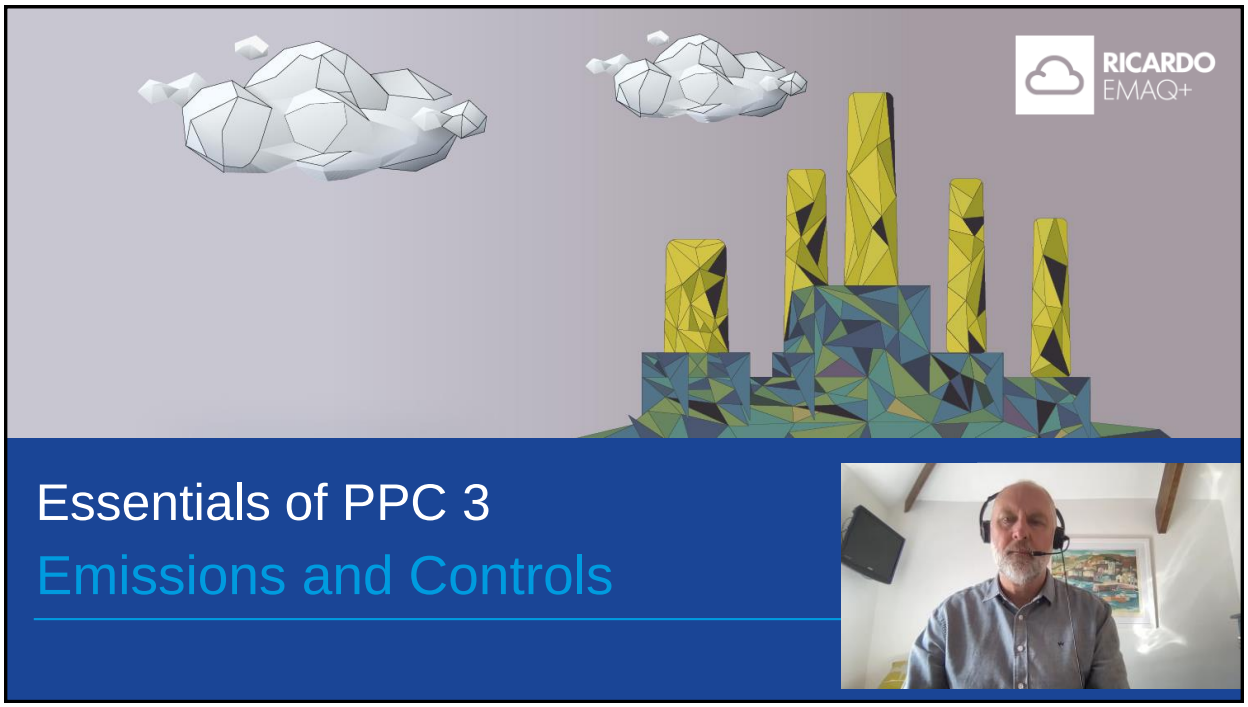
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EMAQ+
Essentials of PPC 3
Emissions and Controls

1


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RICARDO EMAQ+

Robert Stewart

- Consultant >30 years
- Knowledge Leader for Industrial Regulation
- Supported LAs in Permitting
- Emission Monitoring
- Emission Inventories

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Tim Glews

- Formally Environmental Protection manager for Dudley MBC
- Owner of T.G. Environmental Consultants, an independent business providing advice and training on all Environmental Protection issues

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4

Support to Local Authorities

At Ricardo we have a dedicated team of specialists and look forward to helping you with any of your air quality challenges:

Air quality services :

- ISO 17025 accredited **QA/QC audits** – required by LAQM TG (22)
- **Data management**, data collection, checking, validation, ratification
- **Local site operations**, calibrations/call outs
- **Web reporting -** for example : Air quality in England (airqualityengland.co.uk)
- **Routine data reporting** – weekly, monthly, quarterly, annual – for example : AQE Monthly Report (airqualityengland.co.uk)
- **Short term monitoring surveys** (site installation/decommissioning through to reporting)
- Long term station hire
- Advice on station installation, analyser procurement and, best practice
- **Low cost sensor measurements**, network management
- **Diffusion tube surveys**

Other services :

- **Expert Witness** and Expert Advice
- **LA-PPC/IPPC permit support**
- **Odour nuisance** support
- Air Quality **Modelling**
- **Real world vehicle emissions monitoring** aiding Action Planning
- **Mobile Monitoring** for point source and concentration contour mapping
- **Air quality forecasting** and public dissemination (via sms text, email, web, social media etc.)
- LAQM TG (22) Annual Status Reporting (ASR), Detailed Assessment
- CAZ/LEZ consultancy

For further information please get in touch with David Madle

07968707279 david.madle@ricardo.com

5

Programme for the day

Welcome and Introduction

Session 1: Industrial Pollutants: Emissions to Air

Session 2: Industrial Pollutants: Discharges to Water

Session 3: Industrial Pollutants: Releases to Land

Session 4: Other Pollutants: Noise and Odour

Session 5: Energy Efficiency, Resource Efficiency and Waste Minimisation

Session 6: Noise Assessments, Chimney Height Calculations and Dispersion Modelling, Water Audits and Waste Audits

6

EMAQ - Essentials of PPC 3

- Today's Pollution Prevention and Control webinar provides "An introduction to Local Authority Pollution Prevention and Control" issues.
- It forms one of a series of 5 webinars offered by EMAQ on "The Essentials of PPC".
- The following introductory slides provide a short summary of the aims and scope of this series of five webinars from EMAQ.

7

EMAQ - Essentials of PPC 3

- This webinar builds on and strengthens core EMAQ materials and the professional experience of Ricardo and partner consultancies.
- It is expected that there will be a partnership between an individual attending the webinar and that individual's sponsoring authority or organisation.
- There are 5 "standalone" webinars that, together, comprise a complete 'Essentials of PPC' Training Course:

1. **Introduction to Local Authority Pollution Prevention and Control**
2. **Permitting and regulation**
3. **Emissions and Control**
4. **Monitoring and Compliance**
5. **Management, inspection and Enforcement**

8

EMAQ - Essentials of PPC 3

- The curriculum is based on the statutory duties imposed upon Local Authorities by the pollution prevention and control regime and takes into account legislation, statutory guidance and better regulation to provide a complete understanding of The Essentials of PPC for the officers attending the series of five webinars.
- It combines the knowledge and insight of the presenters with their practical experience of environmental permitting to achieve the following outcomes:
  - **Builds officers competence to effectively understand environmental permitting duties and to appreciate what constitutes best practice;**
  - **Builds the officers confidence to regulate effectively as an environmental permitting officer operating in an industrial setting;**
  - **Provides evidence of an officers ability to effectively implement Local Authority Pollution Prevention and Control as well as Integrated Pollution Prevention and Control measures;**

9

EMAQ - Essentials of PPC 3

Obtaining PPC credits

1. **Register and identify a "supervisor".**
2. **Attend the series of 5 webinars.**
3. **Demonstrate an understanding of the webinar material – via an on-line knowledge check,** (A PPC credit will be issued for successfully passing the knowledge check in addition to the CPD certificate.)
4. **Agree a development plan with a supervisor (or mentor) which, by the end of the five webinar programme, will show evidence of the officer having satisfactorily undertaken the following practical LA-PPC applications:**
   - determining permit applications;
   - setting permitting conditions for inclusion within a permit;
   - undertaking permit inspections and successfully reporting on the inspection;
   - risk assessing permitted activities to determine appropriate subsistence fee

   (supervisor to verify officers attainment)

10

EMAQ - Essentials of PPC 3

Obtaining a Certificate in Pollution Prevention and Control

- A certificate will then be issued to those officers who have:
  - Registered;
  - Gained all 5 credits for passing the individual knowledge tests;
  - Paid the fee to take the final on-line ‘proficiency test’;
  - Successfully sat the 'proficiency test' designed to show a co-ordinated knowledge of all aspects of the Essentials of the LA-PPC course;
  - Who’s Supervisor has:
    - verified the bona fides of the candidate and that the test was undertaken under the required conditions
    - confirmed that the candidate has had experience of the practical elements of PPC listed in their development plan

11

EMAQ - Essentials of PPC 3

Details of the Knowledge Checks and final Proficiency Test

- **Internet based knowledge checks and proficiency test**
- **On-line ‘knowledge checks’ to gain the PPC credit** obtained via 20 multi-choice questions
  - Delegates can now take the test after completion of each webinar
  - 20 test questions to be completed in one unbroken 2 hour period
  - The pass threshold is 75%
  - Candidates have 3 opportunities to pass
- **Final PPC Proficiency Test** - 20 multi-choice questions, drawn from the entire Essentials of PPC syllabus
  - Delegates notified of their eligibility to take the Proficiency Test after completing all five webinars and passing all knowledge checks
  - 20 test questions to be completed within an unbroken two hour period
  - The pass threshold is 75%
  - Candidates will have 2 opportunities to complete the proficiency test.
  - Supervisor will be asked to verify the candidate’s identity and practical experience following the test

12

EMAQ - Essentials of PPC 3

Note on Scope of Today's Course

- The webinars in "The Essentials of PPC" course cover a very wide subject area and although the most important permitting related issues are addressed by the content of the webinars there may be issues on which delegates require more detail.
- For general questions concerning the course or administration of the webinars, please email EMAQ.
- For specific queries concerning LA – PPC, please take the opportunity to raise these issues with the presenter via an email to EMAQ
- EMAQ provide more detailed Advanced Technical webinars and seminars which build on the knowledge gained from the Essentials of PPC course, please see the annual training programme on the EMAQ web site for further details of what further advanced training is available.
- Thank you for supporting EMAQ, we hope that you enjoy your training.

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EMAQ - Essentials of PPC 3

Any Questions? Please Email EMAQ to receive a response emaq@ricardo.com.

Thank You

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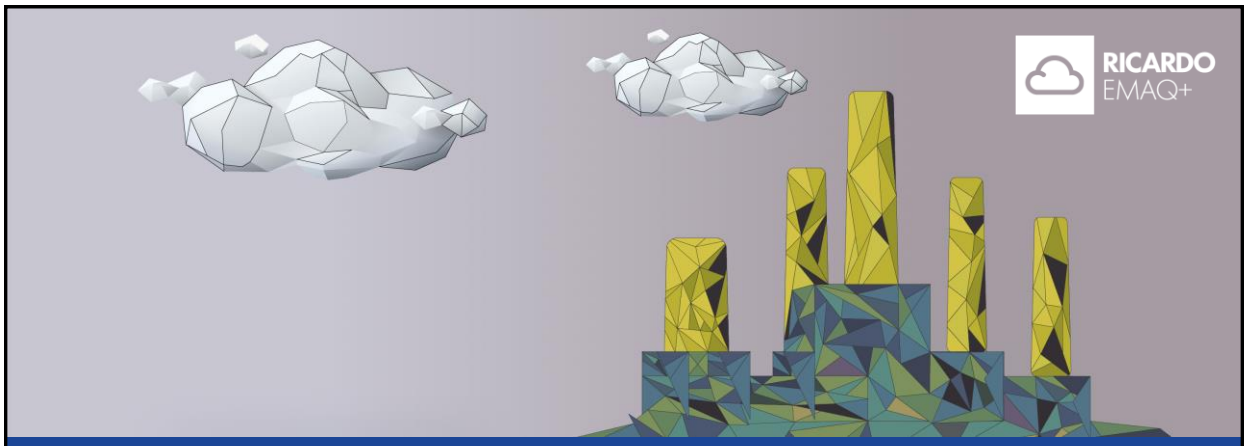

Essentials of PPC 3

Session 1: Industrial Pollutants - Emissions to Air

1

Contents

- The nature of air pollution and categories of pollutants:
  - Common air pollution types; particles, gaseous and multi-phase pollutants;
  - Common air pollution types; Acids, ozone, NO_x and SO_x, with links to air quality.
- A review of the common control techniques for the above species which are appropriate for Part B and Part A(2) permitted activities.

2

Industrial Pollutants - Emissions to Air

The Nature of Air Pollution and Categories of Pollutants:

- Common air pollution types; particles, gaseous and multi-phase pollutants;
- Common air pollution types; acids, ozone, NO_x and SO_x, with links to air quality.

3

Industrial Pollutants - Emissions to Air

The Nature of Air Pollution and Categories of Pollutants

- The aim of this presentation is to give a useful review and appreciation of the range of pollutants which need to be controlled by permitted activities and the associated control techniques that should be considered as BAT.
- It is possible to build a useful generic approach to control by categorising pollutants by looking at:
  - **Formation;**
    (i) ***Intrinsic***: e.g. sulphur or metals in fuels and feed-stocks) or,
    (ii) ***Generated***: e.g. PAH, dioxins etc.
  - **Physical state / phase** (solid or droplet phase particulates; gaseous species; multiphase species, e.g. subliming types, condensing vapours, dissolving vapours / gases and VOCs);
  - **Chemical characteristics** (e.g. acidic / basic; or oxidisable / reducable species);
  - **Nature of the associated release media** (e.g high / low temperature; dry or wet flue gases involved) – often a function of the pollution control device used.

4

Industrial Pollutants - Emissions to Air

Common Air Pollutant Types

Common Particulate Phase Pollutants:

- **Solid phase total particulate matter (grit, dust, soot, fume);**
  The most common pollutant arising from permitted activities, emitted by combustion activities, mineral activities, foundry activities, etc.;
  Often general permit conditions to prevent or minimise "visible emissions" from crossing the boundary of a permitted activity and specific conditions to control emission, such as the Ringlemann condition;
- **Solid phase metallic species (usually salts or oxides) below melting point;**
  These particulate pollutants are often evolved from the metal melting sector, such as copper and lead; PG2/08(13) sets ELV's of 20mg/m^3 for copper and copper compounds and 2mg/m^3 for lead and lead compounds;
- **Vapours comprising pollutants (Polychlorinated biphenyls, dioxins);**
  For example, dioxins (and furans) emitted from an aluminium foundry, See PG2/16(13) where a 1ng/m^3 ELV is permitted when monitored by annual extractive methods. Control normally involves good raw material choices, good process controls, especially temperature control and as an end of pipe technology, being adsorbed onto activated carbon.

5

Industrial Pollutants - Emissions to Air

Common Air Pollutant Types

Common Particulate Phase Pollutants continued:

The most common method used to remove such solid, dry particles is by interception (e.g. dry filtration). However, inertial separation (cyclone), wet arrestment and electrostatic attraction / precipitation are some of the other approaches available, to be covered later in this presentation.

- **Liquid droplets** (They are considered as particulates!):
  - Condensing vapours, i.e. below dew point (e.g. sulphuric acid mist);
  - This pollutant is likely to be emitted from permitted activities where acid scrubbing is used as an arrestment method, such as to arrest highly alkaline pollutants;
  - Or, where acid fume is the pollutant of concern from an acidic treatment activity, such as the acid pickling baths used in the pre-clean for a galvanising activity. PG2/02 (13) sets an ELV of 30mg/m^3 for Chloride expressed as HCl;
  - Dissolved vapours e.g. HCl in entrained water droplets after wet scrubbers are a potential source of acid vapours and droplet emissions.

Clearly, dry filtration would not work for such species and another approach is needed.

6

Industrial Pollutants - Emissions to Air

Common Air Pollutant Types

Common Gaseous Phase Pollutants:

- **Acid Gases** - Sulphur Dioxide (SO_2); Hydrogen Chloride (HCl); Hydrogen Fluoride (HF)];
- **Basic Gases -** Ammonia (NH_3 and Amine Species);
- **Combustion Gases –** Carbon Monoxide (CO); Carbon Dioxide (CO_2); Methane (CH_4); Oxides of Nitrogen (NOx); Products of Incomplete Combustion (PICs e.g. soot).

Common Multi-Phase Pollutants:

- **Acid Gases -** Hydrogen Chloride (HCl), in wet condensing flue gas situations;
- **Metallic Vapours –** Mercury at ambient temperatures, as well as lead, cadmium, etc at normal temperatures associated with combustion; e.g. crematoria and metal melting activities;
- **Dioxins** - Associated with combustion; e.g. metal melting;
- **Subliming Species** – e.g. Ammonium salts; as associated with flux used in galvanising activities;
- **VOCs** - e.g. Organic solvents associated with de-greasing and coating activities.

7

Industrial Pollutants - Emissions to Air

- **A review of the common control techniques for the above species which are appropriate for Part B and Part A(2) permitted activities.**

8

Industrial Pollutants - Emissions to Air

We need to consider 2 types and 3 methods of controlling emissions to air:

1. Front end **(Primary)** measures;
2. Process changes/operational changes **(Primary)** measures;
3. End of pipe solutions **(Secondary)** measures.

The measures listed above are in the order in which they should be considered and deployed at a permitted activity.

A selection of specific pollution control techniques identified as (part of) BAT are provided in Process Guidance Notes; Part B activities and BAT Conclusions/Sector Guidance Notes; Part A(2) activities.

