Scottish Natural Heritage

Considering air pollution impacts in development management casework

Guidance

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Contents

1. Purpose

This guidance is for SNH staff dealing with planning casework involving air pollution issues, but may also be helpful to developers with proposals requiring the assessment of air pollution impacts on protected areas. It outlines the potential impacts on protected areas from air emissions produced by certain types of development, and how we consider these impacts when responding to planning consultations from local authorities and Scottish Government, or consultations from SEPA under the Pollution, Prevention and Control (Scotland) Regulations 2012 (PPC consultations).

The advice considers the direct effects of emissions of ammonia, oxides of nitrogen and sulphur dioxide on the features of protected areas. It does not address the wider consequences of greenhouse gas emissions and global warming.

2. Types of development

The types of development that most commonly give rise to potentially significant air pollution impacts on protected areas are intensive livestock units and various types of industrial scale combustion plants. These developments normally require both planning permission and a PPC licence.

2.1 Intensive livestock units

Intensive livestock units are large indoor facilities for the rearing of pigs and poultry, or for egg production. In Scotland, intensive pig and poultry units are largely concentrated in the east of the country, particularly Grampian, Tayside, Fife, Lothians and Borders. There are proposals in England and Wales for large indoor facilities for dairy cows ('super dairies'), but none to date in Scotland.

The most damaging pollutant from livestock units is the ammonia that arises from the decomposition of animal waste. The ammonia gas released can have a direct effect through increased concentrations in the atmosphere; and an indirect effect through deposition of the gas to soil and freshwater (dry deposition). The effects of ammonia gas from livestock units mainly occur over a short range, as concentrations of ammonia in the air decline quickly with distance from the source. They are therefore normally only an issue for protected areas where livestock units are located within a few kilometres of the protected area boundary.

The amount of ammonia emitted from a livestock unit depends mainly on the number of animals, but also on how the manure is managed, the ventilation system and the use of ammonia stripping devices. The spread of ammonia towards a protected area depends on the prevailing wind and the nature of the surrounding land between the development and the protected area. Some of the ammonia gas is absorbed by intervening vegetation particularly shrubs and trees. The planting of tree belts around livestock units can therefore help reduce the spread of ammonia.

2.2 Combustion plants

Combustion plants include the following different types of facility that burn a range of materials to produce electricity and/or heat for commercial or domestic supply:

- **Energy from waste incinerators** (EfW) burning a mix of industrial, commercial or domestic waste materials.

- **Biomass plants** burning plant or animal material, including wood, straw, poultry litter or energy crops eg. perennial grasses or short rotation coppiced trees.

- **Fossil fuel power stations** which are normally major developments burning coal, oil or gas.

The main air emissions from combustion plants that affect habitats and species are the gases ammonia, sulphur dioxide and oxides of nitrogen (nitrogen oxide and nitrogen dioxide, referred to collectively as NOx). Combustion plants usually release these gases into the atmosphere from a tall stack, where they react quickly with other gases in the air to form acids and nitrogen-rich soluble compounds. The nitrogen and acid can be carried considerable distances in the air before being deposited in rain droplets (wet deposition). This, together with wide ranging dry deposition, means that pollutants from combustion plants tend to be more widely dispersed than from livestock units.

Dry deposition from combustion plants can have short range impacts up to 15km, but wet deposition of nitrogen and acid can have an impact beyond this, particularly from the larger combustion plants. Long range impacts from fossil fuel power stations, can be countrywide. The only recent proposal of this scale in the UK has been for a new a coal-fired power station at Hunterston in North Ayrshire. The application was subsequently withdrawn, but it is worth noting that Scottish Government required SNH and SEPA to undertake an assessment of the air pollution impacts of the proposal. This was a large, complex task requiring the consideration of impacts on protected areas throughout the whole of the UK.

3. Air pollution impacts

3.1 Ammonia

Ammonia gas can affect plants in two ways. The direct toxic effect of high concentrations of ammonia gas in the air can result in death or damage to plants. Lichens and bryophytes are the most sensitive, but there is also evidence of a damaging effect on some higher plants. Plants can also be affected indirectly through the deposition of ammonia and ammonia compounds to the ground, which contributes to increased rates of nitrogen and acid deposition (see below).

3.2 Nitrogen deposition

Ammonia and NOx emissions contribute to an increase in the deposition of nitrogen and the eutrophication of habitats. This can alter the composition of plant communities, and lead to an overall loss of plant diversity as nitrogen-loving plants predominate. The most sensitive habitats are those supporting plant communities that are adapted to low levels of nutrient nitrogen, such as heathland, bogs, montane habitats and some types of grassland. Rivers and standing waters may also be vulnerable where eutrophication can lead to algal blooms that block out light to other aquatic plants. However, freshwater systems are typically phosphorus limited, and so nitrogen deposition can be less important than in terrestrial systems.

