritised for intervention by SEPA due primarily to concerns around flaring and noise.

Objectives

The main objectives of this review are:

1. To identify what further interventions SEPA could consider in light of SEPA's policies and guidance, industry guidelines, actions taken to date and industry best practice.
2. To identify if there are any further actions SEPA could consider to improve engagement with the community in light of SEPA's engagement with the community to date.
3. To identify other monitoring approaches SEPA could consider in light of SEPA's and the companies approach to monitoring to date.

Scope

The scope of this review is the ExxonMobil Chemical Ltd Fife Ethylene Plant.
In order to meet the objectives, the reviewers need a basic understanding of the regulatory history for the site since 2017.

Outside the Scope of the Review

The following are outside the scope of the review:

- This neighbouring Shell Natural Gas Liquids (NGL) plant and the associated facilities at Braefoot Bay.
- The flaring incidents that occurred during April 2019. SEPA has announced its intention to submit a report to the Crown Office and Procurator Fiscal Service for consideration of prosecution in relation to the flaring at the Mossmorran complex during April 2019 and as such this will not be included in the review so as not to compromise or prejudice any proceedings.
- An assessment of SEPAs decisions; (a) permitting decisions on applications made by ExxonMobil Chemical Ltd Fife Ethylene Plant for their PPC permit and any amendments and

SEPA initiated variations, and (b) decisions on actions relating to compliance at the site, including enforcement action.

- A review of any alleged or potential health impacts from the ExxonMobil Chemical Ltd Fife Ethylene Plant facility.

Appendix 2

Organisation	Role	Working together
SEPA	Regulate the site under the PPC Regulations to protect the environment and human health. Regulate the site under the Control of Major Accident Hazard (COMAH) Regulations on issues concerning environmental protection. SEPA cannot advise on site safety and has no powers to regulate light emissions.	We are a joint competent authority with the HSE under COMAH but managing the impacts of flaring is not a COMAH issue.
HSE	Regulate the site under the Health and Safety at Work Act to protect the health and safety of site staff. Regulate the site under COMAH on issues concerning the health and safety of people on and off site.	We work jointly on COMAH issues and meet regularly to review and share information on our work.
Fife Council	Responsible for managing and improving local air quality and regulating statutory nuisance, including light (in practice, for odour and noise, where these are not covered by permit conditions enforced and issued by SEPA).	We meet regularly and keep our partners informed on what is happening at Mossmorran and share the results of our 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 Public Health Department to assess and report on the health impacts of flaring. We also work with Fife Council and others through the Mossmorran and Braefoot Bay Community and Safety Liaison Committee.
NHS Fife Public Health Department	Responsible for the protection and the improvement of their population's health and health care.	
Public Health Scotland (PHS)	Scotland's national agency for improving and protecting the health and wellbeing of all of Scotland's people. Working with local and national partners to create places, services and communities that enable everyone to thrive.	