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Industrial Pollutants - Emissions to Air

Front End Measures (Primary) Include:

- **Environmental Management Systems / good housekeeping and other management measures such as the training of operators.**
- **Strict control of input materials and wastes / residues:**
  - Source selection to eliminate intrinsic pollutants from raw materials, (eg use of low sulphur fuels);
  - Removal of a polluting raw material from the process all together; e.g. asbestos
  - Substitution of raw materials for less polluting substances; e.g. low solvent coatings
  - A waste management plan to promote re-use and re-cycling of residues and wastes and therefore the minimisation of such materials where possible.
- **Separation of feed-stocks;** e.g. removal of fine material from raw materials stock piles in minerals sector and separation of contaminants from raw materials, e.g. ferrous metals removed from non-ferrous scrap reclaimed for a non-ferrous foundry activity.
- **Totally contained storage (silos) and enclosed transfer conveyors for dusty materials;** e.g. fugitive dust control in minerals sector.
- **Suppression measures;** e.g. water sprays for wind blown dusts from loading vehicles.

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Industrial Pollutants - Emissions to Air

Process Changes / Operational Changes (Primary) Include:

- **Major process changes:**
  - Selection of a **cleaner process technology** (new plant); e.g. move to powder coatings from VOC based coatings;
  - **Major retrofit** of upgraded technology for existing plant e.g. Replacement of a wet arrestor with a ceramic filtration plant.
- **Process optimisation strategies:**
  - **Operational changes**; e.g. use of combustion monitoring and control equipment on cremators to promote the best time / temperature / turbulence burn characteristics ("3 Ts"). Part of **good combustion practise** designed to reduce emissions of combustion related pollutants from combustion activities;
  - **Minor engineering changes** to existing process technology; e.g. fitting improved secondary air injection on furnaces to reduce emissions of combustion related pollutants.

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Industrial Pollutants - Emissions to Air

End of Pipe Solutions (Secondary) Include:

Air pollution abatement and control technologies;

- Captures the pollutant to eliminate or minimise concentrations before it is emitted to air e.g. Bag filtration plant.

Dispersion measures;

- Disperses the residual pollutant into the air in a "safe" way to prevent harmful ground level concentrations occurring i.e. chimney stack terminating at a modelled height.

N.B. The above solutions may be used in conjunction with each other!

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Industrial Pollutants - Emissions to Air

End of Pipe Control Techniques for particulates, Includes:

- **Settlement Chambers -** For very coarse particulate;
- **Inertial (Multi) Cyclones -** For coarse particulate (often used in timber products industries);
- **Dry Back / Wet Back Curtain Filters** – Often used for paint spray booths, not very efficient;
- **Wet Scrubbers –** Uses water / liquid to arrest particulate matter, often considered as old technology;
- **Wet ESP –** For controlling condensing Volatile Organic Compounds;
- **Dry ESP** – Generally used in large Part A(1) and A(2) activities due to cost implications;
- **Fabric Filter -** Commonly used for a wide range of **dry** particulate emissions (lower temperatures);
- **Ceramic Filters -** Used for a wide range of **dry** particulates (higher temperatures);
- **HEPA Filters -** Commonly used for fine **dry** particulates in food and pharmaceutical sectors.

The fabric filter is often the preferred option, where dry particulate is involved, as this can often offer removal efficiencies in excess of 99% for a wide range of particle sizes.

Devices can be used in combination to control a range of particle sizes and types.

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Industrial Pollutants - Emissions to Air

Particle Control – Dryback Spray Booth (Simple)

Dry back spray booth with disposable corrugated cardboard filter. (Image from airflow Ltd)

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Industrial Pollutants - Emissions to Air
Particle Control – Wetback Spray Booth (Simple)

Wet back spray booth, showing a curtain of water running down the rear surface and water reservoir in the trough shown at the base. (Image from Ultrimax Ltd)

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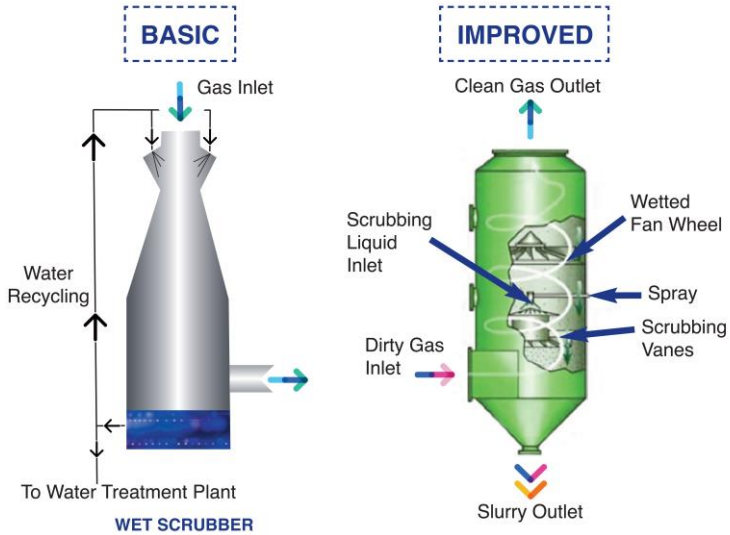
Industrial Pollutants - Emissions to Air
Particle Control – Wet Scrubbing (Complex)



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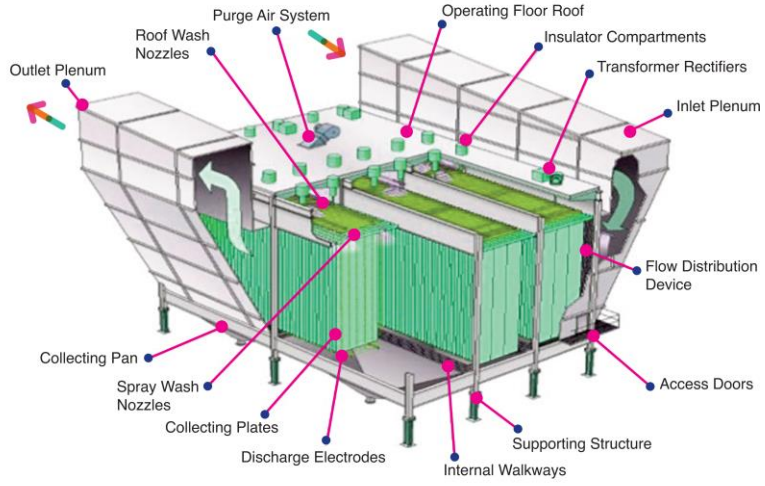
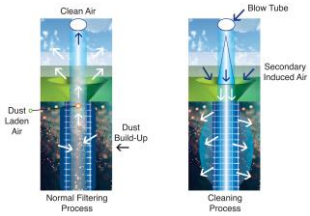
Industrial Pollutants - Emissions to Air
Particle Control – Wet Electrostatic Precipitation



Wet electrostatic precipitator

17

Industrial Pollutants - Emissions to Air
Particle Control - Dry Filtration (On-Line Cleaning)



(Image from Gwyn Thomas Ltd, Environmental Engineers)

Advantages

- High efficiency, giving concentrations <10 mg/m_3.
- Continuous operation at high gas velocities.
- Ideal for low, medium and **heavy** dust burdens.
- Robust design and very versatile.
- Low efficiency drop over time even with increased flow rates.
- Can offer additional reactive surface treatment coatings for acid gases and other species.

Disadvantages

- Compressed air supply needs to be constant, £.
- Quality of compressed air needs to be dry and free from oil and water contaminants.
- Can't handle wet particulate or wet gases.
- Temperature limitations, max 200°C.
- Can have difficulty with bursting / blinding / disengagement.

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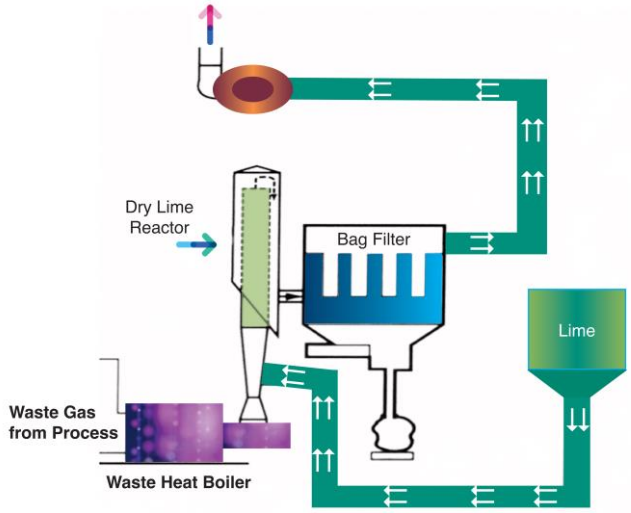
Industrial Pollutants - Emissions to Air
Fabric Filter with Dry Alkali / Sorbent Injection



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Industrial Pollutants - Emissions to Air
Bag Filter, Panel Filter and HEPA Filter Examples

Bag Filter

Panel filter

HEPA filter

Images from 'Control of Odour and Noise from Commercial Kitchen Exhaust Systems' 06-05-2022 (2nd EMAQ Edition)

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Industrial Pollutants - Emissions to Air

End of Pipe Control Techniques for Acid Gases, Includes:

- **Dry Absorption / Neutralisation.** This is dry scrubbing using an injection of fine alkaline powder, eg $Ca(OH)_2$ to neutralise acid gases. It is often used in combination with fabric filters to remove particulates and the solid salts produced (see previous slide). e.g. waste incinerators and ceramic production;
- **Semi Dry Absorption / Neutralisation.** This is semi-dry scrubbing using an injection of an alkaline slurry to neutralise acid gases. Again, often used in combination with fabric filters to remove particulates;
- **Liquid Absorption (wet scrubbing) / neutralisation.** Wet scrubbing uses injection of suitably treated liquids (usually water based) to chemically remove acid or alkaline gases. Choice of dosing agent and cooling effect means it can be used for removing other gaseous or vaporous species e.g. ammonia, mercury / heavy metal vapours/ VOCs.

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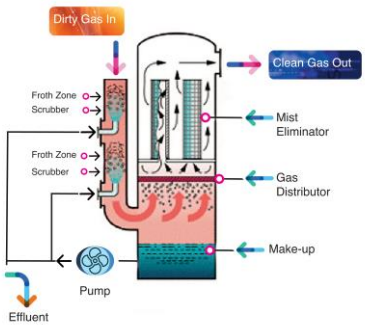
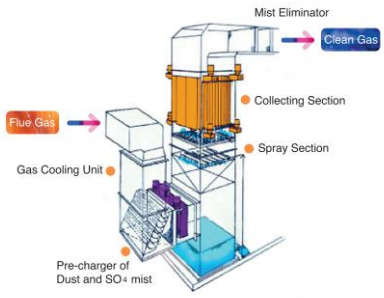
Industrial Pollutants - Emissions to Air
Wet Scrubber Examples





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Industrial Pollutants - Emissions to Air

Control Techniques for Combustion Gases, Includes:

Primary measures:

- Good selection of fuel and metered introduction of fuel (especially important if the fuel is waste material)
- Good mixing of combustion gases;
- Measures to smooth out calorific value fluctuations (Mix the raw material if it has a differential calorific value).

Process Changes / Optimisation:

- **Choice of good combustion technology;**
- **Good combustion practice, i.e. the three T's:**
  - Gas must spend sufficient **Time** in secondary combustion zone to ensure complete combustion;
  - Must be sufficient **Turbulence,** i.e. Good mixing between gas and oxygen;
  - Must be sufficient thermal energy (**Temperature**) for oxidation to occur;
  - Oxygen / fuel ratio must be acceptable to avoid starvation or quenching.

Secondary (end of Pipe) measures:

- After burners;
- Catalytic convertors.

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Industrial Pollutants - Emissions to Air

Control Techniques for Nitrogen Oxide, Includes:

Primary measures:

- Type / source of fuel used, e.g. electrical power;
- Choice of good combustion technology;
- Staged combustion measures to avoid excessive temperatures (eg low NOx burners),
- Reduction in oxygen levels (e.g. optimising excess air, flue gas recirculation, oxy /fuel burners, re-burning).

Secondary (End of Pipe) measures:

- Selective catalytic reduction (NH_3 injection / V_2O_5 Catalyst at 450^oC),
- Selective non-catalytic reduction (NH_3/urea injection at high temperature),
- Oxidation / liquid absorption ($NaClO_2$ added to scrubber liquor).

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Industrial Pollutants - Emissions to Air

Control Techniques for Dioxin and Furans, Includes:

Primary Measures:

- Eliminate dioxins and furans from feed stocks;
- Use of good combustion practice in design and operations;
- Avoiding catalytic reformation by good boiler design, tube cleaning, rapid quenching etc.

Secondary (End of Pipe) measures:

- Combined use of acid gas and particulate control devices, (also good particulate temperature control). For example, dry or semi-dry acid gas scrubbing, followed by fabric filters;
- In addition, dioxin sorbents, such as activated carbon, can be added to flue gases prior to particulate filters to enhance dioxin (and mercury) removal.

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Industrial Pollutants - Emissions to Air

Control Techniques for Volatile Organic Compounds

VOCs are mainly controlled by **Primary Measures** to manage solvent use.

Primary Measures:

- **Good house keeping measures;**
- **Product reformulation, by moving process to:**
  - High solids coatings or water-based coatings;
  - Liquid, solvent free coatings;
  - Powder coatings.
- **Process Change (by employing improved application systems) e.g;**
  - HVLP / Air Assisted / Airless / Centrifugal/ Electrostatic Spraying.

Secondary (end-of pipe) measures;

- Biofiltration; regenerative / non-regenerative adsorption;
- Wet scrubbing / Condensation / Freezing;
- Catalytic incineration or High temperature incineration.

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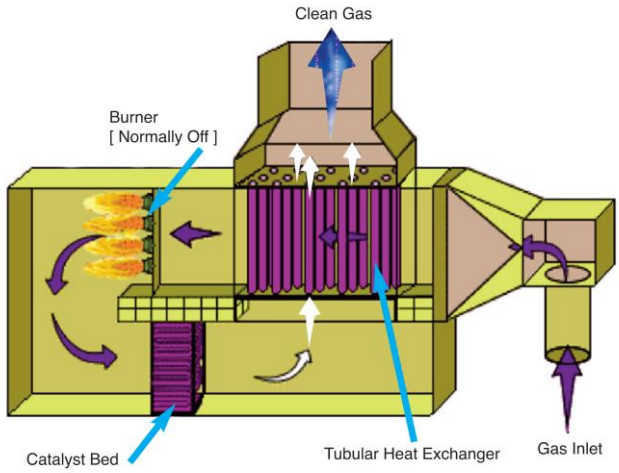
Industrial Pollutants - Emissions to Air



End of pipe VOC abatement using incineration and a catalyst

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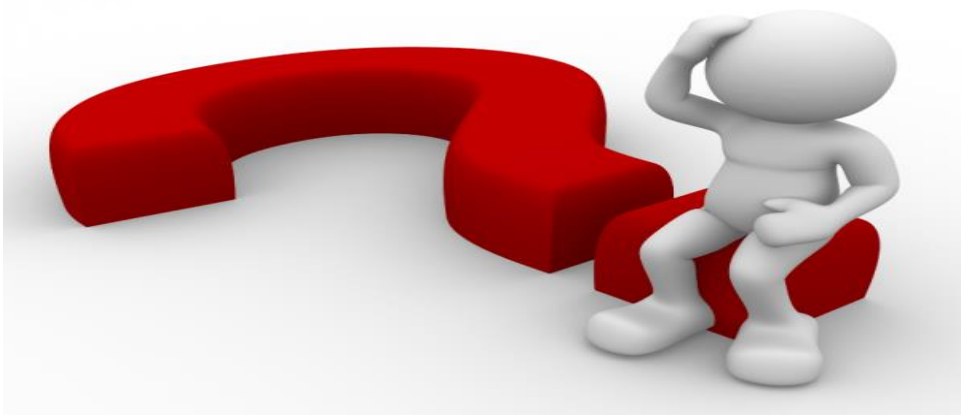
Industrial Pollutants - Emissions to Air – End of Session 1

- Any Questions? Please Email EMAQ to receive a response emaq@ricardo.com.
- Thank You



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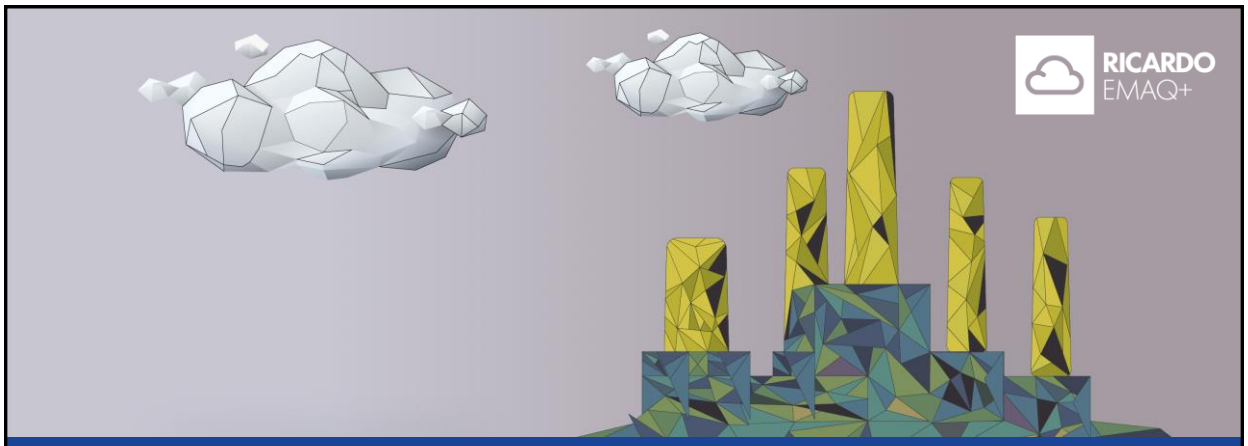


Essentials of PPC 3

Session 2: Industrial Pollutants – Discharges to Water

1

Contents

- The regulation of discharges to water and sewers.
- Define water pollution.
- Identify principal water pollutants / characteristics.
- Identify sources of pollution to water.
- Identify common control mechanisms for A(2) activities.
- Discharge to water permit conditions for A(2) activities.
- Consent to discharge for an A(2) activity.