3.3 Acid deposition

Ammonia, NOx and sulphur dioxide emissions contribute to an increase in acid deposition and the acidification of soils and water. This affects the ability of micro-organisms to breakdown organic matter, reducing the availability of important nutrients for plants. Acidification can also release heavy metals from soils that have a direct toxic effect on plants and lock up additional nutrients.

Habitats most sensitive to acidification are those without the buffering effect of base-rich soils and water, such as bogs or moderately acidic grasslands. Acid deposition is less of a problem than it has been in the past, due to the reduction in industrial emissions of sulphur dioxide. However, the acidifying effects of ammonia and NOx emissions are probably holding back the recovery of some habitats.

4. Screening out impacts on protected areas

The assessment approach adopted by the UK country agencies, SEPA and Environment Agency is a staged risk assessment with an initial screening process. The screening thresholds described below for Scotland may differ to those applied in England, Wales and Northern Ireland.

4.1 Distance from the development

The first step in the screening process is a check for any protected areas within the range of potentially harmful emissions from a development. Screening distances vary with the type and size of development (see Table 1). Screening distances are precautionary and based on the likely dispersal of air emissions from the largest developments of each category. Any protected areas or features beyond the screening distance are not at risk, and only those within the screening distance require further assessment.

The screening distance for short range effects from coal and oil fired power stations (mostly dry deposition) is 15km, but longer range effects of wet deposition have to be considered beyond this distance. Air emissions from such facilities are likely to disperse beyond country boundaries and so may affect protected areas in other parts of the UK. You should contact counterparts in the other country agencies in such circumstances.

Table 1. Screening distances recommended for different types of development

Type of development		Screening distance (km)
Pig or poultry unit		10
EfW & biomass plants	<20MW	2
	≥20MW	15
Coal, oil or gas fired power stations		15 for short range impacts, but also longer range effects to consider

4.2 Site Relevant Critical Levels and Critical Loads

The second step of the screening process is the application of Site Relevant Critical Levels (Cl_e) and Critical Loads (CL_o) to the qualifying features of the protected areas that are sensitive to air pollutants. CL_e are the atmospheric concentration thresholds, and CL_o the deposition rate thresholds, of a pollutant below which a habitat is unlikely to suffer any damage (see Box 1). CL_e and CL_o are referred to collectively below as CL.

Box 1 Site Relevant Critical Levels and Loads

A **Critical Level** is the minimum concentration of a pollutant in the atmosphere ($\mu g/m^3$). at which habitats may be affected. Critical levels are used to screen for direct impacts of ammonia gas (annual mean of 1 $\mu g/m^3$ for habitats containing lichens and bryophytes or 3 $\mu g/m^3$ for less sensitive higher plants). They also apply to nitrogen oxides (30 $\mu g/m^3$) and sulphur dioxide (30 $\mu g/m^3$ or 20$\mu g/m^3$ for lichens), though in practice these thresholds are rarely breached.

A **Critical Load** is the minimum rate of deposition of a pollutant at which a habitat may be affected (kg/ha/yr). Critical Loads are key to screening the impacts of nitrogen and acid deposition, and vary depending on the sensitivity of the habitat affected.

It is important to note that exceedance of Critical Levels or Loads doesn't necessarily mean that a habitat will be affected, but just that below these thresholds we can be confident that there won't be any effect.

The on-line database APIS (Air Pollution Information System) provides CL for all habitat features of protected areas in the UK (see Box 2). Note that there are no CL for individual species, but there may be impacts to consider where a species is dependent on a particular habitat, and where air emissions have an impact on the habitat.

In order to screen protected area features against CL the developer must calculate the amount of additional pollutant that the protected area is likely to be exposed to as result of the development. This additional exposure is the **Process Contribution (PC)**, and can be calculated using a variety of models, or screening tools, depending on the nature of the development and the associated pollutants (see screening tools section below). For ammonia gas, the PC is the increase in the surface concentration to which the feature would be exposed ($\mu g/m^3$). For nitrogen and acid deposition it is the increase in the annual rate of deposition on the feature (kg/ha/yr).

Once the PC is known, it is added to the existing background concentration, or deposition rate, to give a measure of the total exposure of a habitat to a pollutant if the development went ahead. APIS provides background concentrations of ammonia and deposition rates of nitrogen and acid for all protected areas in the UK (see Box 2). The PC plus the existing background level of a pollutant is known as the **Predicted Environmental Concentration (PEC)**.

