

EASR guidance:

Permit/Registration

activity:

Combustion plant

generating electricity

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DRAFT FOR ENGAGEMENT

Contents

Contents.....	1
Introduction	1
What activity does this guidance apply to?	1
What this guidance does not apply to	2
Authorisation Level	3
Key dates:.....	4
Environmental controls.....	5
Start-up and shutdown emissions for all plant	5
Emissions dispersion for all plant	5
Controls to achieve good combustion for diesel and gas engines:	7
Emissions controls for diesel and gas engines	8
Abatement techniques for diesel engines	9
Abatement techniques for gas engines	9
Emission limits and monitoring requirements for all plant.....	10
Management techniques	11
Maintenance	12
Operator training.....	12
Resource use and efficiency.....	12
Interpretation of terms	14
Disclaimer.....	16

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Introduction

This document provides information and guidance for anyone undertaking the combustion of fuel to produce electricity in plant >1MW or a combination of plant that aggregates to >1MW as set out in the Environmental Authorisation (Scotland) Regulations (EASR). It may be read alongside [the standard conditions for one or more electricity generators with a combined thermal input of more than 1 megawatt](#).

Standards described in this document are minimum requirements and these may need to be stricter if the activity is carried out on a EASR schedule 20 installation or part of a schedule 27 medium combustion plant where Best Available Techniques (BAT)/ general principles apply e.g. if an air quality impact assessment requires stricter Emission Limit Values (ELVs).

What activity does this guidance apply to?

This guidance details authorisation requirements for combustion engines used for generation of electricity only where their thermal input is > 1MW or aggregates to > 1 MW. This guidance does not apply to gas turbines used to generate electricity (which will already be compliant) or [biomass fuelled combined heat and power \(CHP\) plant which is regulated already](#).

A combustion plant is defined as any technical apparatus in which fuels are oxidised in order to use the heat thus generated, subject to the exclusions listed in EASR.

Generating combustion plant means any combustion where the energy utilised is used to generate electricity for export off-site or for use on-site, including CHP engines. We will refer to these as “generators”

Thermal input is the capacity of the generator. It is calculated using the net calorific value (CV) not the gross CV. You can ask the manufacturer for the calorific value or you can calculate it using Association of Manufacturers of Power generating Systems (AMPS) method.

What this guidance does not apply to

- Excluded combustion plant as defined in EASR schedule 26, part 3 regulation 1 sub-paragraph 2 ie:
 - Generating plant for the sole purpose of maintaining power supply at a site during an on-site emergency.
 - Testing of any generating plant for no more than 50 hours per year.
 - Generating plant with a defined nuclear safety role under a nuclear site licence issued by the Office for Nuclear Regulation.
- Any mobile plant that is:
 - Not connected to national transmission or distribution system, or is
 - Deployed for a period less than 6 months, or is
 - Meeting the requirements of the NRMM regulations.
- Generators providing electricity for placement on an island distribution system where their operation is unplanned or cannot be reasonably anticipated. This includes a plant that has not been designated as a “planned generating plant” in the authorisation but the plant is being operated to address an unforeseen distribution system outage caused by adverse weather or fault. Such plant will be designated as “unplanned generating plant” in the authorisation and will be excluded from the scope of this guidance.
- Gas turbines are already required to meet the requirements of this guidance through their authorisation issued under EASR schedule 27. SEPA does not anticipate that there will be any gas turbines with a thermal input of less than 1 MW, consequently gas turbine plant will not be included in the scope of this guidance.
- Biomass combined heat and power plants which are excluded from the scope of this guidance as evidence suggests the plants in Scotland are modern and already have a low level of NO_x emissions (less than 300 mg/m³). The cost of additional measures (e.g. Selective Catalytic Reduction) to meet the 190 mg/m³ would be disproportionate to the environmental benefit of improved air quality.

Authorisation Level

Aggregation greater than 1MW at an authorised place means any individual generating combustion plant greater than 1 MW or a combination of less than 1MW combustion plant which when combined aggregate to thermal input greater than 1 MW. The required level of authorisation is shown in Table 1.