2

Industrial Pollutants – Discharges to Water

The Regulation Of Discharges To Water And Sewers

3

Industrial Pollutants – Discharges to Water

Regulation of discharges to water

- The Environment Agency (EA) *or Natural Resources Wales (NRW)* **must** be consulted on all LA-IPPC (Part A2) permit applications.

Regulation 59 of EP Regs 2016 (for Part A2 installations)…

- Power for the Environment Agency to serve Local Authorities with a notice in respect of controls at permitted activities to protect the aquatic environment.
  - Duty on LA to implement EA notice via conditions on the permit.
  - Or stricter limit values or more onerous conditions as the LA deems appropriate.
- Early involvement of the EA/NRW is advised particularly where a permit condition is likely to be required for discharge to water issues.
- Once the permit conditions are issued there is no legal requirement for the EA to help enforce… there is an Memorandum Of Understanding.

Note: The EA/NRW will **not** assess BAT for the activity when developing water discharge conditions, the LA must determine BAT using the EA recommended conditions.

4

Industrial Pollutants – Discharges to Water

Regulation of discharges to sewers

- Operators must apply to the sewerage undertaker for a trade effluent consent, which will set the conditions for a discharge to sewer.
- The conditions generally derived for the protection of the sewer, the sewage treatment process, and compliance by the sewerage undertaker with its discharge consent of the cleaned product to a watercourse. This is not only for environmental protection purposes, but also for charging purposes to cover the cost of treating the effluent.
- The sewerage undertaker will consult the EA if a new or altered trade effluent discharge could alter the discharge on the receiving water. The EA will check whether the proposed discharge to sewer will have any significant adverse effect on the receiving water either:
  - after treatment at the sewage works, or
  - by discharge from a combined sewer overflow before reaching the sewage works.
- If an adverse effect is likely, the EA will request the sewerage undertaker to include specific requirements in the trade effluent consent.
- **For purposes of the permit, pressure tests, integrity checks, camera surveys should be standard for all such effluent transport systems on the site of the A(2) permitted activity.**

5

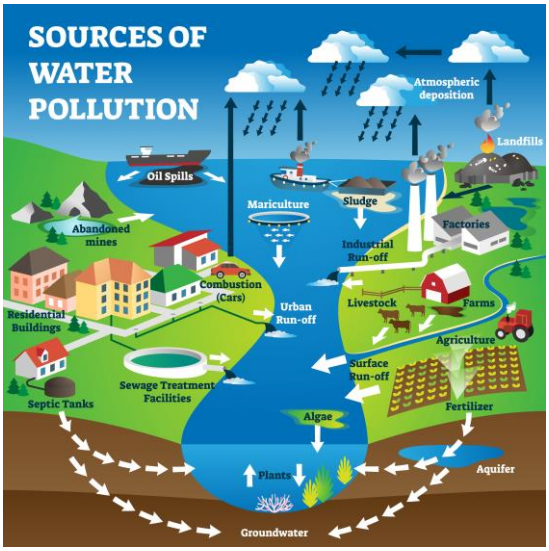
Industrial Pollutants – Discharges to Water

Define Water Pollution

6

Industrial Pollutants – Discharges to Water

Define Water Pollution



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Industrial Pollutants – Discharges to Water

Define Water Pollution

- Natural water (e.g. rivers, sea, groundwater etc) contains many dissolved and suspended substances.
- Water becomes polluted:
  - when contaminants are added at a rate which exceeds natural breakdown or dilution processes;
  - when the contamination is toxic to plant or animal life.
- The severity of pollution depends on:
  - Toxicity;
  - Persistence;
  - Bioaccumulation (the ability of a substance to be accumulated within the body of an organism).

8

Industrial Pollutants – Discharges to Water

Define Water Pollution

- Linking seriousness of a water incident to enforcement may be appropriate.

	Cat 1	Cat 2	Cat 3	Cat 4
Water quality	Persistent and/or extensive effect on water quality eg 7 days, eg 1-2km, but case specific	Significant but localised: Heavy rainbow oil film eg low dissolved oxygen and high ammonia eg all of a ditch, few100m of river	Minimal effect: Limited effect on water quality, normally only around point of discharge, but including thin oil sheen or film extending over a larger area.	No impact
Aquatic ecosystem	Major damage to aquatic ecosystems i) Destruction or major damage to fish population and/or habitat ii) Destruction or major damage to SSSI or other important aquatic wildlife habitats iii) Destruction or major impact on invertebrate populations iv) Gross and extensive contamination of bed of watercourse	*Significant damage* to aquatic ecosystems i) Significant impact on fish population and/or fish habitat ii) Significant but localised damage to an SSSI or other important aquatic wildlife habitats iii) Significant effect on invertebrate population and other aquatic fauna and flora. iv) Serious but localised contamination of bed of watercourse	*Minor damage*: bed of watercourse only marginally contaminated around point of discharge	No impact
Salmonids	more than 5	less than 5	n/a	[adults]
Brown trout and other non- migratory trout	more than 50%	10-50%	less than 10%	[individuals or trout biomass]

9

Industrial Pollutants – Discharges to Water

Identify Principal Water Pollutants / Characteristics

10

Industrial Pollutants – Discharges to Water

Identify Principal Water Pollutants / Characteristics

- **Soluble organics -** deplete oxygen.
- **Suspended solids** - cause turbidity, impair aquatic life and indirectly deplete oxygen.
- **Trace organics** (such as phenols) - cause taste and odour problems and increase the cost of water treatment. Can have a high Biological Oxygen Demand (BOD) – deplete oxygen.
- **Nitrogen** and **phosphorous** – cause eutrophication, leading to high turbidity and depletion of oxygen.
- **Heavy metals, cyanides and toxic organics** - may be acutely toxic.
- **Oil and floating material -** produce unsightly conditions and can block light, and deplete oxygen.
- **Colour** and **turbidity** - present aesthetic problems and restrict light penetration into the water.

11

Industrial Pollutants – Discharges to Water

Identify Principal Water Pollutants / Characteristics

- **Temperature and pH** (acidity/alkalinity);
- **Biochemical Oxygen Demand at 20ºC** (Determines the amount of oxygen needed for micro-organisms to bio-degrade organic waste into non-harmful matter e.g. CO_2, N_2, H_2O);
- **Chemical Oxygen Demand** (Determines the amount of oxygen needed for chemical oxidation of organic and inorganic compounds);
- **Suspended solids** (Cause turbidity and impair aquatic life);
- **Nitrogen and phosphorus** (eutrophication substances);
- **Fat, oil and grease** (FOG);
- **Specific contaminants**:
  - Toxic metals (Mercury, Cadmium, Chromium (VI), Lead, Arsenic);
  - Phytotoxic elements (copper, manganese, nickel, tin, zinc, iron, boron);
  - Other - Cyanide, Phenol, Chlorine.

12

Industrial Pollutants – Discharges to Water

Identify Principal Water Pollutants / Characteristics

- Metals and their compounds.
- Arsenic and its compounds.
- Biocides and plant health products.
- Materials in suspension.
- Substances which contribute to eutrophication (particularly nitrates and phosphates).
- Substances which have an unfavourable influence on oxygen balance (measured by BOD, COD).

GHS classification(s)
Acute Toxicity: Oral: Category 2
Acute Toxicity: Dermal: Category 1
Acute Toxicity: Inhalation: Category 2
Skin Corrosion/Irritation: Category 2
Serious Eye Damage/Eye Irritation: Category 1
Specific Target Organ Toxicity (Repeated Exposure): Category 1
Aquatic Hazard (Chronic): Category 1
Aquatic Hazard (Acute): Category 1

Label Elements
Signal word: DANGER
Pictograms(s)

Hazard statement(s)
H300 Fatal if swallowed.
H310 Fatal in contact with skin.
H315 Causes skin irritation.
H318 Causes serious eye damage.
H330 Fatal if inhaled.

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CSBP

SAFETY DATA SHEET
Sodium Cyanide Solid

ABN: 81 008 668 371

H372 Causes damage through organs through prolonged or repeated exposure.
H400 Very toxic to aquatic life.
H410 Very toxic to aquatic life with long lasting effects.
AUH032 Contact with acids liberates very toxic gas.

13

Industrial Pollutants – Discharges to Water

Identify Principal Water Pollutants / Characteristics

- Organohalogen compounds and related substances.
- Organophosphate compounds.
- Organotin compounds.
- Substances possessing carcinogenic or mutagenic properties.
- Persistent hydrocarbons.
- Persistent and bioaccumulable organic toxic substances.
- Cyanides.

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Industrial Pollutants – Discharges to Water

Identify Sources Of Pollution To Water

15

Industrial Pollutants – Discharges to Water

Identify Sources Of Pollution To Water

There are many sources of wastewater from permitted activities:

- Process activities;
- Washing/cleaning;
- Cooling processes;
- Wet abatement systems;
- Rain and storm;
- Accidental emissions/releases;
- Mopping up operation (after a spill);
- Fire fighting.

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Industrial Pollutants – Discharges to Water

Identify Sources Of Pollution To Water

There are four outlets for waste water from permitted activities:

- Sewer / drain;
- River;
- Estuary;
- Coastal waters.

The controls applicable to these outlets are derived from a range of legislation. For Part A(2) activities, BAT applies and impacts need to be prevented or minimised.

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Industrial Pollutants – Discharges to Water

Identify Sources Of Pollution To Water

- **Regulator's role – A Precautionary note:**
- **In general focus will be on the controlled discharge to sewer/water course, however, be aware that other discharges may be important.**
- AQ20/07 considers the surface water runoff from galvanizing works – until recently, the runoff from roofs and yards into surface water was widely thought to be uncontaminated. However, zinc oxide, ammonium chloride and other compounds are released when fluxed work is put into the galvanizing bath. Some fume escapes the extract hood and some fume passes the filter. It lands on roofs and yards and some is soluble in rainwater.
- Significant levels of zinc and ammonia in the runoff can be expected, for example, zinc concentrations 2.3 - 154 milligrams / litre have been measured in discharges to surface water.
- If the receiving river is designated as a freshwater fishery under the Freshwater Fish Directive, then it has a statutory target for zinc and also for total ammonium and un-ionised ammonia.
- **It's important to consider all sources of pollution.**

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Industrial Pollutants – Discharges to Water

Identify Common Control Mechanisms For A(2) Activities

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Industrial Pollutants – Discharges to Water

Identify Common Control Mechanisms For A(2) Activities

For each wastewater stream the following questions should be addressed:

1. Can the quantity and contamination level be reduced or eliminated by process optimisation?
2. Can the streams from different parts of the plant be collected separately?
3. Can the streams be reused or recycled on site (after treatment)?
4. Should any of the streams be treated separately or jointly with other streams?

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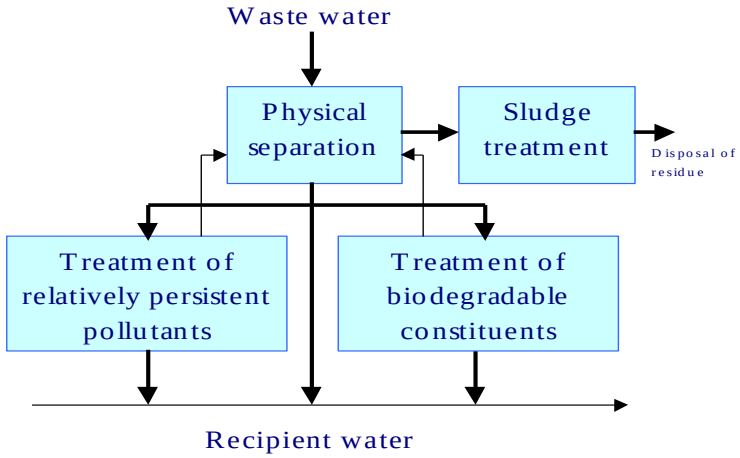
Industrial Pollutants – Discharges to Water

Key Flows in Waste Water Treatment



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Industrial Pollutants – Discharges to Water

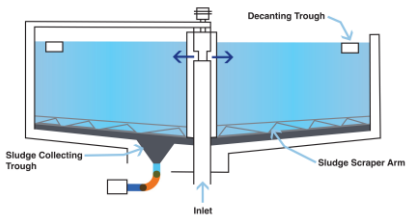
Physical Separation – (Primary / Secondary)

Aimed at suspended solids and insoluble liquids:

- Grit separation;
- Coagulation/flocculation;
- Sedimentation;

- Air flotation;
- Coarse filtration (sand/gravel);

- Membrane filtration;
  - micro-filtration (MF) and ultra-filtration (UF).
- Oil water separation.



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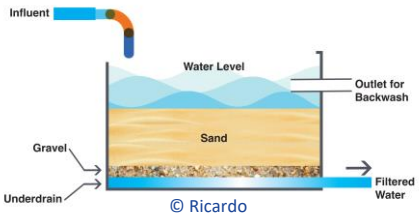

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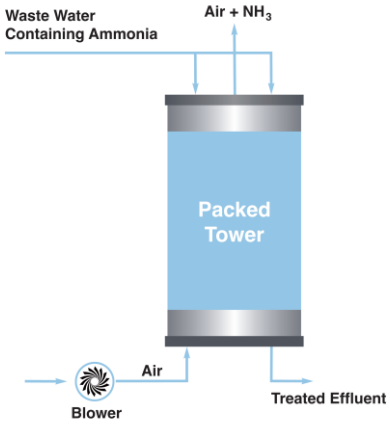
22

Industrial Pollutants – Discharges to Water

Treatment of Relatively Persistent Pollutants - (Secondary/Tertiary)

Aimed at the removal of inorganic and poor or non-biodegradable components:

- Precipitation;
- Crystallisation;
- Oxidation (chemical, wet air)
- Chemical reduction;
- Chemical hydrolysis;
- Nano-filtration, reverse osmosis;
- Other: adsorption, ion exchange, extraction, distillation / stripping, evaporation, incineration.



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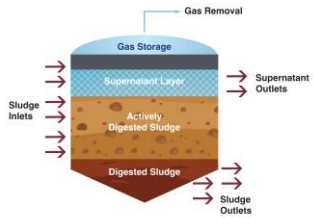
23

Industrial Pollutants – Discharges to Water

Biological Treatment - (Secondary / Tertiary)

Aimed at removal of biodegradable soluble content and selective metals and sulphur:

- **Anaerobic treatment;**
  - anaerobic contact process, up-flow anaerobic sludge blanket (UASB) process, fixed bed filter process, expanded or fluidised bed anaerobic process.
- **Aerobic treatment;**
  - activated sludge process, trickling/percolating filter process, expanded bed process, biological NandP removal process.



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Industrial Pollutants – Discharges to Water

Sludge Treatment

Aimed at treatment, recycling and / or disposal:

- Bio-solids destruction (by aerobic or anaerobic digestion process);
- Solids concentration (thickening);
- Solids de-watering (drying beds, centrifugation, vacuum filtration);
- Organic solids destruction (incineration);
- Disposal (landfill).

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Industrial Pollutants – Discharges to Water

Simple On-site Treatment Systems

Dedicated wastewater treatment facilities may vary:

- simple traps (sumps, silt traps, oil interceptors);
- simple treatment (e.g. neutralisation tank);
- complex treatment (full wastewater treatment plant).

The treatment technique chosen must be appropriate to the types of contamination, on-site constraints and environmental benefits to be gained, so as to meet the emission limit values demanded by the regulator of the operator.

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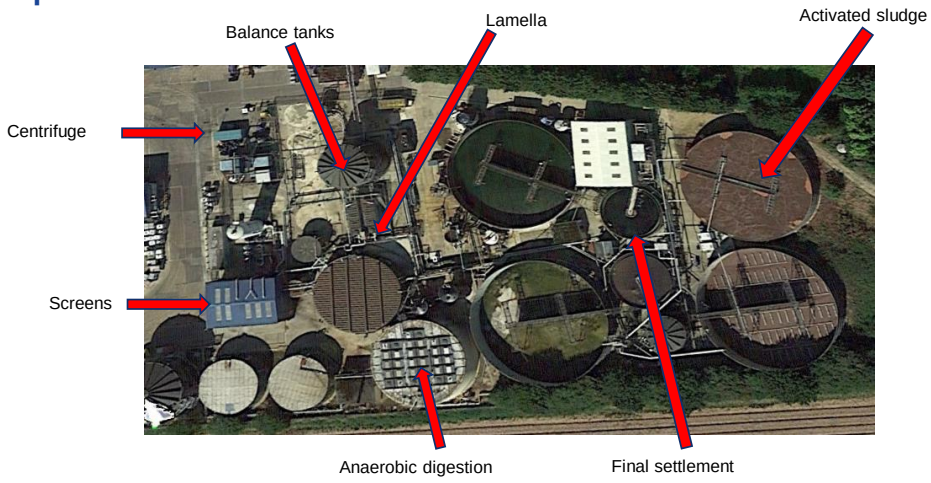
Industrial Pollutants – Discharges to Water

Example Effluent Treatment Plant



Google Earth (2023) https://earth.google.com

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Industrial Pollutants – Discharges to Water

Discharge To Water Permit Conditions For A(2) Activities

28

Industrial Pollutants – Discharges to Water

Discharge To Water Permit Conditions For A(2) Activities

For example, SG3 requires as BAT:

- All emissions are controlled, as a minimum, to prevent a breach of water quality standards;
- Run-off from the installation shall be controlled and managed and where necessary (given the nature of the run-off) treated before discharge in a suitable effluent treatment plant;
- Process effluent shall be kept separate from surface drainage unless agreed with the regulator;
- There shall be no intentional point source emissions of List I and List II substances to groundwater.