If the PEC of a pollutant does not exceed the CL for a feature then the additional pollution predicted to arise from the development is unlikely to have an impact on the feature and it

can be screened out of any further assessment. For many protected areas in Scotland and the rest of the UK, existing levels of pollutants to which they are exposed are close to or exceeding CL. In such circumstances, a new development may only make a small additional contribution to the overall exposure, and the screening stage allows for this. Where **PC<1%CL** the contribution from the development is *de minimis* and can be screened out of any further assessment. Note that PC estimates from the commonly used SCAIL-Agriculture screening tool (see below) are conservative, and the alternative *de minimis* screening threshold of **PC<4%CL** is normally applied.

Box 2 APIS (Air Pollution Information System)

http://www.apis.ac.uk

APIS is an on-line source of information on air pollution and its effects on habitats and species. It has been developed in partnership by the UK conservation and regulatory agencies and the Centre for Ecology & Hydrology (CEH). It aims to provide a consistent approach to the assessment of air pollution impacts across the UK.

A search facility allows the user to look up the Site Relevant Critical Levels or Loads for each of the pollution-sensitive features of all European sites and SSSIs. The system also provides predicted background concentrations and deposition rates for the different pollutants at each site or grid reference location (5km^2 resolution), and the proportion of the overall deposition arising from different sources.

The website includes a user guide, a general introduction to air pollution issues, a summary of key air pollution impacts for each pollutant-habitat combination, an overview of air pollution impacts on habitats and species in the UK, and an explanation of how the critical loads and levels have been derived.

The precautionary thresholds PEC<CL and PC<1%CL (or PC<4%CL for SCAIL-Agriculture estimates) are used to determine whether a proposal will have a likely significant effect (LSE) on the features of a European site, and therefore if an appropriate assessment is required. An appropriate assessment is only required where both of these thresholds are not met. The same thresholds apply when considering the likelihood of significant damage to SSSI features and the need for further assessment. If these thresholds are not met then it doesn't necessarily imply an adverse effect on site integrity or that significant damage to a feature will occur. It just means that further assessment is required.

4.3 Cumulative impacts

Screening must also consider the effects in-combination with other developments. The background levels of pollutants in APIS will account for operational facilities up to the date of the latest background monitoring used to generate the APIS data (3 year means 2011-2013). However, screening analysis, must also take account of available data on the additional emissions from more recent developments, and proposals still at the planning stage.

4.4 Screening tools

SCAIL-Agriculture is the most commonly used screening tool for the short range impacts of air emissions from intensive livestock unit, while another version SCAIL-Combustion is commonly used to screen emissions from combustion plants (see Box 3). The SCAIL-Combustion tool was initially designed to assess the impact of small to medium scale combustion plants (20-50MW), but the model has been validated using much larger power stations and so can be used for screening of any sized power station.

More complex dispersion modelling may be required for the larger combustion plants or where there is uncertainty regarding impacts and more detailed or accurate analysis is required. Short range dispersion models include ADMS (Advanced Dispersion Modelling System) and AERMOD (American Meteorological Society/Environmental Protection Agency Regulatory Model). FRAME (Fine Resolution Atmospheric Multi-pollutant Exchange) is a model commonly used for estimating longer range dispersal and deposition of air pollutants from large combustion plants.

Box 3 SCAIL (Simple Calculation of Atmospheric Impact Limits)

http://www.scail.ceh.ac.uk

SCAIL is a set of on-line screening tools used to consider the short range impact of air emissions. SCAIL-Agriculture is a tool for screening impacts from agricultural sources, including intensive livestock units. SCAIL-Combustion is the equivalent for screening combustion plants. The models were developed for SEPA and partners by CEH, and are maintained on CEH's web server. The tools are available to anyone for simple modelling of ammonia emissions close to protected areas.

The tools require details of the proposal. SCAIL-Agriculture requires details such as location, numbers of animals, type of housing and management of manure. SCAIL-Combustion requires details such as location, stack dimension and gas temperatures, velocities and emission rates. The models then calculate the increases in ammonia concentration and the rate of nitrogen and acid deposition on a specified protected area (Combustion), or on protected areas within a specified search radius (Agriculture), and compares these with the Site Relevant Critical Level/Loads for each sensitive habitat type within the protected areas.

The website includes a comprehensive user guide and an online tutorial that walks you through the data entry and results pages. The default results are for the closest point of the protected area to the proposed development, but specific grid references can be entered to examine particular feature locations within the protected area.