Table 1. Table of authorisation levels for different generator activities

Authorisation Level	Activity Definition	EASR Reference
Permit	the combustion of fuel in an individual combustion plant with a thermal input greater than 1 MW that generates electricity.	Schedule 20 and/or Schedule 27
Registration	burning any fuel in combustion plants which generate electricity on the same site with an aggregated rated thermal input of 1 MW or more	Schedule 26 Part 3
Variation to permit	burning any fuel in combustion plant or plants which generate electricity on the same site with an aggregated rated thermal input of 5 MW or more	Schedule 20 and/or Schedule 27

*Schedule 27 of EASR contains the requirements of the Medium Combustion Plant Directive (MCPD) EU/2015/2193.

Any deployment of mobile generating plant for a period greater than 6 months or connected to a transmission/distribution system will require the appropriate level of authorisation. Where a mobile plant is performing a function that a static generator can provide, it will require the appropriate level of authorisation. Mobile plant that meets the requirements of the Non-Road Mobile Machinery (Type-Approval and Emission of Gaseous and Particulate Pollutants) Regulations 2018 SI764/218 (NRMM) are excluded from the scope of this guidance.

If there is a likelihood that mobile and static generators will be deployed for greater than 6 months the operator should take the appropriate measures to ensure that they have the correct

level of authorisation. SEPA may require an appropriate level of authorisation for mobile generators deployed for any length of time if there is likely to be an adverse effect on the environment.

The requirements described in this guidance can apply to generators affected by EASR schedule 27 (MCP) controls, this means:

- where the generator operates more than 50 operating hours per year, the requirements in this guidance will be placed in the authorisation.
- the exemption from emission limit values (ELVs) for MCPs that operate less than 500 operating hours no longer applies and generators operating less than this period will need to meet the limits specified in this guidance. Any plant with an agreed extension to 1000 operating hours will also need to meet the limits specified.
- ELV's are set out in this guidance and Schedule 27. If ELVs from both this guidance and Schedule 27 could apply the stricter ELV must be met.

Key dates:

- 1st of January 2029: plant burning fuel of 1 MW or more to generate electricity will need an authorisation from SEPA.
- 1st of January 2029: plant already authorised as a Schedule 27 activity (MCP) equal to or greater than 5 megawatts must have the existing authorisation varied to incorporate generator requirements.
- 1st of January 2030: operators must demonstrate compliance with emission limit values (ELVs) in authorisations.
- 31st December 2033: generators that provide electricity to an island distribution system where the main supply comes from the mainland and where their use is planned or can be reasonably anticipated, will require authorisation. This includes periods of operation to cover planned outages of the distribution system or to provide peak supply that supplements any incoming electricity feed to the island. Such plant will be designated

“planned generating plant” in the authorisation. This is subject to ministerial review by 31 December 2030.

- 31st December 2039: generators that provide electricity to an island distribution system, where their use is due to an unplanned interruption of the main power supply to the island from the mainland will require authorisation. This is subject to ministerial review by 31 December 2035.

Environmental controls

It is expected that the methods described in this section are utilised to control emissions from the electricity generating activity. Where other methods are used, they should offer at least an equivalent level of environmental protection.

Start-up and shutdown emissions for all plant

- The number of start-up and shutdowns of generators should be kept to a minimum.
- All reasonable steps must be taken to minimise emissions during start-up and shutdown.

Emissions dispersion for all plant

To ensure sufficient dispersion is not impaired by low velocity or deflection:

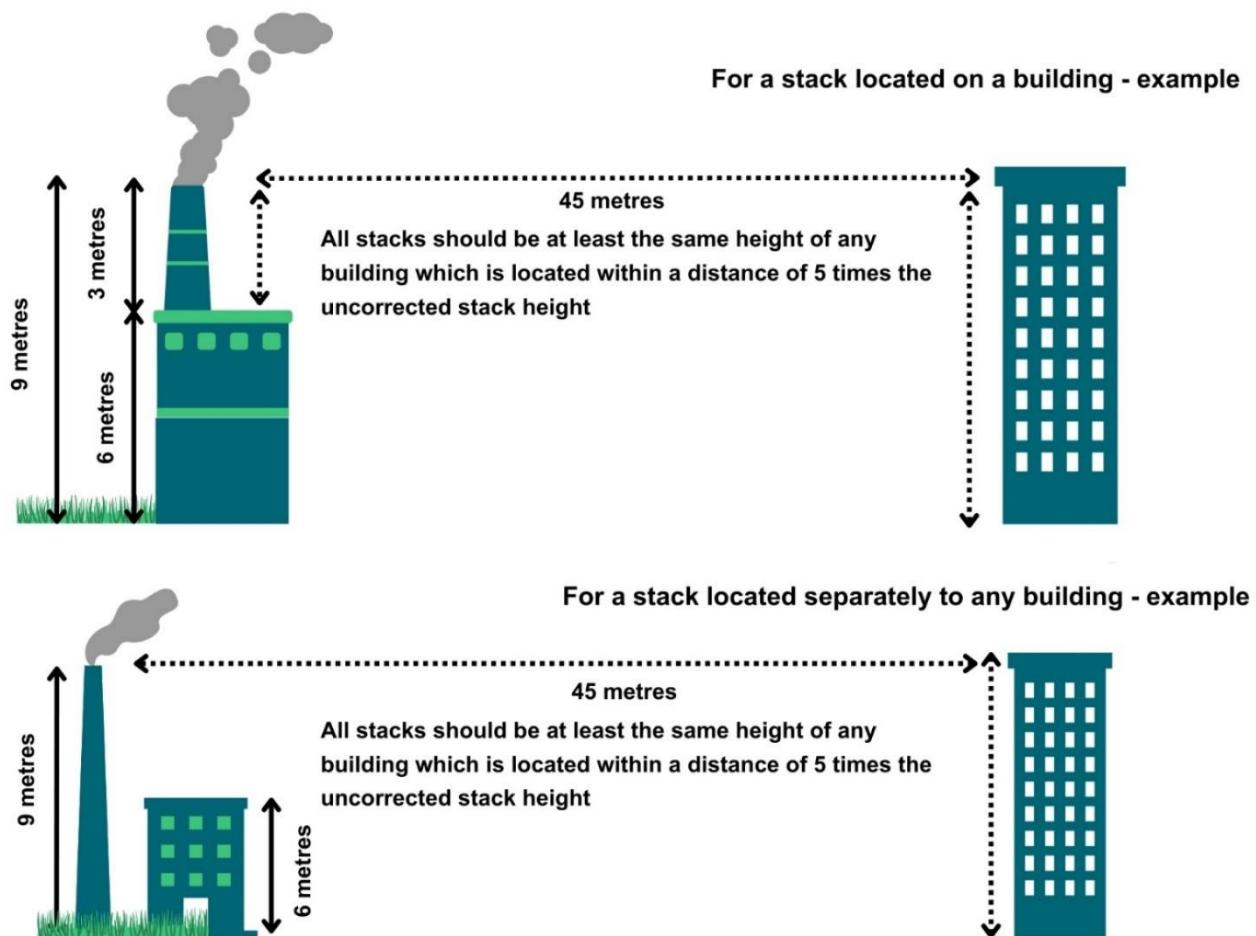
- stack(s) exit must be vertical.
- a cap or restriction at the end of the stack should not be used.
- a cone may be used to aid air dispersion.
- Emission stacks for any electricity generators must have a height as follows:
 - For a stack located on a building, the stack height must be greater than or equal to 3 metres above the building's roof ridge height; or
 - For a stack located separately to any building, the stack height must be greater than or equal to 3 metres above the ground; and

- All stacks must be at least the same height of any building which is located within a distance of 5 times the uncorrected stack height.