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Industrial Pollutants – Discharges to Water

Discharge To Water Permit Conditions For A(2) Activities

For example, SG3 requires as BAT; continued:

- The operator shall have a clear diagrammatic record of the routing of all installation drains, subsurface pipework, sumps and storage vessels including the type and broad location of the receiving environment; (Ref:BAT 57)
- The operator shall identify the potential risk to the environment from drainage systems recorded by BAT 57 and shall devise an inspection and maintenance programme having regard to the nature and volume of waste waters, groundwater vulnerability and proximity of drainage systems to surface waters;
- All sumps should be impermeable and resistant to stored materials;
- All storage tanks should be located within bunds that are designed, constructed and located to appropriate standards and ensuring that the volume is more than 110% of the largest tank.

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Industrial Pollutants – Discharges to Water

Discharge To Water Permit Conditions For A(2) Activities

For example, SG3 requires as BAT; continued:

- The appropriateness of the monitoring requirements will vary depending upon the sensitivity of the receiving water and should be proportionate to the scale of the operations, nature of the discharge and receiving water. For each release point the following information is required:
  - The specific volume flow from the process to sewer/controlled water;
  - The sensitivity of the receiving water;
  - The volume of discharge compared to the percentage dry river flow of the receiving water.

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Industrial Pollutants – Discharges to Water

Consent To Discharge For An A(2) Activity

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Industrial Pollutants – Discharges to Water

Consent To Discharge For An A(2) Activity

Discharge consents:

- The Environment Agency issue consents to discharge with respect to discharges to water courses, while the sewerage undertaker (water utility company) issues discharge consents for the discharge of trade effluent to sewers;
- The EA should supply the Local Authority regulator with details of any consents to discharge relating to an A(2) activity together with details of any previous breaches, prosecutions, etc;
- A Part A(2) permit condition supersedes an EA consent to discharge, but consents remain in force unless they are formally revoked by the Env Agency;
- The A(2) permit will normally contain a condition to require the operator to comply with the consent to discharge requirements, thereby fulfilling the requirements of both the permit and the discharge consent.

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Industrial Pollutants – Discharges to Water

Consent To Discharge For An A(2) Activity

Example of excerpts from a consent to discharge:

1.2 **Place of Discharge**

1.2.1 The Discharge shall be made in the manner and at the place specified as:

a via a 100 millimetre diameter pipe;

b discharging to unnamed tributary of Willingford Stream (Tributary of the River Dudwell);

c at National Grid Reference TQ 65967 19140;

d shown marked "Discharge Point" on Site Plan attached to this consent.

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Industrial Pollutants – Discharges to Water

Consent To Discharge For An A(2) Activity

Example of excerpts from a consent to discharge, continued:

1.3 **Sampling Point Requirements**

1.3.1

a A sample point shall be provided and maintained at National Grid Reference TQ 65966 19147, as shown marked 'Sample Point' on the attached Site Plan, or some other point as agreed in writing with the Agency, so that a representative sample of the Discharge may be obtained.

b The Consent Holder shall ensure that all constituents of the Discharge pass through the said sampling point at all times and in any legal proceedings it shall, for the purposes of Section 10 of the Rivers (Prevention of Pollution) Act 1961, be presumed, until the contrary is shown that any sample of the Discharge taken at the said sampling point is a sample of what was being discharged into controlled waters

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Industrial Pollutants – Discharges to Water

Consent To Discharge For An A(2) Activity

Example of excerpts from a consent to discharge, continued:

1.4 **Volume**

1.4.1 The volume of the Discharge shall not exceed 12.6 cubic metres per day.

1.5 **Composition**

1.5.1 The Discharge shall not contain more than:

a 20 milligrammes per litre of biochemical oxygen demand (measured after 5 days at 20°C with nitrification suppressed by the addition of allyl-thiourea);

b 30 milligrammes per litre of ammoniacal nitrogen (expressed as N);

c 20 milligrammes per litre of suspended solids (measured after drying at 105°C).

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Industrial Pollutants – Discharges to Water

Consent To Discharge For An A(2) Activity

Example of excerpts from a consent to discharge, continued:

8 **Recording and Reporting**

8.1 **a** The Consent Holder shall establish and operate a documented maintenance programme and record all non-routine actions undertaken that may have adversely affected effluent quality. Copies of the programme shall be made available for inspection by the Agency's officers at all reasonable times.

b On request the Consent Holder shall supply the Agency with a written report on the maintenance and all non-routine actions that may have adversely affected effluent quality.

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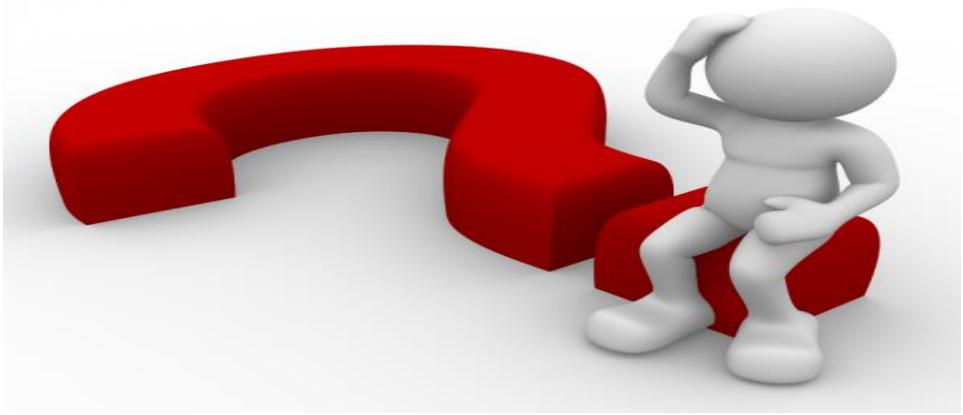
Industrial Pollutants – Discharges to Water – End of Session 2

- Any Questions? Please Email EMAQ to receive a response emaq@ricardo.com .
- Thank You



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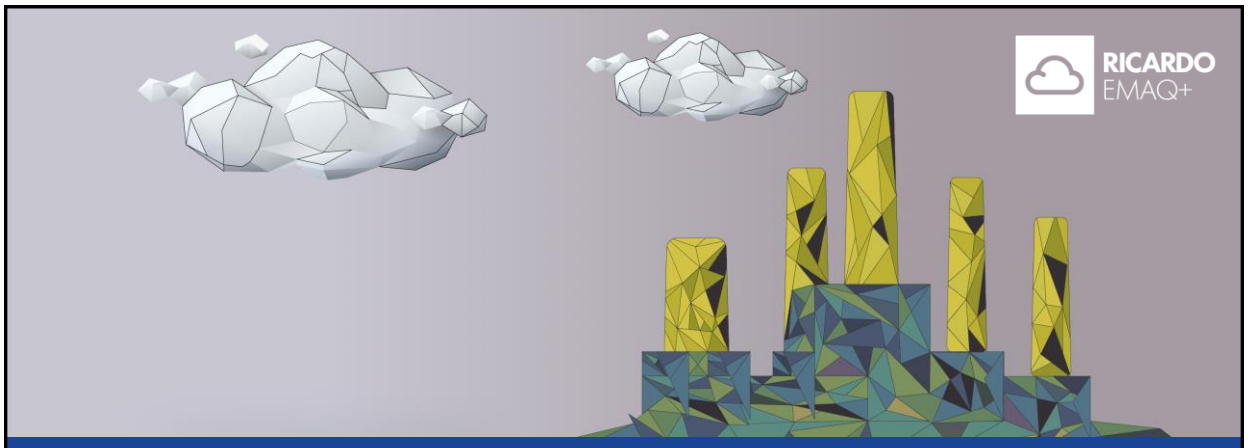


Essentials of PPC 3

Session 3: Industrial Pollutants – Release to Land

1

Contents

- Implications for LA-PPC and LA-IPPC Permitted Activities.
- The Nature of Releases to Land from Permitted Activities.
- Types of Pollutants.
- Receptors.
- Controls.
- A(2) Permit Conditions.
- Controls Summary.

2

Industrial Pollutants – Release to Land

Implications for LAPPC and LA-IPPC Permitted Activities

3

Industrial Pollutants – Release to Land

Implications for LAPPC and LA-IPPC Permitted Activities

- Releases to land are NOT an issue to be included as permit conditions for LA-PPC (Part B) permitted activities. Permit conditions only regulate emissions to air.
- The provisions of the Environmental Damage Regulations and Part 2A of the Environmental Protection Act 1990, as well as planning controls may be applied to Part B activities where land contamination has occurred.
- Releases to land from an LA-IPPC (Part A2) installation are regulated under EP Regulations where the pollutants arise from **permitted activities** on the site.
- LA-IPPC focuses on the prevention (and remediation) of land contamination arising from the permitted activity, enabling the regulator to apply conditions on contaminated land to return the regulated site to a satisfactory state (**having regard to the state of the site before the installation was put into operation**).
- An A(2) permit should have adequate provision for monitoring the site condition prior to closure due to the surrender or revocation of the permit.

4

Industrial Pollutants – Release to Land

The nature of releases to land from permitted activities

5

Industrial Pollutants – Release to Land

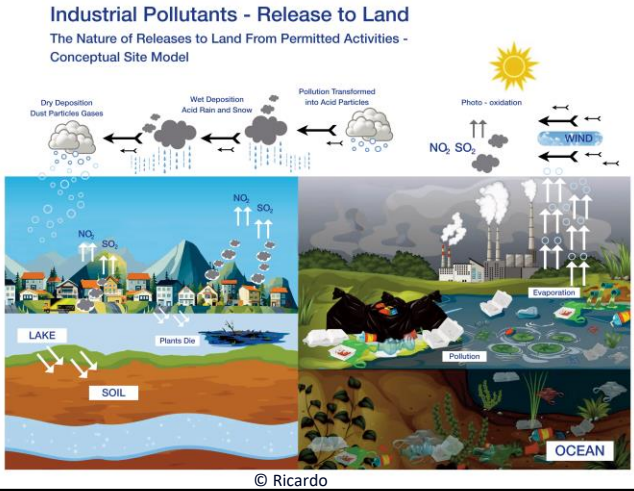
The Nature of Releases to Land from Permitted Activities

- Accidental releases to land of raw materials, product, wastes or residues from the permitted activity.
- The consequences of an incident due to water run-off from the measures by the fire service to address the incident, fire water or water to dilute the concentration of substances spilt during the incident.
- Surface or foul water drainage can cause release to land (ground water) as well as run-off from hard standing or roofed areas.
- In addition, abatement technologies for air and water discharges can generate pollutants which could be released to land.
- Contamination of the land can be a problem in itself or as a reservoir of polluting potential for groundwater and the wider aquatic environment.

6

Industrial Pollutants – Release to Land

The Nature of Releases to Land from Permitted Activities - Conceptual Site Model



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Industrial Pollutants – Release to Land

The Nature of Releases to Land from Permitted Activities

- For an LA-IPPC activity, a release to land is a polluting emission caused by the permitted activity.
- The aim of LA-IPPC is to take preventative measures against pollution to ensure no deterioration of a site during operation of the plant. Article 11 of the Industrial Emissions Directive (referenced by EPR Schedule 7 for Part A activities) requires that on closure of the site, measures are taken ‘to avoid any pollution risk and restore the site to a satisfactory state’.
- Preventative measures, **evidence** of absence of spillages or other releases and accurate maintenance records (or remediation work where undertaken) can all form part of a submission to a Local Authority to surrender an A(2) permit.

8

Industrial Pollutants – Release to Land

The Nature of Releases to Land – Poor Materials Storage and Management

Images from Tim Glews

9

Industrial Pollutants – Release to Land

The Nature of Releases to Land – Accidental Spillage of Heating Oil

Image from Tim Glews

10

Industrial Pollutants – Release to Land

Types of Pollutants

11

Industrial Pollutants – Release to Land

Types of Pollutants

- This essentially depends on the permitted activity under consideration: For example;
  - Sludges from wet arrestment systems and clay storage areas at heavy clay goods activity sites,
  - Solvents / VOC's at the sites of permitted surface coating activities,
  - Slag at permitted metal melting activities,
  - More generally, oils and grease from deliveries / storage / use where mechanical equipment is used.
- Raw materials, products and process wastes / residues can all result in land contamination;
- The summary of releases for a permitted A(2) activity can be found in the BAT Conclusion or Sector Guidance (SG) note, this describes specific materials / pollutants which may potentially be released to land by the permitted activity.

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Industrial Pollutants – Release to Land

Types of Pollutants

SG6: Secretary of State's Guidance for the A2 Surface Treatment using Solvents Sector.

The summary of releases in SG6 lists releases to land including solid waste or sludge, metals, oils and greases for a variety of activities undertaken in the sector.

In addition it comments that:

'Release to air may also be released to land or water depending upon the abatement technology employed, e.g. via collected dusts, sludge's or liquors;'

Good management of abatement waste is a basic and essential permit condition requirement.

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Industrial Pollutants – Release to Land

Types of Pollutants

SG 6 Secretary of State's Guidance for the A2 Surface Treatment using Solvents Sector.

Releases to land are also identified in the environmental impacts of permitted activities covered by the Sector Guidance note.

For example, for delivery, storage and handling of raw materials:

- Spillage of solvent during off-loading, leakage from storage and process pipe-work, accidental spillage;
- Spillage of dry powder materials during off-loading, handling and transfer operations.

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Industrial pollutants – Release to Land

Types of Pollutants – Oily Spillages on Hard Standing and Soft Surface

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Industrial Pollutants – Release to Land

Receptors

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Industrial Pollutants – Release to Land

Receptors

- In addition to potential impacts on the health of **people and animals**, releases to land can have adverse effects on the environment via **surface water, vegetation, building materials and services / utilities.**
- A key feature of the permit application for an LA-IPPC activity is that it should clearly identify where any foreseeable emissions from the activity into (or from) the site could arise.
- The site 'baseline' report should provide information on potential (or actual) sources of substances on a site as well as identifying pathways for substances and relevant receptors.

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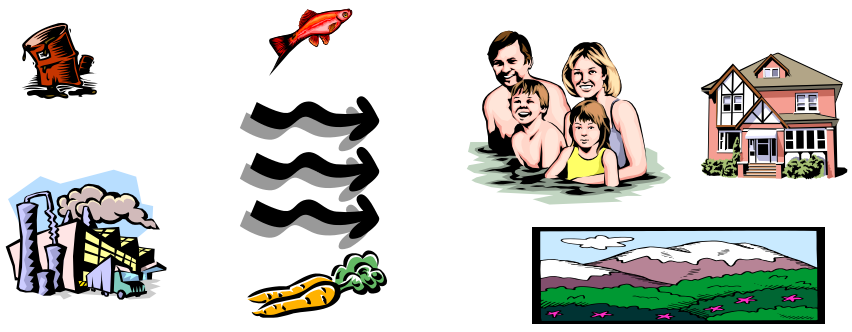
Industrial Pollutants – Release to Land

Receptors: The Source – Pathway – Receptor Model

Source Pathway Receptor



Break the pathway to provide protection

Image from Tim Glews

18

Industrial Pollutants – Release to Land

Controls

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Industrial Pollutants – Release to Land

Controls

BAT Conclusions (where available) define BAT as do SG Notes in the absence of BAT conclusions, BAT includes an obligation on the operator of the permitted activity to undertake the following measures:

- Ensure that permitted activities are controlled to minimise spillage, leaks and fugitive emissions (dust) from the permitted activity;
- Storage areas are hard-surfaced, regularly inspected to check on condition and repaired as required to maintain protection in the case of spillages occurring;
- Delivery connections are located within bunded/contained areas, bulk storage tanks are bunded (110% capacity of the largest container);
- Maintain a high standard of housekeeping.

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Industrial Pollutants – Release to Land

Controls

- Fitting of high level alarms on storage silos and interlocking substance delivery to prevent overfilling and subsequent spillage;
- Monitoring of transfer pipes and vents during filling operations;
- Use of enclosed transfer systems from storage silos to the permitted activity processes for dusty materials and liquids (solvents);
- Recover / recycle residues where possible;
- Monitoring / investigation of integrity of transfer pipework;
- For some installations this will include sewers and underground pipework and sumps, etc.

