Air quality assessment of flaring activities at Fife Ethylene Plant: non-technical summary

Objective: This note provides a non-technical summary of the investigation into how flaring at Fife Ethylene Plant (FEP) might impact local air quality. It looked at a worst case scenario and calculated associated emissions to compare against international Air Quality Objectives.

How were the impacts offlaring on local air quality investigated?

We used a computer program to undertake 'dispersion modelling', a technique which tracks how materials released into the atmosphere are moved around by the wind and mixed with the surrounding air. This can be used to predict the amount (or 'concentration') of a pollutant that you could breathe in after it is emitted from an emission source. Using a range of conservative assumptions which produced a **hypothetical, unrealistically high worst-case scenario** (flaring rates tripled and flaring at this rate occurring 365 days of the year with black smoke), **we estimated the maximum ground level concentration of pollutants that could occur where members of the public are present as a result of emissions from FEP.**

Predictions were compared against Air Quality Objectives (AQOs) set by international bodies, including the World Health Organisation (WHO), the European Commission and the Scottish Government to protect human health from air pollution.

By ensuring the program considered **worst-case assumptions**, we were able to increase confidence that our findings would be within the AQOs during actual operation if the program indicated this was the case.

In addition to emissions from FEP, our investigation also accounted for the emissions from the neighbouring Shell Fife FNGL Plant and other non-industrial sources, such as roads, or emissions from people burning gas in their homes.

We also considered how the wind turbines near to FEP might change how the emissions are mixed in the atmosphere by including data on their location and type in the computer program. Finally, we compared the results from the computer program against previous monitoring results provided by the Mossmorran & Braefoot Bay Independent Air Quality Monitoring Review Group.

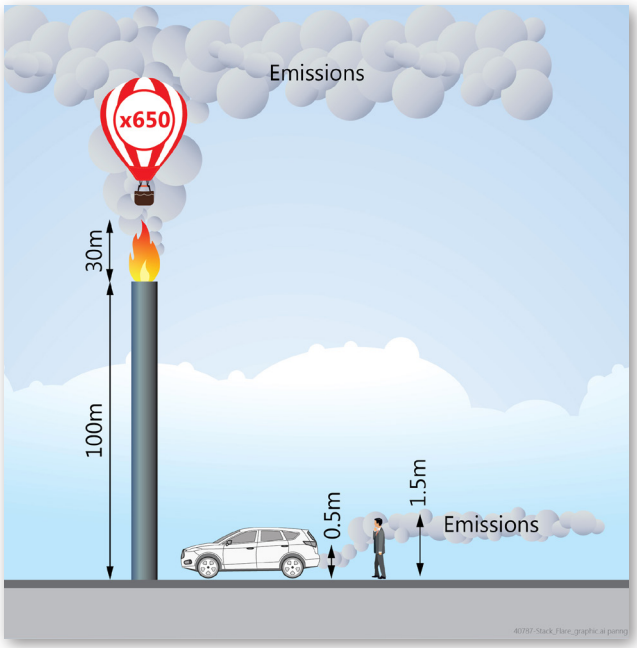
What pollutants are emitted from the flare?

The gas flared at FEP primarily consists of the same type of compounds (known as 'hydrocarbons') that are found inthe natural gas used to heat homes or to cook with, though in different quantities. When these compounds are burnt in the flare, they are mainly converted to carbon dioxide and water vapour. Neither of these are harmful to health at concentrations typically found in the atmosphere.

However, flaring can cause other materials to be created, such as nitrogen dioxide, which can affect human health when they are above certain concentrations, and it is these emissions which are considered 'pollutants'. In some cases, particularly when a large volume of gas is sent to the flare over a very short period, a process known as 'incomplete combustion' can occur. When this happens, other pollutants such as particulate matter (or 'soot') can be formed, which makes the flare look smoky. Our computer program assumed there was no steam injected to the flare, resulting in incomplete combustion and a heavily smoking flame throughout the year to represent an **extremely unlikely worst-case scenario**. We considered emissions of nitrogen dioxide, carbon monoxide, particulate matter, unburnt hydrocarbons, benzene, toluene, ethyl benzene and xylene.

What we found out

The computer model predicted concentrations of all air pollutants emitted from FEP were well below their Air Quality Objectives and, as such, unlikely to have a significant impact on air quality and human health. The predicted concentrations were much lower than those from other emission sources, such as cars and domestic heating. This conclusion is consistent with previous studies and monitoring data reported by SEPA and the Mossmorran & Braefoot Bay Independent Air Quality Monitoring Review Group. Whilst other emission sources, such as traffic, might emit a lower amount of material than a flare, these emissions occur at ground level and much closer to areas where people are present. This means there is less chance for the pollutants to mix with non-polluted air before you breathe them in. The FEP flare emissions are released 100 metres above ground level, whilst the heat released by the flare is equivalent to that which could keep approximately 650 hot air balloons in the air.



Due to this heat, the emissions continue to rise further away from the ground after they are emitted, which means there is a lower risk to health due to improved mixing and dilution within the air.

We found most pollutants emitted from the flare were predicted to contribute less than 10% of the Air Quality Objective at ground level with many being less than 1%.

Due to these low values, and the worst-case basis on which we assessed the emissions, there does not appear to be any scientific merit in undertaking further studies, such as air quality monitoring. It would be difficult for monitoring equipment to detect many of the values predicted to occur at ground level from the flare emissions.

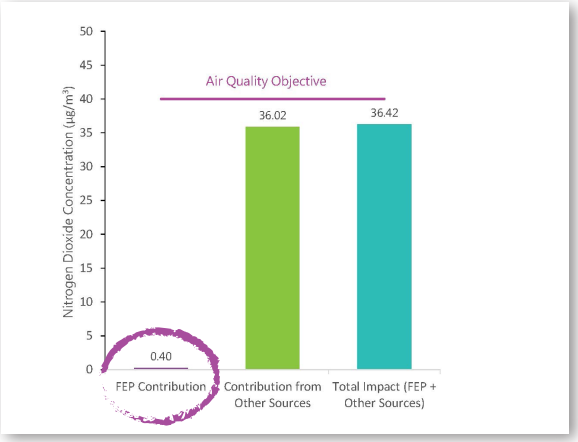


Figure 1: Predicted concentrations of nitrogen dioxide

Figure 2: Predicted concentrations of fine particulate matter

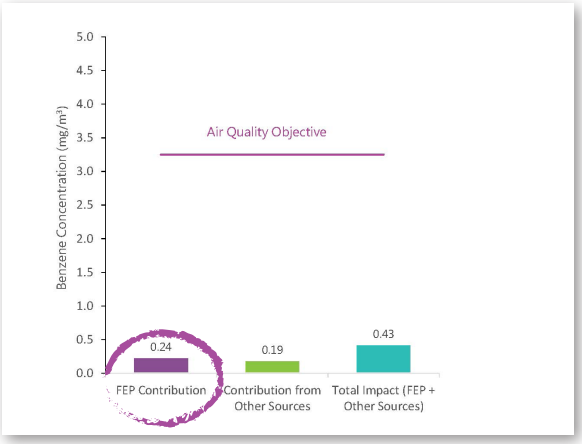


Figure 3: Predicted concentrations of benzene

What do the findings mean?

Due to the low values produced when assessing an unrealistic worst-case scenario, , it is very/highly unlikely/not possible for FEP to significantly impact the local air quality of people in Fife.

Based on the worst case scenario investigation conditions and the low levels found, there does not appear to be any scientific merit in undertaking further studies, such as air quality monitoring. It would be difficult for monitoring equipment to detect many of the values predicted to occur at ground level from the flare emissions.