5. Assessment of potential impacts on protected areas

Further assessment is required where the initial screening thresholds have been exceeded (ie. PEC≥CL and PC≥1%CL). In these cases, we need to advise whether or not it can be concluded that there will be no adverse effect on the integrity of European sites and/or if any significant damage is likely to occur to SSSI features. No thresholds

have been identified for use in Scotland at this stage and the assessment of impacts is a matter of judgement. This will normally require advice from the relevant specialist adviser for each feature likely to be affected, and should include a more detailed examination of factors such as:

- the precise location and extent of a feature with reference to variations in pollutant levels and CL exceedance across the site, particularly when considering large protected areas;
- the current condition of a feature and other pressures the feature may be subject to, which could have a bearing on the sensitivity of the feature to increased pollution;
- the effect of any existing CL exceedance on a feature and an examination of the source apportionment information in APIS;
- any existing management measures that might be offsetting air pollution impacts.

Simple screening tools such as SCAIL tend to be conservative and describe a worst case scenario, and so more detailed dispersal modelling may help in providing a more accurate measure of the true risk to a feature. However, this can be time-consuming and costly to the applicant, and so any requirement for this should be discussed with SEPA.

6. Roles of SNH and SEPA

SNH involvement in advising on the developments described above is through the planning process, as a statutory consultee to the planning authority, or Scottish Government for the larger energy plants with an output greater than 50MW. SEPA may also consult us, because all the developments over a certain size are regulated under the Pollution, Prevention and Control (Scotland) Regulations 2012, and so require a permit from SEPA before they can operate. All the commercially operated energy power plants require a PPC permit, as do the larger livestock units (≥ 2,000 pigs/750 breeding sows or ≥ 40,000 poultry).

It is important that we liaise closely with SEPA colleagues at all stages of a development to ensure a coordinated approach to planning and PPC processes, and that we provide consistent advice regarding any air pollution impacts on protected areas. This includes any pre-application discussions or early engagement with applicants to identify any issues and how they might be resolved.

Where both planning permission and a PPC licence are required, we prefer that planning permission and PPC licence applications are made at the same time. If a planning application is submitted prior to a PPC application, then it should include a general description of the process, techniques and technology proposed, in addition to either:

a) details of processes, techniques and technologies proposed, and an assessment of environmental impact associated with technology choice, including the production of a detailed list of receptors, a description of potential impact on sensitive receptors, proposed mitigation measures and emissions standards to be achieved;

or

b) demonstration that, assuming a worst-case scenario with sensitive receptors present, the development could reasonably achieve agreed defined emissions standards through existing technology.

If this information is not provided, we may be unable to respond fully to a planning consultation, which might delay planning authority or Scottish Government decisions.

For planning consultations

SNH will:

- Undertake the initial screening exercise, including test for likely significant effect on Natura sites and the test for likely significant damage on SSSIs;
- Consult SEPA if any conservation site is screened in and the proposed development is considered a high risk ie. is a large combustion plant, incinerator or intensive livestock unit;
- Provide advice to the planning authority regarding the potential impacts on protected area features identified through the screening exercise, including advice regarding any potential adverse effect on integrity of Natura sites, for applications where any conservation site is screened in.

SEPA will:

- Confirm the adequacy and validity of air emission data submitted as part of an application for large combustion plants, incinerators or intensive agriculture facilities, for applications where any conservation site is screened in.
- Air modelling will only be assessed by SEPA at the planning stage if the facility is of a substantial size, e.g. a large power station or similar facility. It is expected that most dispersion modelling carried out for planning purposes will not be assessed.

For PPC permit determinations

SNH will:

- provide advice to SEPA regarding the potential impacts on protected area features where they have been screened in by SEPA, including advice regarding any potential adverse effect on integrity of Natura sites.

SEPA will:

- advise on the emission and dispersal modelling that the applicant is required to carry out (the degree of modelling scrutiny will depend on the risk associated with the application);
- confirm the adequacy and validity of any air emission data submitted as part of an application (this includes data with respect to any potential cumulative impacts in combination with development not covered by the latest background deposition data in APIS);
- ensure that the appropriate Best Available Techniques (BAT) are included in a proposal to minimise the emission of any potentially harmful pollutants (Horizontal Guidance Note IPPC H1: Environmental Assessment and Appraisal of BAT). The air emission and dispersal data provided by the applicant should take account of the reduction in air emissions expected from the deployment of appropriate BAT;
- Undertake the initial screening exercise, including test for likely significant effect on Natura sites and the test for likely significant damage on SSSIs.