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Industrial Pollutants – Release to Land

A(2) Permit Conditions

22

Industrial Pollutants – Release to Land

A(2) Permit Conditions

The permit should include conditions which disrupt the source-pathway-receptor model, reference the the BAT Conclusions / SG Note; for example:

- **Run-off** from raw material storage areas **should** be **channelled / transported** to **suitable effluent treatment plant** to prevent or minimise discharge of pollutants from the permitted site.
- All effluent treatment plant, including **interceptors should** be:
  - impermeable;
  - visually inspected weekly; and
  - have an annual maintenance inspection. Prior to this inspection all contents to be removed;
  - All inspections to be recorded in writing and the records made available to an authorised officer of the Council on request.
- All storage tanks **should** be surrounded by a **bunded** area **impervious** to the material being stored in the tanks. The bunded area to be capable of storing **110% of the capacity** of the largest tank within the bund.

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Industrial Pollutants – Release to Land

A(2) Permit Conditions

- The operator **should** produce an **accident management plan to** identify the hazards, assesses the risks and measures required to reduce the risk of potential events or failures that could lead to an environmental impact. The plan should identify:
  - the actions to be taken to minimise these potential occurrences; and
  - the actions to deal with such occurrences so as to limit their consequences.
- In the case of **abnormal emissions** arising from an accident, such as a spillage, the operator **should**:
  - investigate immediately and undertake remedial action as soon as practicable;
  - promptly record the events and actions taken;
  - ensure the regulator is made aware, as soon as practicable.

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Industrial Pollutants – Release to Land

A(2) Permit Conditions - Examples:

- No emissions from the permitted activity **shall** give rise to the introduction into ground water of any “List 1” or “List 2” substance specified in the Water Framework Directive/Groundwater Directive;
- All operational areas within the permitted activity site boundary **shall** be provided with an impervious surface, spill containment kerbs, sealed construction joints and connected to a sealed drainage system or such alternative as agreed in writing with the regulator.

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Industrial Pollutants – Release to Land

A(2) Permit Conditions - Examples:

- No material which adversely affects the state of the site of the permitted activity from the information reported to the regulator in the baseline land contamination report, (reference xyz) shall be deposited on, in or under the land within the boundary of the permitted activity;
- The operator of the permitted activity shall notify the regulator as soon as practicable, concerning any matter which alters the findings of the baseline land contamination report, (reference xyz).

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Industrial Pollutants – Release to Land

A(2) Permit Conditions - Examples:

On-Going Compliance Monitoring

- As part of the routine site inspection programme, compliance with relevant permit conditions should be assessed:
  - *Check state of mitigation measures (bunding);*
  - *Check that adequate maintenance has been carried out to ensure continued compliance with conditions;*
  - *Check that inspections have been carried out and findings reported. Follow up where actions for improvement have been identified.*

- Overall objective - must ensure that control of site operations does not lead to additional land contamination.

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Industrial Pollutants – Release to Land

A(2) Permit Conditions - Examples:

Decommissioning Plan/Site Surrender Report

- *A **site decommissioning plan** shall be submitted in writing to the regulator, for approval, within 4 months of the issue date of this permit. The approved plan shall be updated as may be necessary due to changes in plant, equipment or materials used at the permitted activity site. The approved plan shall be reviewed and resubmitted to the regulator every 3 years from the date of the first submission. The plan shall include:*
  - ***A complete methodology** to be adopted in the decommissioning of the permitted activity, to include:*
    - *Removal of key plant or machinery likely to be contaminated;*
    - *Removal of contamination associated with the plant and machinery;*
    - *Minimising any contamination from the installation buildings during demolition;*
    - *Removal of contaminated subsurface infrastructure (pipework / tanks) as may be necessary.*
  - ***An assessment of the impact** of decommissioning on the nearest sensitive receptors;*
  - *The Preparation of a **ground contamination report** to include the testing of soil within the decommissioned activity site to demonstrate contamination levels are no greater than those submitted in the operators permit application baseline site report .*

Note: Actual testing may not be required if the operator can demonstrate satisfactory containment and management during the operation of the permitted activity.

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Industrial Pollutants – Release to Land

Controls Summary

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Industrial Pollutants – Release to Land

Controls Summary

Restoring Sites Polluted Under an LA-IPPC Permit

There are three main elements to restoring a site:

1) Removing, treating or immobilising pollutants;
2) Remedying any harm caused;
3) Mitigating the effects of any harm.

For example removal of underground storage tanks, treat soil contaminated by spillages on site, ensure no residue in ground water, if there is, measure to ensure no harmful effect and confirm with the Environment Agency.

Legal controls; EP Regulation 23: Steps to be taken after the revocation take effect. And Regulation 44: Power of court to order cause of offence to be remedied.

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Industrial Pollutants – Release to Land – End of Session 3

- Any Questions? Please Email EMAQ to receive a response emaq@ricardo.com .
- Thank You

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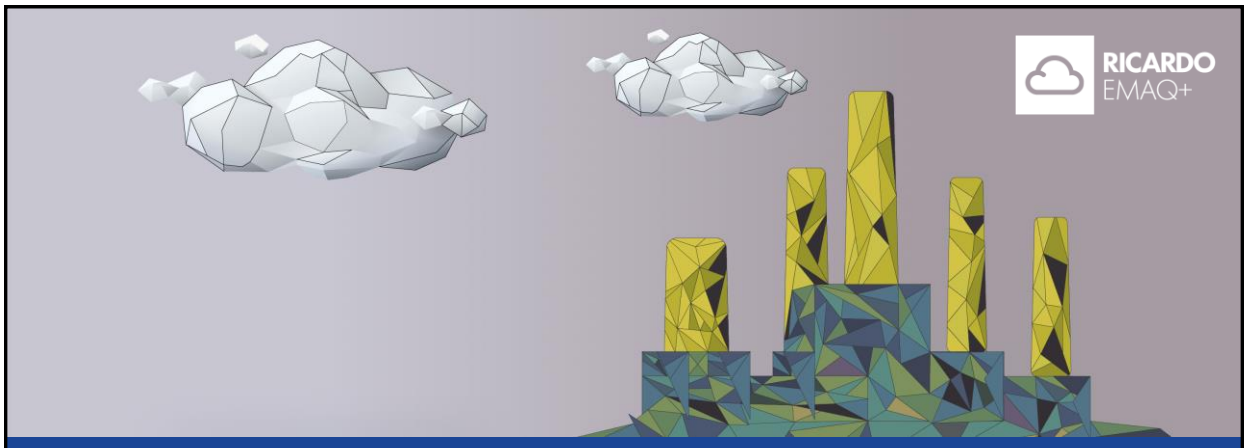

Essentials of PPC 3

Session 4: Other Pollutants: Noise and Odour

1

Contents

- An understanding of the nature of noise and odour and how they are / are not applied to Part B and A(2) permitted activities.
- Specifically address; broad-band noise, tonal noise, low frequency noise, the impact of noise and control techniques to be deployed at permitted activities.
- Odour assessments and how to interpret the results to construct permit conditions / determine permit condition compliance.

2

Noise (and Vibration)

3

Other Pollutants: Noise and Odour

Noise (and Vibration)

- Noise is considered as pollution under the IED Directive and hence noise emissions are considered under LA-IPPC (Part A2). LAPPC (Part B) controls do not consider noise, so noise cannot be controlled by permit conditions at Part B activities. LA-IPPC permitted activities often include plant and equipment which may emit significant levels of noise (and vibration) to the environment.
- Local Authorities should consider the likelihood of significant noise or vibration beyond the boundary of a permitted activity.
- The General Guidance Manual indicates that permit conditions should reflect the same standards of noise protection as those required under the provisions of the statutory nuisance regime in Environmental Protection Act 1990.

4

Other Pollutants: Noise and Odour

Noise (and Vibration)

- It is assumed by this presentation that a reference to “noise” also includes “vibration”.
- It is unlikely that vibration from a permitted activity will be of sufficient magnitude to cause structural damage to property, but vibration may be the cause of anxiety for nearby residents and so should be considered where appropriate to do so.
- Noise can have impacts on wildlife such that mitigation measures may be needed and should be considered in the permit application, for example if the installation is near to a SSSI.
- A simple assessment for noise can be undertaken, that is whether noise from the permitted activity is audible beyond the site boundary.
- If a detailed assessment is needed then the aim is to quantify, characterise and qualify a known or anticipated problem.

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Other Pollutants: Noise and Odour

Noise (and Vibration)

- The human ear can detect a large range of sound. Noise levels are measured in decibels (dB) which has a logarithmic scale to accommodate the wide range in a simple indicator.
- Because the human ear responds differently at different frequencies so a weighting is applied to sound meters to modify the measurement, these are commonly known as ‘dBA’ readings.
- dB = decibel: A = sound weighted to replicate human hearing
- Typically, under controlled conditions, the average person can just perceive a 1 dB change, a 3 dB change is noticeable, 6 dB is obvious.
- A 10 dB change corresponds to a halving or doubling of loudness (amplitude).

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Other Pollutants: Noise and Odour

Typical sound levels (from EA Guidance H3 Part 2)

Situation/noise source	Sound pressure level in dBA	Sound pressure in μPa	Average subjective description
30m from a military jet aircraft take off	140	200,000,000	Painful, intolerable
Pop concert	105	3,500,000	
Night club	100	2,000,000	
Pop concert at mixer desk	98	1,600,000	
Passing heavy goods vehicle at 7m	90	630,000	Very noisy
Ringing alarm clock at 1m	80	200,000	
Domestic vacuum cleaner at 3m	70	63,000	Noisy
Business office	60	20,000	
Normal conversation at 1m	55	11,000	
The reading room of the British Museum	35	1,100	
Bedroom in a quiet area with the windows shut	30	630	Very quiet
Remote country location without any identifiable sound	20	200	
Theoretical threshold of hearing	0	20	Uncanny silence

N.B. Since the sound pressure level is in dBA, strictly speaking a comparison with the sound pressure in μPa cannot be made; nevertheless the table illustrates, in general terms, the concept of the log functions of the decibel scale.

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Other Pollutants: Noise and Odour

Noise (and Vibration)

- Typically sound has a wide range of frequencies (audible range is about 20 Hz – 20 kHz). '**Broad band**' describes noise is over a wide band of frequencies.
- However, sound can have high proportion of energy in a narrow band or at a single frequency (a pure tone) - this is **"tonal noise".** Examples of sources of tonal noise include fans, compressors, motors and transformers.
- Tonal noise is generally more noticeable and more annoying than non-tonal noise at the same amplitude. Tonal noise is easily distinguished by the human ear a higher level of broadband noise is tolerated compared to tonal noise, which at a lower level can be disturbing.
- **Low frequency noise** is particularly disturbing and difficult to determine the source and to mitigate due to difficulty in preventing transmission and penetration
- Noise analysis can be carried out by frequency bands to determine the distribution of frequencies, this is know as octave band analysis and is a useful tool to deploy when undertaking noise disturbance investigations.

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Other Pollutants: Noise and Odour

Noise (and Vibration)

- BAT Conclusions (where available) and Sector Guidance (SG) notes identify the most significant noise sources at LA-IPPC activities. A LA should consider the likelihood of significant noise or vibration from the installation and incorporate appropriate conditions into the permit to control the noise.
- Noise should be identified by source, quantified and characterised and the impact assessed – proximity of receptors, periods, frequency, etc.
- Control measures such as enclosures, silencers, restrictions on operating times, etc should be reviewed and effectiveness demonstrated by the operator.
- Noise surveys, measurement, investigation or modelling may be necessary but should **not** generally be undertaken if activities are quiet or remote from receptors or if there is no history of noise complaints arising from a functioning activity.
- Noise MUST be addressed in the Part A(2) permit application form

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Other Pollutants: Noise and Odour

Noise mitigation measures (from SG4)

Operation	Control Measure
Scrap Deliveries	▪ Scrap storage in enclosed area ▪ Minimising deliveries at night* ▪ Minimise the drop height for scrap deliveries ▪ Deliveries using pallets or stillages
Scrap Handling and charging	▪ Develop storage systems to avoid double handing ▪ Minimising charging height ▪ Use screens and barriers to conceal noise sources
Site Vehicle Movements	▪ Using vehicles with "directional and localised sound" for reverse alarms to concentrate noise at the area of immediate danger ▪ Replacing diesel powered forklift trucks with electric or LPG powered ▪ Minimising vehicle movements at night ▪ Using even roadways for vehicle movements
Knock-out / shake-out	▪ Acoustic screens and enclosures* ▪ Cushion impacts using resilient linings ▪ Make stillages, chutes and tables less effective noise radiators
Fans, pumps and motors	▪ Acoustic screens, enclosures and baffles ▪ Fitting silencers to avoid noise travelling along ducting ▪ Selection of less noisy engineering equipment ▪ Fitting resilient hangers for wall-mounted equipment
Grinding, fettling, shot blasting (finishing operations)	▪ Acoustic screens and enclosures* ▪ Selection of less noisy engineering equipment ▪ Millings, fettling scrap and off-cuts transported in bags
General	▪ Fitting noise reducing flaps to outside doors ▪ Maintaining a closed doors policy ▪ Improving sound insulation of buildings ▪ Holes and openings closed off (use mechanical where necessary)

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Other Pollutants: Noise and Odour

Noise (and Vibration)

Example Permit Conditions

- The operator shall identify key plant and equipment with the potential to give rise to significant noise and take such measures as are necessary by way of mitigation and maintenance of plant and equipment in order to minimise noise emissions audible over the boundary of the permitted activity site.
- Scrap handling systems shall be designed to avoid double handling and to minimise the drop height for deliveries and charging operations.
- A noise report shall be provided to the regulator before any plant or equipment is modified or new plant or equipment is used to demonstrate that the noise and vibration emitted by the plant or equipment achieves the required BAT standard.

Keep conditions simple and follow the BAT Conclusions / SG note suggested conditions.

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Other Pollutants: Noise and Odour

Example permit conditions

4.28 The Permitted Installation shall, subject to the conditions of this permit, be controlled as described in the documentation in the original permit application response under section 2.9 where;

- As part of the environmental management system the operator shall employ good practice measures for the control of noise, process operations that generate any increase in noise, shall be investigated to ensure that the noise remains within the accepted criterion for the installation as per condition 8.16.

4.29 The Operator shall make available the Environmental Management System (EMS) schedule for noise and vibration control to the Regulator upon request. Any proposed changes to the installation, where there is any potential increase in noise or vibration from new equipment, where the criterion in condition 8.16 may be breached, shall not be made unless agreed in writing by the Regulator.

8.16 Noise from the installation shall not exceed the levels in Table K.

Table K Noise Emission Levels		
Location	Day (07:00 to 23:00)	Night (23:00 to 07:00)
At any residential location by day (free-field). At any residential façade at night. (Or any surrogate point with appropriate distance corrections.)	50dB $L_{Aeq\,T}$ (or 3dB above background without any tonal component.) which ever is the greater.	45dB $L_{Aeq\,T}$ 60dB L_{Amax} (or 3dB above background without any tonal component.) which ever is the greater.

(In applying Table K BS 4142 1997 methodology shall be employed for all measurements).

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Other Pollutants: Noise and Odour

Noise (and Vibration)

Example Permit Conditions – Noise management plan

Emissions from the permitted activity shall be free from noise and vibration at levels likely to cause harm to health or pollution over the site boundary, as perceived by an authorised officer of the Council, unless the Operator has employed appropriate measures to prevent or where that is not practicable to minimise the effect of noise and vibration detected over the site boundary.

The Operator shall:

- If notified by the Council that the permitted activities are causing harm to health or giving rise to pollution over the site boundary due to noise and vibration, submit in writing to the Council for written approval, within the period specified by the Council, a noise and vibration management plan which identifies and minimises the risks of pollution from noise and vibration;
- Implement the approved noise and vibration management plan, from the date of approval and complete the implementation in accordance with the noise and vibration plan deadline, unless otherwise agreed in writing by the Council.

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Odour

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Other Pollutants: Noise and Odour

Odour

- What are the key considerations for a permit to achieve effective odour control?
  - Raw Materials.
  - Emission limit compliance.
  - Monitoring and Recording.
  - Improvement / Upgrading.
  - Training and Experience.
  - Storage / Handling / House keeping.
  - Waste products.
- We will use animal rendering as an example but the principals discussed can be applied to most permitted activities.