Emission stack height examples:

- A stack exits through the roof of a building with a roof ridge height of 6 metres. The stack will need to be tall enough to extend to at least 9 metres from the ground line of the building so that it is 3 metres above the roof ridge. As it exits through the roof, the stack won't need to be 9 metres long itself, just long enough to reach a 9 metre height from the building ground-level.
- A stack stands beside the building which it serves. The building roof ridge height is 6 metres. In this case the stack will need to be at least 9 metres tall.
- In both the above cases, there is another building located within 5 times the uncorrected stack height i.e. $5 \times 9 \text{ metres} = 45 \text{ metres}$. This building has a roof ridge height of 12 metres. Both stacks will need to be extended a further 3 metres to have a corresponding height of this additional building.

Diagram 1 on the next page shows examples of stack heights and distances from other buildings as described above.

Diagram 1: Examples of stack heights and distances

Controls to achieve good combustion for diesel and gas engines:

The aim is to minimise emissions of oxides of nitrogen and prevent any visible airborne emissions from any part of the process.

- Emissions of oxides of nitrogen can be minimised through a combination of engine combustion optimisation, flue-gas recirculation and use of Selective Catalytic Reduction (SCR) or alternative abatement.
- Emissions from combustion processes should be free from smoke during normal operations.
- Emissions of carbon monoxide and other hydrocarbon emissions should be limited through good combustion of fuel and taking steps to avoid incomplete combustion.

- Sulphur oxides must be limited by using suitable low sulphur fuels compliant with the sulphur content of liquid fuels regulations.
- Emissions of ammonia should be limited through monitoring of the dosing of reagents used in the SCR abatement.
- Flue gases can be recirculated to assist optimum combustion and reduce emissions of oxides of nitrogen.
- The following should be managed and controlled:
 - Fuel content and its feed rate.
 - Lubricating oil input.
 - Engine timing.
 - Temperature in the combustion chamber.
 - Oxygen levels.

Emissions controls for diesel and gas engines

The emissions from the electricity generation activity which require control include:

- Oxides of nitrogen (NO_x).
- Visible smoke.
- Carbon monoxide (CO).
- Ammonia, where selective catalytic reduction (SCR) abatement is utilised.

Emissions from a stack need sufficient dispersion and dilution in the atmosphere so that they do not ground at concentrations harmful to human health or the environment.

Flues and ductwork should be cleaned regularly so that a build-up of material does not affect emissions and their dispersion.

Abatement techniques for diesel engines

Selective Catalytic Reduction (SCR)

Selective catalytic reduction (SCR) uses urea as a reagent in the presence of a catalyst to convert oxides of nitrogen into N_2 , CO_2 and H_2O . Sensors identify the temperature of the gas and NO_x concentration to determine appropriate dosing.

Flue Gas Recirculation (FGR)

Flue gas recirculation (FGR) is used to reduce the levels of NO_x emitted from the engine by recirculating exhaust gases into the engine's cylinder; this reduces the amount of oxygen in the cylinder which lowers combustion temperatures and the formation of NO_x .

Not all diesel engines will be able to be retrofitted with FGR. More modern engines may already have FGR in place and still exceed the required emission limit. FGR alone is unlikely to achieve the required reduction in NO_x emissions.

Diesel Particulate Filters (DPF)

Diesel particulate filters (DPF) remove particulate matter from exhaust gases. They are often used in conjunction with SCR to protect the catalyst. DPFs require servicing to ensure continued operation – this will be specified by the installer based on estimated run hours/load profile etc.

Abatement techniques for gas engines

Gas engines will only require NO_x emissions to be addressed as sulphur and other impurities are at very low levels within natural gas.

'Lean burn' gas engines should be able to comply with ELVs. By altering the parameters of the engine – effectively 'tuning' the engine, most lean burn engines should be able to comply with the NO_x emission limit value. The manufacturer of the engine or a suitably qualified service engineer should be able to advise further.

Where a lean burn engine cannot be 'tuned' to achieve required emission limits selective catalytic reduction (SCR) may be appropriate.

Lean NO_x catalysts are an alternative to SCR and work by injecting a small amount of diesel fuel or other hydrocarbon reductant into the exhaust upstream of a catalyst. The hydrocarbon acts to convert oxides of nitrogen to N₂ and O₂. The mechanisms are analogous to SCR but use a different reductant and catalyst composition. Depending on exhaust temperatures 50% to 60% reductions of oxides of nitrogen can be achieved.