SNH should therefore only receive PPC consultations when protected area features have been screened in by SEPA using the distance and CL thresholds described above.

The flowchart in Annex 1 summarises the steps to follow when dealing with a planning and PPC consultations involving potential air emission impacts on protected areas. We need to avoid any duplication of effort at the PPC stage; where there have been no changes to the proposal that would affect air emissions then the outputs of the screening and assessment that has been undertaken as part of a planning consultation should be considered during the PPC application determination.

7. Contact

For further advice contact:

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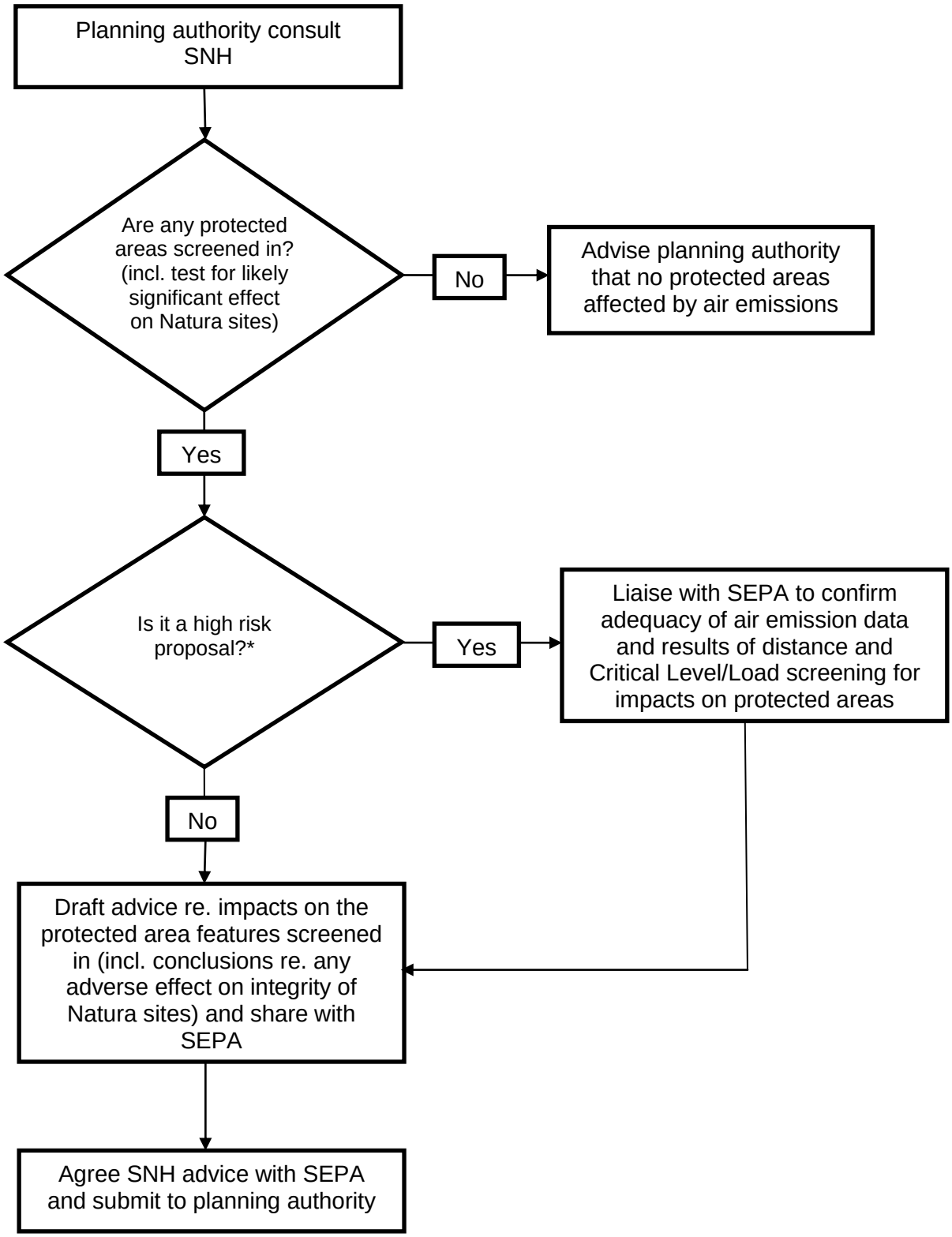
Annex 1 Procedure for dealing with planning applications with potential air pollution impacts on protected areas



***** high risk proposals are large combustion plant, incinerators or intensive livestock units