Odour Source → Odour Pathway → Odour Receptor

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Other Pollutants: Noise and Odour

Odour

Using animal rendering as an example, the main activity stages are as follows:

Raw Materials / Storage

Cooking

Oil recovery, grinding etc

Product despatch

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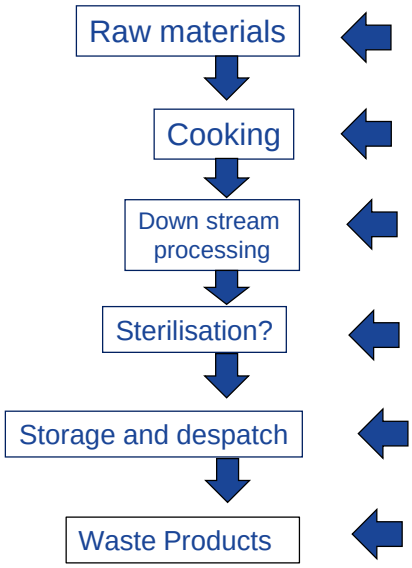
Other Pollutants: Noise and Odour

Odour



Factors to consider	Nature of release
Trucked to activity site, odour depends on age and condition of material.	Delivery loss into work space. Handling; possible fugitive loss?
Moisture removal, hot feed stock Batch or continuous	Contained emission Exceptionally intense odour
Hot feed stock	Contained emission Intense odour
Hot feed stock	Contained emission Intense odour
Warm feed stock, Closed or open storage	Loss into work space Fugitive odour?
Enclosed or open storage. Time before disposal	Fugitive odour unless waste is enclosed. Odour as product leaves site

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Other Pollutants: Noise and Odour

Odour - Permitting considerations for raw materials

Raw material quality	• Limit the type, condition, age of material type accepted at activity site • May also be planning conditions to consider?
Raw material delivery and unloading	• Limit time / no raw materials standing in open storage • Use air locks to contain emissions during unloading • Steam clean vehicles after use
Raw material storage	• Containment and extraction – negative pressure and totally enclosed buildings to minimise fugitive emissions
House keeping	• Spills and comprehensive cleaning schedule, impermeable internal/external surfaces



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Other Pollutants: Noise and Odour
Odour - Permitting considerations for cooking

Odour containment	• Modern equipment retains evaporated moisture in closed system – permit condition to require enclosed system.
Odour control – normal *(low intensity)*	• SG 8 states control requirement: A. Condensation + oxidation (e.g. boiler); B. Direct oxidation (regenerative system); • Condition to require optimum 3T's (time, temp, turbulence).
Odour control – abnormal *(high intensity)*	• Tends to be short term but intense emission. • Condition(s) designed to minimise odour emission beyond the site boundary.

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Other Pollutants: Noise and Odour
Odour - Permit considerations for downstream processes

Odour containment	• Allows segregation of high intensity odour from low intensity odour and work room air. • Enables better odour treatment and control.
Odour control	• Incinerate along with gaseous cooker emissions and good dispersion of residual odour.

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Other Pollutants: Noise and Odour
Odour - Permit considerations for product storage

Odour containment	• As per raw material. • Low level odour will still be detectable. • dust emission possible.
Odour control	• Bio-filtration, chemical scrubber, may use room air to support combustion process.
Housekeeping	• Dust spills which may become wind borne. • Must keep dry otherwise decomposition occurs. • Prevent accumulations by good housekeeping.

Images © Ricardo

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Other Pollutants: Noise and Odour
Odour - Permit considerations for monitoring and management

Monitoring	• Need to monitor key activity parameters, e.g.
	  • Continuous Temp, O2 for incineration.
	  • Monitor fan operation – ensures extraction rate maintained and therefore less fugitive emissions.
	  • pH, Redox, pump operation etc. for chemical scrubbing.
	  • Watering, weeding, etc for biofilter.
	  • Odour performance testing / olfactory monitoring?

Records	• Monitoring results. • Building integrity. • Cleaning and abatement plant maintenance.
Investigation	• Accidents, abnormal events, complaints.
Maintenance	• Routine and reactive maintenance. • Key spares and consumables for abatement plant.
Training	• Permit requirements. • Environmental issues.

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Other Pollutants: Noise and Odour

Odour

The photograph below is an example of a poorly designed biofilter, resulting in distorted flow patterns and emission of partially treated odour = complaints!

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Other Pollutants: Noise and Odour

Odour

Example permit condition – Boundary odour condition

- Typical simple condition for Part B or Part A(2) permits;
- ***"All emissions to air from the Permitted activity shall be free from offensive odour, as perceived by an authorised officer of the Council outside the site boundary."***
- **However**, where a permit application includes an operator assessment that determines there is no potential for odour releases which may cause offence, with a brief explanation of why he/she has reached this view, and the regulator is in agreement, it is acceptable that no odour boundary condition is included in the permit.
- In such circumstances, any deviation from the statutory guidance (PG / SG Note) should be recorded in a decision document.

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Other Pollutants: Noise and Odour

Odour - Example permit condition – Boundary odour condition

- *"*All emissions to air from the permitted activity shall be free from offensive odour, as perceived by an authorised officer of the Council outside the site boundary." *In specific circumstances where offensively odorous emissions are released for reasons which are beyond the direct control of the activity operator, a breach of this condition will be deemed **not** to have occurred where the operator can show that all reasonable steps were taken and due diligence exercised to prevent or minimise the release of offensive odour.*

SG Note 8; This permit condition recognises that is likely to be episodes where offensive odour will extend beyond the site boundary due to the nature of the permitted activity. A **"due diligence"** approach is adopted. Guidance states that there should be "very few" escapes of offensive odour beyond the boundary of the site and that any escape should not exceed two hours on more than two occasions per year. In the event of this frequency being exceeded the regulator would be expected to undertake investigations into whether due diligence was being achieved.

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Other Pollutants: Noise and Odour

Odour

Example permit condition – Odour management plan

- Emissions from the permitted activities shall be free from odour at levels likely to cause pollution over the site boundary, as perceived by an authorised officer of the regulator, unless the operator has used appropriate measures, including, but not limited to, those specified in any approved odour management plan, to prevent or where that is not practicable, to minimise the odour.
- The operator shall:
  - If notified by the regulator that the activities are giving rise to pollution over the site boundary due to odour, submit to the regulator for approval within the period specified, an odour management plan which identifies and minimises the risks of pollution from odour;
  - Implement the approved odour management plan, from the date of approval, unless otherwise agreed in writing by the regulator.

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Other Pollutants: Noise and Odour

Odour

Example permit conditions – Handling and processing odour conditions

- All points of transfer shall be designed to be leak-proof and spill-proof. Means for cleaning and transferring spillages back to the raw material reception area shall be provided.
- Cooker exhaust gases shall pass through an interceptor and then be directed to an indirect condenser. The non condensable gases directed to the wet scrubbing unit and effluent to the on site water treatment plant. The type and capacity of the condensers shall be sufficient in relation to the quantity and quality of liquid discharges from the permitted activity.
- The inlet and outlet temperatures of the condensers shall be continuously monitored and recorded.

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Other Pollutants: Noise and Odour

Odour

Example permit conditions – General permit conditions

- The use of odour-masking agents and counteractants to meet the requirements of condition **xx** of this permit shall not be permitted.
- Bulk storage tanks shall be fitted with a high-level alarm or volume indicator to warn of and thereby minimise the possibility of overfilling.
- Good housekeeping shall be undertaken at at all times.

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Other Pollutants: Noise and Odour

- Any Questions? Please Email EMAQ to receive a response emaq@ricardo.com .
- Thank You

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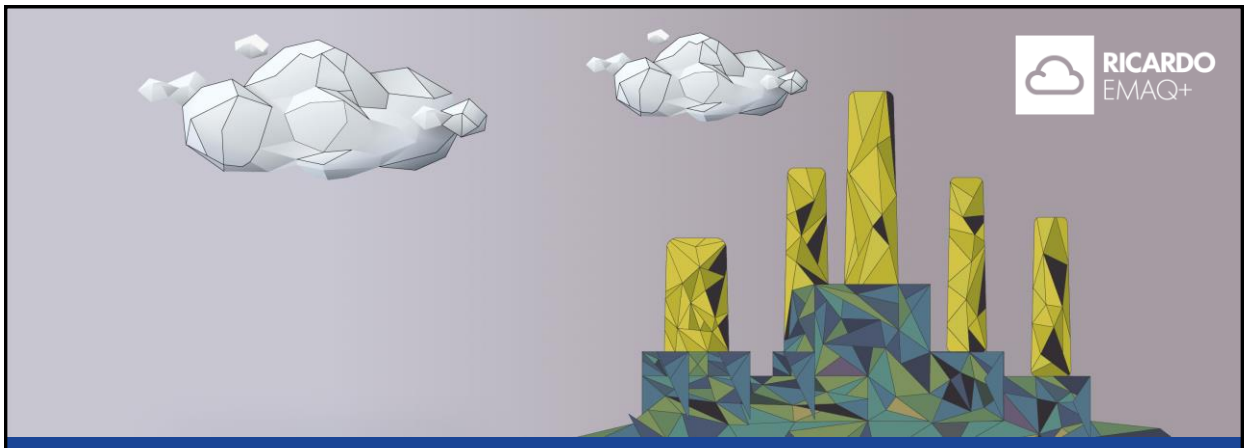

Essentials of PPC 3

Session 5: Energy Efficiency, Resource Efficiency and Waste Minimisation

1

Contents

2

Energy Efficiency – An understanding of energy efficiency and how it can be applied to Part A(2) permitted activities

3

Energy Efficiency, Resource Efficiency and Waste Minimisation

Energy Efficiency

- The direct and indirect release of energy, such as heat is considered as “pollution” by the IED and so also the LA-IPPC regime. It may be substantial and may affect the local environment and contribute more widely to raising global temperatures.
- For example; the release of hot flue gases into the external air from processes associated with combustion, such as glass making, foundries, minerals drying etc, can release significant amounts of heat to the environment.
- In addition, the release of water used for cooling permitted activity processes into streams and rivers can have significant effects on aquatic life.
- However, the main issue of concern regarding pollution associated with energy used by permitted activities (and industry in general) arises from the heavy reliance on the combustion of fossil fuels to produce most of the energy.
- Other concerns are the use of finite resources and the need to minimise and conserve such uses.

4

Energy Efficiency, Resource Efficiency and Waste Minimisation

Energy Efficiency

- Energy may be in the form of electricity from coal and gas fired power stations, or it may result from the direct firing, on site, of fossil fuels (such as gas, oil and coal) for example; in industrial boilers and dryers.
- Combustion releases carbon dioxide into the atmosphere. This, and other green house gases (such as methane SO_2, NOx, etc) contribute to global warming.
- The UK has International obligations to reduce green house gas emissions. The main strategies are centred around reducing the release of CO_2 from fossil fuel combustion.
- In addition, fossil fuels are finite and cannot be replaced. Thus important that these energy resources are used wisely and more efficiently. A(2) permit conditions address this issue.
- Other strategies are to decarbonise industry and electricity supply using low carbon renewable sources, such as wind power, wave power, hydro-electric, and solar energy.
- The use of non-fossil fuels (e.g. biofuels, coppiced wood, wood waste) is being promoted.
- Use of carbon capture technologies is also being considered for some activities (power plant, hydrogen production plant). This removes CO_2 from the flue gases and liquefy it or ad/absorb it onto a solid substrate, so that it is not released to the environment.

5

Energy Efficiency – Climate Change Levy and Climate Change Agreements

6

Energy Efficiency, Resource Efficiency and Waste Minimisation

Energy Efficiency

Climate Change Levy (CCL) and Climate Change Agreements (CCA)

- CCL is a fiscal measure to encourage Operators to use / introduce energy efficiency measures and use less fossil fuels.
- It applies to fuels and electricity and increasing each year: https://www.gov.uk/guidance/climate-change-levy-rates
- Some exemptions apply:
  - Small users, Domestic and charity sector.
- CCA scheme offers a discount on CCL to energy intensive industry sectors (mainly Part A1 and A2 processes) that agree to improve energy efficiency or reducing CO_2 emissions.
- Agreements are made between the government and Sector Associations.

7

Energy Efficiency, Resource Efficiency and Waste Minimisation

Energy Efficiency

Climate Change Levy (CCL) and Climate Change Agreements (CCA)

- Within the current provisions of the IED and the PPC Act, operators of Part A permitted activities must;
- Meet the basic energy efficiency measures required by the BAT Conclusion / SG Note and be a participant in a Climate Change Agreement (CCA)

OR

- Meet the basic energy efficiency measures required by the BAT Conclusion / SG Note and meet additional specific energy efficiency measures provided by the BAT Conclusion / SG Note and any other measures specified by the regulator (site specific requirements)

Note: BAT Conclusions also specify energy requirements - indicators of energy "performance" should be developed to allow monitoring of BAT conclusion requirements, e.g. units of energy consumed per unit of product.

8

Energy Efficiency – Example energy efficiency permit conditions

9

Energy Efficiency, Resource Efficiency and Waste Minimisation

Energy Efficiency

Example energy efficiency conditions SG2 – Glassmaking.

- Basic:
  - The operator shall produce a report annually on the energy consumption of the permitted activity;
  - The operator shall monitor energy flows and target areas for reduction that shall be updated annually;
  - In order to optimise combustion, the operator shall, where practicable, monitor carbon monoxide and oxygen in waste gases;
  - The operator shall ensure that all plant and equipment is operated and maintained to optimise the use and minimise the loss of energy;
  - The operator shall ensure that all appropriate containment methods, (e.g. seals and self-closing doors) are employed and maintained to minimise energy loss.

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Energy Efficiency, Resource Efficiency and Waste Minimisation

Energy Efficiency

Example energy efficiency conditions SG2 - Glassmaking

- Additionally.

The energy efficiency of melting can be increased by a number of measures that may include:

- Improving the level of furnace insulation to minimise heat loss;
- Fitting continuous carbon monoxide (CO) and oxygen (O_2) monitoring in order to optimise combustion;
- Increasing the amount of cullet used as this requires less energy to melt compared with virgin raw materials;
- For a multi-port cross-flow regenerative furnace, separation of the regenerators in such a way that air flows and stoichiometries can be adjusted for each burner port;
- Using waste heat to preheat raw material or cullet, or to raise steam in a waste heat boiler;
- Use of oxy-fuel for firing.

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Energy Efficiency – Energy efficiency techniques

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Energy Efficiency, Resource Efficiency and Waste Minimisation

Energy Efficiency

Energy efficiency techniques - SG2 Glassmaking

- The following techniques should be considered:
  - Heat recovery from different parts of the permitted activity;
  - Minimisation of water use and closed circulating water systems and optimised insulation;
  - Plant layout to reduce pumping distances;
  - Phase optimisation of electronic control motors;
  - Optimised efficiency measures for combustion plant.
- **Energy supply techniques**

  The following techniques should be considered:
  - Utilising waste heat from cooling operations to provide space heating;
  - Generation of energy from waste;
  - Use of less polluting fuels.

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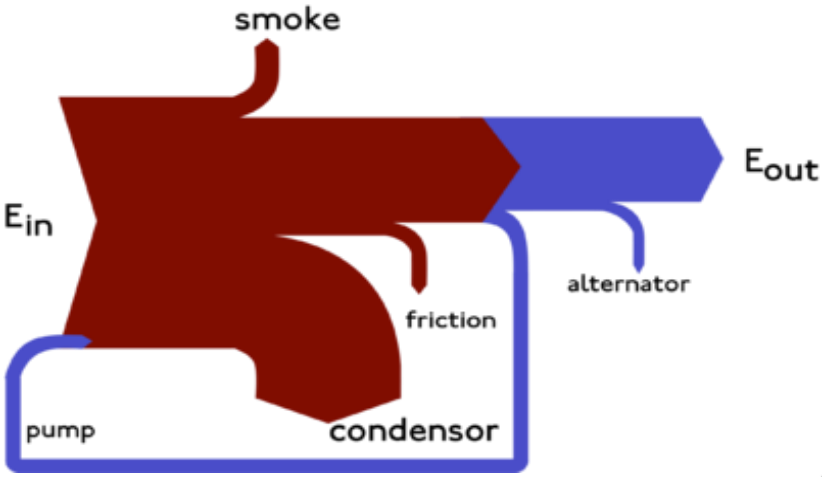
Energy Efficiency, Resource Efficiency and Waste Minimisation

Energy Efficiency Techniques

- The Operator shall monitor and report energy flows and target areas for reduction and update annually. Sankey diagrams and energy balances are useful aids to employ in this matter.



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Energy Efficiency, Resource Efficiency and Waste Minimisation

Energy Efficiency Techniques

Other basic energy efficiency requirements specific to particular SG Notes.

- For example, **SG 04** (Non-Ferrous Metals) the following are indicated to improve energy efficiency:
  - Use of recuperative burners, heat exchangers and boilers to recover heat from process gases;
  - Pre-heating process or fuel gases resulting in higher melting efficiency;
  - Pre-heating charge materials;
  - Use of oxygen enriched air, or oxygen in burners reduces energy consumption. Waste gas volumes also reduced as are the sizes of fans and associated equipment.

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Energy Efficiency, Resource Efficiency and Waste Minimisation

Energy Efficiency Techniques

- Within IPPC it is valid to consider both direct (on site heat) emissions and indirect (remote) pollution when considering energy efficiency.
- **The range of general measures include:**
  - Heat recovery from different parts of process;
  - Minimisation of water use;
  - Good insulation;
  - Optimising plant layout to reduce pumping distances;
  - Using variable speed compressors;
  - Phase optimisation of electronic control motors and fans;
  - Optimisation measures for on-site combustors.

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Energy Efficiency, Resource Efficiency and Waste Minimisation

Energy Efficiency Techniques

- The following energy efficient or more environmentally sustainable supply techniques should also be considered:
  - Use of "Good Quality" combined heat and power;
  - Utilising waste heat from cooling operations to provide space heating;
  - Generation of energy from waste;
  - Use of less polluting fuels;
  - Utilise alternative energy sources, wind, wave, heat pumps.

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Energy Efficiency, Resource Efficiency and Waste Minimisation

Resource efficiency and waste minimisation - IED and Statutory guidance requirements

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Energy Efficiency, Resource Efficiency and Waste Minimisation

Resource efficiency and waste minimisation

The IED Directive requires that waste production is avoided; 'where waste is produced it is recovered or, *where that is technically and economically impossible*, it is disposed of while avoiding or reducing any impact on the environment.'