Rich burn gas engines may need a three-way catalyst, or a non-selective catalytic reduction (NSCR) unit retrofitted to achieve ELVs for oxides of nitrogen. NSCR works by passing exhaust gases from the engine through a metallic or ceramic honeycomb covered with a platinum group catalyst. The catalyst promotes the low temperature reduction of NO_x to N₂ and O₂.

The efficiency of the catalyst is directly related to the air/fuel mixture and temperature of the exhaust. As such, additional engine controls and oxygen sensors may need to be added in order to obtain the correct O₂ concentrations, and therefore NO_x reductions within exhaust gases. Typically, NO_x conversion efficiencies for NSCR systems range from 90-99%.

Emission limits and monitoring requirements for all plant

- Oxides of nitrogen (NO_x) emissions from any existing electricity generator must not exceed 190mg/m³.
- Oxides of nitrogen (NO_x) emissions from any new diesel engines must not exceed 190mg/m³.
- Oxides of nitrogen (NO_x) emissions from new gas engines as defined in MCPD must not exceed 95 mg/m³
- Other than condensed water vapour, all releases to the air during normal operation must be free from visible emissions.
- Monitoring must be carried out:
 - with reference to monitoring standard BS EN 14792
 - Within the first 4 months of starting operations and then 3 years after that, or as otherwise specified in the authorisation,

- Without adding air to dilute emission
 - During normal operations and under stable conditions.
- The sample point should be:
 - Designed according to BS EN 15259,
 - Installed, maintained and clearly marked to ensure safe and representative collection.

Management techniques

Good management techniques, training and well-maintained infrastructure are key to prevent and limit the consequences of accidents which could have an impact on the environment. For example, bunding should be used around liquid storage to contain any spillages, but good management and maintenance would take this a step further by ensuring that the integrity of the bunding is checked regularly to prevent leaks, and deliveries and movements around the site are well controlled. This will enable you to comply with environmental regulations, avoid incidents, and avoid any costs incurred through loss of resources.

- Effective control of emissions starts with proper management, supervision and training for process operators.
- Implement an environmental management system to help identify and provide a systematic approach to manage, monitor and control your environmental issues and maintain efficiency. These can be certified through ISO 140001, BS8555 or EMAS but can also be in-house.
- Develop and maintain an emergency response plans e.g. specific actions for preventing and mitigating spills or runoff that may affect water bodies. For best practice and guidance [read the CIRIA Guide to Containment Systems for the prevention of pollution \(C736F\)](#).

Maintenance

Maintenance can be categorised as ‘preventative’, or ‘corrective’ (also known as ‘reactive’). Preventative maintenance includes regular planned checks, servicing and maintenance of equipment to prevent or reduce failures and breakdowns which can lead to pollution incidents, safety concerns and costly downtime. Corrective maintenance includes identifying and repairing a fault once it has occurred with the aim of restoring equipment or systems to their optimum operational condition(s).

- All aspects of the activity plant, buildings and equipment should be properly maintained and there should be a written maintenance programme with a record that the maintenance has been carried out.
- Equipment should be used properly and preventative maintenance carried out.
- Spares and consumables should be held on site so that rapid repairs can be carried out and there is no temptation to continue operating with ineffective emission controls in place.
- Inspections should include verification of the operation of any continuous monitoring equipment, the presence of any blockages and also identification of any leaks of either odorous air or liquid.

Operator training

- Staff at all levels need to have training and instructions as to their duties to control emissions from the activity. This should include awareness of the SEPA permit/registration requirements and actions to take in response to any environmental event that may result in emissions from the activity.
- A training record should be kept for each member of staff.

Resource use and efficiency

Best practice for resource use and efficiency is to review and implement any potential opportunities to reduce emissions and wastes. In addition to reducing the impact on the environment, you will also benefit because resource efficiency is also about:

- Reducing costs (raw material and waste disposal).
- Maximising output of product or service from a given level of materials and energy (competitive advantage).
- Finding an outlet for surplus materials therefore removing them from the waste chain.
- Helping Scotland achieve its goal of becoming a zero-waste society.
- Reducing pollution risks and avoiding reputational impacts.