It is also a requirement that permit applications describe measures for the prevention and recovery of waste generated by the permitted activity.

The General Guidance Manual defines waste minimisation as a systematic approach to the reduction of waste at source, by understanding and changing processes and activities to prevent and reduce waste.

The financial costs of using alternative raw materials should not be considered in isolation when assessing viability.

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Energy Efficiency, Resource Efficiency and Waste Minimisation

Resource Efficiency and Waste Minimisation - Techniques for resource efficiency waste minimisation

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Energy Efficiency, Resource Efficiency and Waste Minimisation

Resource Efficiency and Waste Minimisation

Techniques for resource efficiency waste minimisation

Range from basic housekeeping through monitoring to the application of clean technologies.

Waste minimisation can include:

- Ongoing identification and implementation of waste prevention;
- Training, active participation and involvement of staff;
- Monitoring of materials and development of benchmarks or Performance Indicators to identify changes in resource use;
- The recovery and re-use of waste materials in the permitted activity, for example, solvent recovery and re-use.

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Energy Efficiency, Resource Efficiency and Waste Minimisation

Resource Efficiency and Waste Minimisation – BAT for resource efficiency and waste minimisation

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Energy Efficiency, Resource Efficiency and Waste Minimisation

Resource Efficiency and Waste Minimisation

BAT Conclusions (where available) and Sector Guidance notes provide potential indicators for monitoring resource use.

BAT includes:

- Recording material usage and waste generation to establish internal benchmarks;
- Waste minimisation audits – to match frequency of permit review period and if none within two years of application then to be undertaken within 18 months. To be used to develop a waste management plan for submission to and approval by the regulator;
- Specific recommendations arising from audits to be implemented within timescale approved by the regulator.

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Energy Efficiency, Resource Efficiency and Waste Minimisation

Resource Efficiency and Waste Minimisation

The SG notes also include sector-specific BAT items, for example:

- SG4 (non- ferrous metal sector) includes items for minimising dross production, reclaiming foundry sand and re-use of waste sand.
- SG6 (surface treatment using solvents sector) includes an item on minimising consumption of organic solvents.

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Energy Efficiency, Resource Efficiency and Waste Minimisation

Resource Efficiency and Waste Minimisation

A(2) Permit conditions **should** include specific requirements to:

- Operate and maintain equipment to minimise use raw materials and the production of waste;
- Monitor and benchmark the use of materials.

Permits **could** include monitoring of process activities for example:

- Annual inventories of raw materials;
- Tonnes of raw material(s) per tonne of good product;
- Tonnes of sub-quality (reject) product per tonne of good product;
- Tonnes of water used per tonne of good product.

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Energy Efficiency, Resource Efficiency and Waste Minimisation

Resource Efficiency and Waste Minimisation

Example bench marks (PI's) – some available in BREF notes (but not all sectors)

Consumption	
Water consumed	1590 kg/t
Electricity consumed	83 kWh/t
Heat/Fuel consumed	698 kWh/t

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Energy Efficiency, Resource Efficiency and Waste Minimisation

Resource Efficiency and Waste Minimisation

Example bench marks (KPI) – BREF note

Others	
Steam produced	890 kg/t
Chemicals environment air	2.80 kg/t
Chemicals environment effluent	0.65 kg/t
Chemicals environment effluent oxygen	2.46 kg/t
Chemicals product	1.43 kg/t
Chemicals other	0.76 kg/t
Treated air for odour control	9510 kg/t
Boiler exhaust	789 kg/t
CO	30 g/t
Effluent ammonia	390 g/t
MBM/Meal to landfill	126 kg/t
Waste controlled	960 g/t
Waste filter medium	1420 g/t
Waste effluent sludge	12 kg/t
Waste effluent	13 kg/t
Waste scrap	210 g/t
Waste oil	60 g/t
Raw material handled total	1.17 t/t raw processed
Dioxins	
Nitrates	

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Energy Efficiency, Resource Efficiency and Waste Minimisation

Resource Efficiency and Waste Minimisation – Example permit conditions

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Energy Efficiency, Resource Efficiency and Waste Minimisation

Resource Efficiency and Waste Minimisation

Example Permit Condition – efficient use of raw materials

- The Operator shall;

  (a) take all practicable measures to ensure that raw materials, including fuels and water, are used efficiently;
  (b) maintain records of the types and quantities of raw materials, including fuels and water used, in accordance with condition 12.1 of this permit;
  (c) review and record at least every four years from the date of issue of this permit all methods available to reduce risks to health and environmental pollution and improve the efficiency of raw material, fuel and water use;
  (d) Instigate, with the written approval of the Council any further practicable measures identified by a review by a date approved by the Council.

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Energy Efficiency, Resource Efficiency and Waste Minimisation

Resource Efficiency and Waste Minimisation

Example Permit Condition – Avoidance, recovery and disposal of wastes and residues produced by a Part A(2) permitted activity

- The operator shall take appropriate measures to ensure that all waste products produced by the permitted activities are minimised in quantity and pollution potential. Wherever possible waste produced by the permitted activities shall be recovered for re-use as a raw material. Residues shall be recycled directly into the permitted activities where possible and in particular shall ensure that;

  (a) the waste hierarchy referred to in Article 4 of the Waste Framework Directive is applied to the generation of waste by the permitted activities; and
  (b) any waste generated by the permitted activities is treated in accordance with the waste hierarchy referred to in Article 4 of the Waste Framework Directive; and
  (c) where disposal is necessary, this is undertaken in a manner which minimises its impact on health and the environment.

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Energy Efficiency, Resource Efficiency and Waste Minimisation

Resource Efficiency and Waste Minimisation – Future considerations – UK BAT and the circular economy

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Energy Efficiency, Resource Efficiency and Waste Minimisation

Resource Efficiency and Waste Minimisation

Future considerations – UK BAT

- The UK BAT process is underway, this involves the production of new BAT Conclusion guidance notes.
- The BATC Notes will consider very carefully what is BAT for non-direct issues that the operation of the permitted Part A(2) activity may have on the wider environment.
- The measures included in the statutory guidance will need to be interpreted into permit conditions for Part A(2) permitted activities by regulators and an understanding required by operators to demonstrate compliance with these measures.

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Energy Efficiency, Resource Efficiency and Waste Minimisation

Resource Efficiency and Waste Minimisation

Other information sources:

The General Guidance Manual references sources on Sustainable patterns of Consumption and Production (SCP).

The circular economy model, resource optimisation and waste minimisation to reduce global warming and travel towards net zero for carbon emissions are becoming much more significant factors to consider for permitted activities and are likely to feature much more prominently in reviewed and new guidance for permitted activities.

The Environment Agency is the principal waste regulator for England, don't be afraid to ask your local waste team for advice.

WRAP:

http://www.wrap.org.uk/wrap_corporate/about_wrap/index.html

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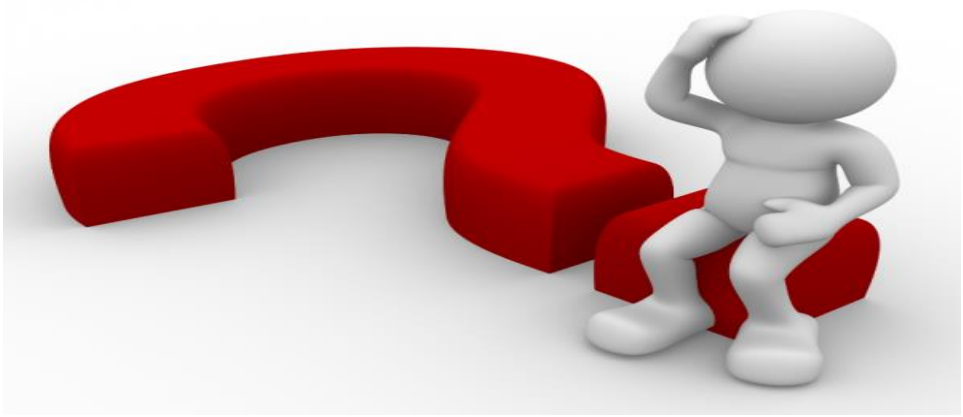
Energy Efficiency, Resource Efficiency and Waste Minimisation

- Any Questions? Please email EMAQ+ to receive a response emaq@ricardo.com
- Thank You



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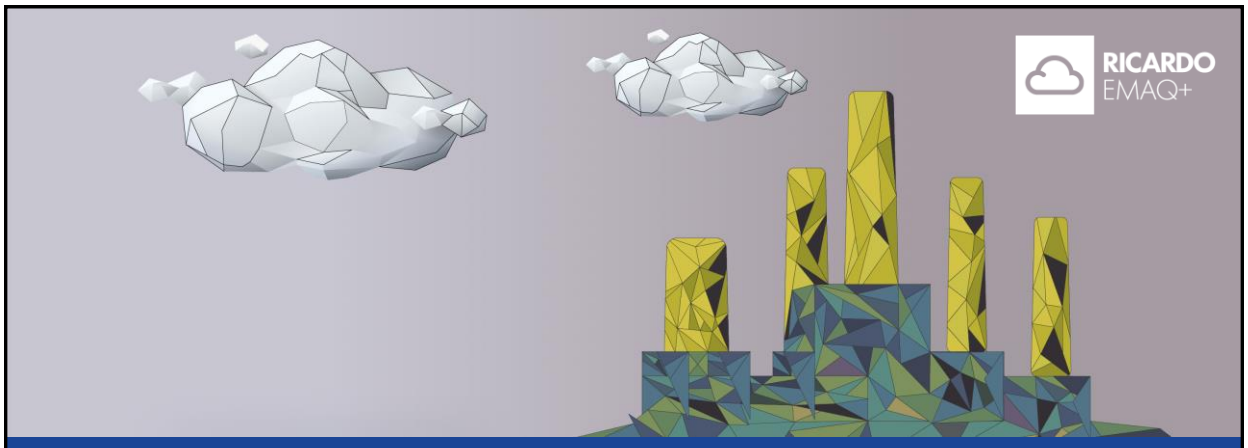

Essentials of PPC 3

Session 6: Noise Assessments, Chimney Height Calculations and Dispersion Modelling, Water and Waste Audits

1

Contents

- **Noise Assessments:**
  - Noise guidance, assessment, mitigation, equipment, locations, considerations.
- **Chimney Height Calculations and Dispersion Modelling:**
  - Chimney height calculation and plume dispersion, example chimney height calculations, dispersion modelling considerations and new site example.
- **Water Audits:**
  - Assessment types, water efficiency audits, example of a water audit, BAT, water release modelling.
- **Waste Audits:**
  - Waste audits, benefits, BAT, waste minimisation hierarchy and principles, example audit.

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Noise Assessments

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Noise Assessments, Chimney Height Calculations and Dispersion Modelling, Water and Waste Audits

Noise Guidance

- The General Guidance Manual requires Local authorities, when assessing **LA-IPPC** applications, to:

  ‘consider the likelihood of significant noise or vibration emanating from the permitted activity. Where either or both are likely, permit conditions should reflect the standards of noise protection that would have been achieved under the statutory nuisance regime in Part III of the Environmental Protection Act 1990.’

- Confusingly, despite the standard to achieve through permit conditions is equivalent to that achieved by statutory nuisance, the standard to apply via permit conditions is BAT, not BPM!
- Q: How? Apply the measures in the appropriate statutory guidance.

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Noise Assessments, Chimney Height Calculations and Dispersion Modelling, Water and Waste Audits

Noise Guidance

- The **Sector Guidance notes** generally provide a summary of activities which may cause noise issues at a permitted activity and provide a summary table of typical mitigation measures.
- Note that this is noise and/or vibration at or beyond the activity boundary, NOT occupational noise exposure, that is a health, safety and welfare concern.
- The general A(2) SG Note BAT requirement for noise is:

‘ The operator should identify key plant and equipment with the potential to give rise to significant noise and take such measures as are necessary by way of mitigation and maintenance of existing plant and equipment in order to minimise noise having regard to…’

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Noise Mitigation Measures from SG 3

Operation	Control Measure
Scrap Deliveries	▪ scrap storage in enclosed area ▪ minimising deliveries at night* ▪ minimise the drop height for scrap deliveries
Scrap Handling and charging	▪ develop storage systems to avoid double handing ▪ minimising charging height ▪ use screens and barriers to conceal noise sources
Site Vehicle Movements	▪ using vehicles with “directional and locallised sound” for reverse alarms to concentrate noise at the area of immediate danger ▪ replacing diesel powered forklift trucks with electric powered ▪ minimising vehicle movements at night
Knock-out / shake-out	▪ acoustic screens and enclosures* ▪ cushion impacts using resilient linings ▪ make stillages, chutes and tables less effective noise radiators
Fans, pumps and motors	▪ acoustic screens, enclosures and baffles ▪ fitting silencers to avoid noise travelling along ducting ▪ selection of less noisy engineering equipment
Grinding, fettling and shot blasting	▪ acoustic screens and enclosures* ▪ selection of less noisy engineering equipment
General	▪ fitting noise reducing flaps to outside doors ▪ maintaining a closed doors policy ▪ improving sound insulation of buildings ▪ holes and openings closed off (use mechanical where necessary) ▪ enclose foundry operations within buildings
* Noise mitigation measures that are likely to be needed in most cases	

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Noise Assessments, Chimney Height Calculations and Dispersion Modelling, Water and Waste Audits

Noise Assessment - SG notes include the following guidance:

- *Noise surveys, measurement, investigation (which can involve detailed assessment of sound power levels for individual items of plant) or modelling may be necessary for either new or existing activities depending upon the potential for generating significant noise.*
- *Operators may have a noise management plan as part of their management system.*
- ***Remember** - Where a permitted activity poses no risk of noise related environmental impact because the activities undertaken are inherently quiet or remote from receptors; these (the above) measures would not normally be required.*

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Noise Assessment

- Guidance on noise assessment procedures is provided in Environment Agency Guidance H3 Part 2 (still current at the time of making this webinar).
- UKAS Accreditation can be gained for Noise Measurement.
- There is currently no MCERTS accreditation for noise measurement equipment or contractors (MCERTS exists for water, stack emissions monitoring, ambient air monitoring, soil monitoring).

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Noise Assessments, Chimney Height Calculations and Dispersion Modelling, Water and Waste Audits

Noise Assessment

The following information on activities is needed to assess noise from a permitted activity:

- Whether sources are continuous or intermittent;
- Emission type – sound or vibration and characteristics;
- Hours of operation;
- Contribution to overall site noise;
- Location within installation;
- Location of receptors;
- Other specific characteristics or site specific circumstances.

Additional information should be provided for infrequent or seasonal operations.

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Noise Assessment

- Additional information should include; day, evening and night time values for background noise levels, specific noise levels, ambient noise levels and vibration data, if relevant.
- 'worst case', tonal noise and low frequency noise should be accounted for separately due to the more significant pollution potential / effects.
- Noise measurement surveys and noise modelling may be undertaken to assess the impact of noise / vibration emitted from the permitted activity.

- For an existing permitted activity the above requirements and the provision of a **Noise Management Plan** could form permit conditions.
- For new activities and variations with a substantial change, the information should be provided in the application documentation.

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Noise Equipment and Locations

Equipment for Noise Surveys

- 'Type' or, 'Class 1' sound level meters and microphones, should be check-calibrated before and after use on site. In addition they and the calibrators used are calibrated by an accredited laboratory at specified intervals.
- Intensity meters can be used at the activity site to identify noise outputs of specific plant and equipment to identify the most significant noise sources.

Measurement Locations

- The preferred technique is to assess and measure at the receptor(s). BS4142 and BS7445 provide guidance on measurement points. Note that permit conditions may set a level at a location within the installation or at the boundary, and that should be sufficient to minimise noise emissions at the receptor location(s).

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Noise Equipment and Locations

Measurement Locations cont'd

- Measurements 1.2 – 1.5m above the ground surface.
- Microphone to be 1m from face of building.
- Minimise effect of wind and rain on microphone by the use of a wind shield.
- Minimise effect of wind and rain on nearby surfaces by selecting acceptable weather conditions to undertake monitoring, DON'T measure if average wind speed>5m/s.
- Minimise electrical interference.

Measurement conditions and deviations from standards to be recorded and reported.

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Noise Assessments, Chimney Height Calculations and Dispersion Modelling, Water and Waste Audits

Noise Assessments: Noise Surveys Factors to Consider

- Background sound can vary between locations and it can vary with weather. Road traffic noise is often a key feature and this varies both with day (weekday vs weekend) and with time of day. However, the variation can be predictable.
- Measurements at a receptor may not be possible but can be predicted if distance to the source is known and there are no significant intervening features, such as large buildings or topographical features, between the source and receptor (or use an alternative measurement location).
- Similarly the effects of sound reduction at a source can be predicted / calculated.

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Noise Assessment: Noise Surveys Factors to Consider

Weather – wind, temperature and humidity affect noise propagation. Dry weather and calm conditions are preferred conditions for monitoring.

Source strength variation – operating patterns, intermittent operations. The noise monitoring report needs to include details of activity operation during survey period.

Ground effects – grassed areas, crops, snow absorb sound. Water, concrete and tarmac are acoustically 'hard' and will reflect noise. Report on the land cover between measurement site and source.

Barriers and reflections – Mounds, banks and buildings will have an effect on the travel of sound. Trees and other vegetation will normally have no effect on sound, other than contributing to the background noise levels due to wind rustling leaves.