Resources include water, raw materials, energy, fuel and wastes used and produced throughout a regulated process. These can be managed in the following ways:

Raw materials

Raw material use should be managed by tracking stores and ensuring that all resources are stored appropriately to avoid contamination, spoilage or leaks. Automatic dosing equipment should be considered to ensure that optimum measured quantities are used throughout the process. LEAN methodologies that focus on reducing waste could be beneficial.

Water

Water should be stored in adequate containers and any pipework and taps maintained to avoid leaks and evaporation. Where possible use rainwater harvesting and recycled water.

Waste

Ensure waste is managed in line with the waste hierarchy (prevention > prepare for reuse > recycle > recover value > disposal). Segregate any waste and store appropriately to ensure that it can be managed as high up the hierarchy as possible.

Heat

Where heat is used or generated, ensure that optimum temperatures are maintained during the process; buildings, pipes and tanks should be insulated to minimise heat loss, and where possible any heat captured and used elsewhere.

Energy

Ensure energy is used efficiently across the site by monitoring energy use, ensuring any lighting, motors, compressors or other equipment is well maintained and working at optimum, rather than maximum, levels. Consider replacing with more energy efficient equipment during upgrades. Servicing to manufacturer's recommendations and preventative maintenance, instead of only reactive maintenance after plant faults, are also important in ensuring equipment works optimally.

Interpretation of terms

Term	Definition
combined heat and power plant	Combustion activity that captures and utilises the heat that is a by-product of the electricity generation process.
complete combustion	Combustion of a hydrocarbon fuel with a sufficient supply of oxygen to ensure only carbon dioxide and water are produced. Incomplete combustion would result in carbon monoxide also being produced.
emission limit value	The mass, expressed in terms of specific parameters, concentration or level of an emission, which may not be exceeded during one or more periods of time. All air emission limit values are to be calculated: (a) At a temperature of 273.15K, (b) At a pressure of 101.3kPa, (c) After correction for the water vapour content of the waste gases, and (d) At a standardised O₂ content of: (i) 6% for medium combustion plant using solid fuels, (ii) 3% for medium combustion plants, other than engines and gas turbines, using liquid and gaseous fuels, 15% for engines and gas turbines.

EASR guidance: Combustion plant generating electricity

Term	Definition
environmental harm	(a) Harm to the health of human beings or living organisms, (b) Harm to the quality of the environment, including: (i) harm to the quality of the environment taken as a whole, (ii) harm to the quality of air, water or land, and (iii) other impairment of, or interference with, ecosystems, (c) Offence to the senses of human beings, (d) Damage to property, or (e) Impairment of, or any interference with, amenities or other legitimate uses of the environment.
environmental event	• Any accident which has caused or could cause environmental harm; or • Any malfunction, breakdown or failure of plant, infrastructure or techniques which has caused or could cause environmental harm; or • Force majeure or action taken to save human life or limb.
generator	Any combustion plant that produces electricity
Megawatts (MW)	Any reference to “MW” in this document should be read as megawatts thermal input
normal operation	Operation of the authorised plant excluding periods such as start-up and shut-down operations, leaks, malfunctions, momentary stoppages and definitive cessation of operations.
oxides of nitrogen (NO _x)	Nitric oxide and nitrogen dioxide, expressed as nitrogen dioxide (NO ₂).

Term	Definition
rated thermal input	The rate at which fuel can be burned at the maximum continuous rating of the appliance multiplied by the net calorific value of the fuel and expressed as megawatts thermal.
shut-down	Any period where the medium combustion plant operates below minimum stable operating conditions.)
start-up	The starting or restarting of all or part of a process following shutdown within an authorised activity before reaching minimum stable operating conditions.
uncorrected stack height	The stack height before any required increases in height are made to account for any nearby buildings.

Disclaimer

This guidance is based on the law as it stood when the guidance was published.

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