Time of measurement – should reflect all operational times of the plant or equipment under scrutiny.

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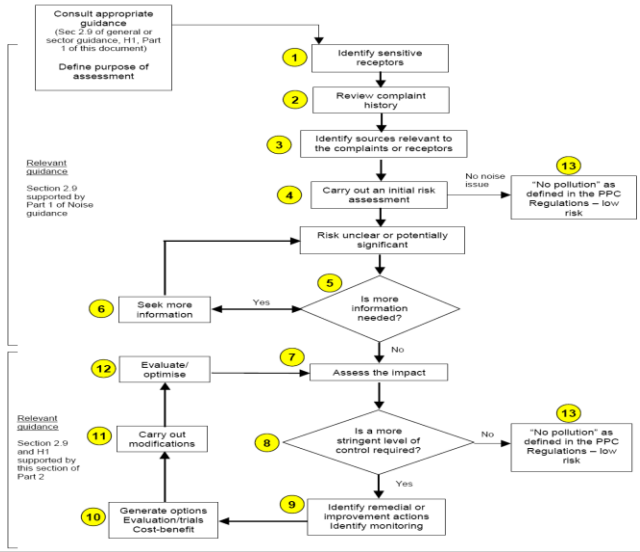
Noise Assessment: Noise Surveys Factors to Consider



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Chimney Height Calculations and Dispersion Modelling

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Noise Assessments, Chimney Height Calculations and Dispersion Modelling, Water and Waste Audits

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Chimney Height Calculations

- Note that older stack height estimation guidance such as the Chimney Heights Memorandum and the former HMIP Guidance note D1 do not address dispersion needs of current air quality standards and are not appropriate for permitted activities. However, they do provide a mechanism for calculating an indicative stack height which can then be verified by dispersion modelling.
- Beware! many SG and PG notes have not been reviewed and still refer to D1; e.g.

> 6 Where waste gas treatment includes an afterburner or a thermal oxidiser or catalytic oxidiser or boiler furnaces, asses the stack height on the basis of the need to comply with BAT 34. The stack height so obtained should be adjusted to take into account local meteorological data, local topography, nearby emissions, and the influence of plant structures. The calculation procedure in HMIP Technical Guidance Note D1, as supplemented by the additional guidance subsequently produced by AEA Technology, should be used as a basis for the assessment, insofar as it is relevant. Alternative dispersion models may be used by agreement with the regulator.

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Chimney Height Calculations

Plume dispersion is affected by many parameters but essentially the predicted maximum ground level concentration is related to the following parameters:

- The pollutant emission rate, grammes per second (g/s);
- The effective stack height in metres (m) – this includes the combined stack height and plume rise;
- The heat release rate of the discharge, Mega Watts (MW);
- Stack gas flowrate, meters cubed per second (m^3/s) and discharge (‘efflux’) velocity, meters per second (m/s);
- Wind speed, meters per second (m/s).

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Chimney Height Calculations

- The effective stack = physical stack height + plume rise (ΔH) will depend on the efflux velocity.
- SG and PG Notes recommend an efflux velocity of 15 m/s to maximise plume rise.

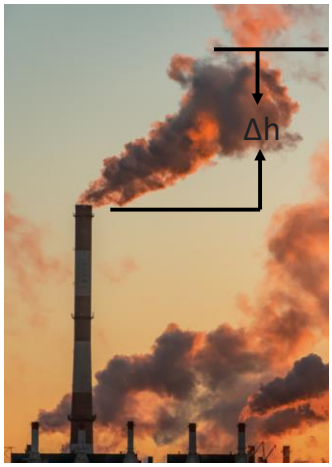
Internal diameter of stack

$$\Delta H = 3W \times {}^{d}/_{U} + Physical\ stack\ height$$

Effective stack height

Efflux speed

Wind speed



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Chimney Height Calculations

- Plume dispersion model formulae can be arranged to calculate a minimum stack height required to safely disperse a plume from a permitted activity.
- The approach is usually to establish the dominant pollutant (or group of pollutants). In D1 a pollutant index is calculated.

Pollutant Index 'Pi' of the effluent air:

$$Pi = \frac{D \times 1000}{(Gd - Bc)}$$ where:

D is pollutant discharge rate (g/s)
G_d is Guideline Concentration
Bc is Background Concentration

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Chimney Height Calculations

- The highest Pi (this may be from one pollutant or a group of pollutants) is used to determine the stack height
- The heat content Q of the plume is calculated from:

$$Q = \frac{V(1-283/Td)}{2.9} \quad MW$$

V is	Flowrate (m^3/s) at discharge conditions
T_d is	Discharge temperature (K)

- For heat content >1 MW, the uncorrected Chimney Height Ub is calculated :

$$Ub = 10^a \times P_i^b$$

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Chimney Height Calculations

- The parameters a and b are given by

$$a = 0.84 - 0.1.\exp(Q^{0.31})$$

$$b = 0.46 + 0.11.\exp(Q^{0.32})$$

- A momentum element is then calculated

$$M = \frac{283 \times V \times w}{Td} \quad \text{where:}$$

M is	discharge momentum
V is	Volume flow rate (m^3/s)
w is	discharge velocity (m/s)

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Chimney Height Calculations

- Um is additional height due to momentum of plume

$$Log10Um = x + (y.log10Pi + z)^{0.5}$$

Where:

$$x = -3.7 + (log10M)^{0.9}$$

$$y = 5.9 + 0.624log10M$$

$$z = 4.24 – 9.7log10M + 1.47(log10M)^2 - 0.07(log10M)^3$$

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Chimney Height Calculations

- Then corrected height of chimney is calculated taking in to account local topography/buildings:

$$C = H + 0.6[U + (2.5H - U)(1 - A - U/H)]$$

Where:

C = Corrected Chimney Height
H = Building height of the highest building within 5U
U = highest of either U_m or U_b
A = Um/Ub

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Example Chimney Height Calculation (1)

Sleaford REP — Fichtner

Stack Height Calculation

Flue Gases

Flow		150,850 Nm³/h	
Temperature	T_s	134 °C	
Moisture	% v/v	16.4%	
Oxygen	% v/v dry	4.9%	
Reference Flow	Dry, 11% O_2	202,851 Nm³/h	
	V	224,894 Actual m³/h	62.470 m³/s
Heat release	Q	6.563 MW	
Exit Velocity	Required	20.0 m/s	
Stack Diameter	Required Max	1.994 m	
	Actual	1.835 m	
Exit Velocity	Actual	29.8 m/s	

$$Q = \frac{V\left(1-\frac{283}{T_s}\right)}{2.9} \cdot (MP)$$

Pollution Index Calculation

Pollutant	Emission Concentration (At Reference Conditions) mg/m³	Discharge Rate D g/s	Guideline Concentration G_d mg/m³	Background Concentration B_c mg/m³	Pollution Index P_i m³/s
HCl	30	1.690	0.800	0.002	2,117
SO_2	100	5.635	0.266	0.007	21,737
Total Acid gases					23,855
CO	375	21.130	10	0.468	2,221
Particulate	30	1.690	0.050	0.037	132,065
NO_2	300	16.904	0.200	0.038	104,476
Lead	0	0.00E+00	5.00E-04	2.50E-05	0
Dioxins	0.00E+00	0.00E+00	5.00E-10	2.66E-10	0
				Pollution Index P_T	132,065

$$P_i = \frac{D}{(G_d - B_c)} \times 1000$$

Grl values are taken from National Air Quality Strategy for short term quality standards. See reference Library>ADMS section> AQSO or from D1 where no EQS exists

P_T for calculation purposes is maximum value in table above

Buoyancy Calculation

	a	-1.4401	
	b	0.5283	
Uncorrected Stack Height	U_b	18.42	
Minimum	$U_b$min	3.06 <Ub	

Q>1MW: $a = -0.84 - 0.1\exp(Q^{0.31})$, $b = 0.46 + 0.011\exp(Q^{0.31})$

Q=<1MW: $a = -1.11 - 0.19 \times \log Q$, $b = 0.49 + 0.005 \times \log Q$

$U_b = 10^a \times P_T^b$ $\quad U_b \min = 1.7 + 0.25 \times Q^{0.9}$

Momentum Calculation

Velocity	w	29.8 m/s
Stack Diameter	d	1.63 m
Momentum	M	1293
	x	-0.922
	y	3.958
	z	-13.819
	Log(U_m)	1.618
	U_m	41.46
	$U_m$min	8.12 <Um

$$M = \frac{283}{T_d} \times V \times w$$

$$\log_{10} U_m = x + \sqrt{y}\log_{10} P_T + z$$

$$x = -3.7 + (\log_{10} M)^{0.9}$$

$$y = 5.9 - 0.624\log_{10} M$$

$$z = 4.24 - 9.7\log_{10} M + 1.47(\log_{10} M)^2 - 0.07(\log_{10} M)^3$$

$U_m \min = 0.82 \times M^{0.32}$

Information from air quality assessment for a renewable energy plant published on internet

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Example Chimney Height Calculation (1)

Buildings

Affected radius	$5U_m$	207.3 m	
Uncorrected height	**U**	**18.42** Ub	(lesser of U_m and U_b)
	A	2.25 U_m/U_b	

$$C = H + 0.6\left(U + (25H - U)\left(1 - A^{-U/H}\right)\right)$$

Buildings and Structures within 5Um

	Boiler House	Straw Barn 2	Turbine Hall	Wood Storage	Straw Barn 2
Distance from stack	16.00	36.43	15.00	21.00	20.78
Height	32.00	18.00	12.00	14.10	18.00
Width (perpendicular to line of stack)	34.95	72.85	30.65	13.50	72.85
K (lesser of H or B)	32.00	18.00	12.00	13.50	18.00
T = (H+1.5K)	80.00	45.00	30.00	34.35	45.00
	Do not Ignore	Do not Ignore	Do not Ignore	Do not Ignore	Do not Ignore
Number of Buildings	5	5	5	5	5

Height	H_m	32	
	T_m	80	H+1.5K
	C	56.8	
	C*	56.8	
Multiple Buildings?	YES	Use C*	
Is U>2.5H?	NO	Use C*	
Is U>T with multiple buildings?	NO	Use C*	
	C	56.8	

$$C^* = H_m + \left(1 - \frac{H_m}{T_m}\right) \times \left[U + (T_m - U) \times \left(1 - A^{-U/H_m}\right)\right]$$

CORRECTED STACK HEIGHT = 57 m
Rounded up to nearest metre

Information from air quality assessment for a renewable energy plant published on internet

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Dispersion Modelling

Modelling the Impact of Stack Emissions

Modelling can provide an estimate of what the air quality will be as the result of various natural and non-natural processes. Air quality modelling can be used to quantify the health and environmental risks arising from releases to the air from industrial activities.

Dispersion of pollutants in the atmosphere is affected by a variety of factors:

- Atmospheric stability;
- Terrain roughness;
- Wind speed;
- Effects of nearby buildings;
- Topography.

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Dispersion Modelling

Weather Effects and Uncertainty

- Under unstable atmosphere conditions significant mixing of the air vertically occurs. This often happens when there is strong sunlight and light winds. In this case the plume will quickly disperse. At night time stable conditions tend to prevail, so that the plume will disperse less quickly. Typically models require weather data from several years to minimise uncertainty.
- Simple assumptions result in high uncertainties (±200%).
- More sophisticated models such as ADMS and AERMOD can take dispersion factors properly into account and uncertainties of ±30% are achievable.

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Dispersion Modelling

Modelling the Impact of Stack Emissions

- Plume dispersion models are commonly used to predict short-term (hourly) or long term (annual) ground level concentrations (µg/m^3) of stack pollutants arising from known or estimated stack emission rates (g/s).
- A key element of dispersion modelling is the need to link stack emissions to their impacts – for example assessing the acceptability of the resulting ground level concentration at a receptor position.

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Dispersion Modelling - Example for a New Site

Detailed modelling using ADMS or AERMOD:

- Background information (Air Quality Archive, AURN, Defra/LA monitoring, APIS);
- Discharge characteristics from plant design;
- Emission rates based on BAT-AELs or ELVs in sector guidance note;
- Local meteorological data (from Met Office);
- Building characteristics;
- Terrain (if required);
- Sensitive receptors (for protection of humans and habitats);
- Consider different statistical periods – required by different pollutants.

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Dispersion Modelling - Example for a New Site

AQ assessment criteria: Planning / Permitting.

Maximum annual mean concentration	% change in concentration relative to Air Quality Standard / Guideline			
	1	2 – 5	6 - 10	>10
75% or less of AQS	Negligible	Negligible	Slight	Moderate
76 – 94% of AQS	Negligible	Slight	Moderate	Moderate
95 – 102% of AQS	Slight	Moderate	Moderate	Substantial
103 – 109% of AQS	Moderate	Moderate	Substantial	Substantial
110% or more of AQS	Moderate	Substantial	Substantial	Substantial

IAQM planning objectives

Step 1 – A process contribution is deemed insignificant, i.e. further assessment is not required, if:

- The short-term process contribution is less than 10% of the short-term environmental standard.
- The long-term process contribution is less than 1% of the long-term environmental standard.

Step 2 – The predicted environmental concentration is deemed acceptable if:

- The short-term process contribution is less than 20% of the short-term environmental standards minus twice the long-term background concentration.
- The long-term predicted environmental concentration is less than 70% of the long-term environmental standards.

EA permitting objectives

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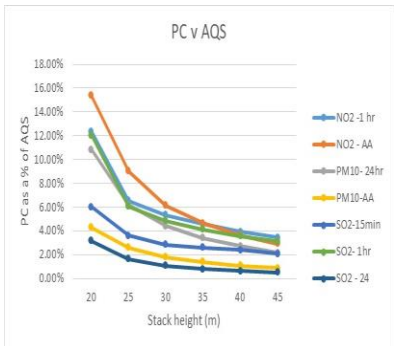
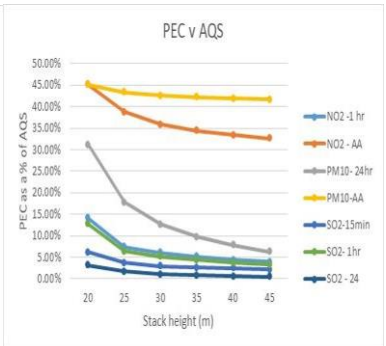
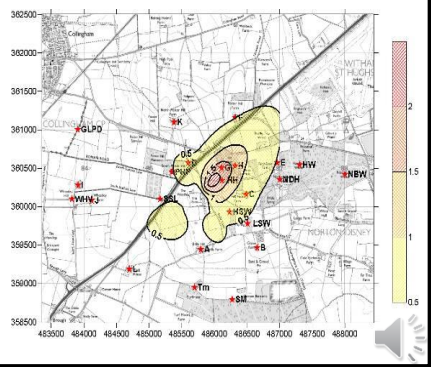
Dispersion Modelling - Example for a New Site

Example figures:

- Showing stack height selection process;
- Annual average NO_2 concentrations for chosen height.







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Dispersion Modelling – Impact Assessment for a New Site

Example comparison against AQ objective for NO_2

Receptor name		NO_2 Annual average				NO_2 99.79%			
		PC	PC/ AQS	PEC	PEC/ AQS	PC	PC/ AQS	PEC	PEC/ AQS
A	Newark Rd	0.3	0.8%	12.2	30.6%	5.2	2.6%	29.0	14.5%
B	Newark Rd	0.2	0.6%	12.1	30.4%	3.1	1.5%	26.9	13.4%
C	The Grange	0.7	1.7%	12.6	31.5%	4.4	2.2%	28.2	14.1%
D	A46, Collingham	0.6	1.5%	12.5	31.3%	6.2	3.1%	30.0	15.0%
E	Wood Ln	0.5	1.2%	12.4	31.0%	2.6	1.3%	26.4	13.2%
F	A46, Lincoln LN6 9JJ,	0.5	1.2%	12.4	31.0%	2.8	1.4%	26.6	13.3%
G	Hill Holt Wood	1.8	4.4%	13.7	34.1%	5.8	2.9%	29.6	14.8%
H	Unnamed Road,	1.4	3.4%	13.3	33.2%	4.6	2.3%	28.4	14.2%
I	Short Wheatley Ln	0.1	0.2%	12.0	30.0%	1.8	0.9%	25.6	12.8%
J	Wheatley Ln	0.1	0.3%	12.0	30.0%	2.0	1.0%	25.8	12.9%
K	Unnamed Road, Collingham,	0.3	0.7%	12.2	30.4%	3.1	1.5%	26.9	13.4%
L	A46, Collingham	0.2	0.5%	12.1	30.3%	2.5	1.3%	26.3	13.2%
	AQS	40				200			

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Dispersion Modelling – Impact Assessment for a New Site

Example comparison against various habitat objectives.

Receptor	SO_2 Annual average ($\mu g/m^3$)				NO_2 Annual average ($\mu g/m^3$)				NO_2 daily average ($\mu g/m^3$)			
	PC	PC/AQS	PEC	PEC/AQS	PC	PC/AQS	PEC	PEC/AQS	PC	PC/AQS	PEC	PEC/AQS
HH	0.6	6%	4.0	40%	1.9	6.3%	13.8	46.0%	4.3	5.7%	28.1	37.5%
HW	0.1	1%	3.5	35%	0.3	1.0%	12.2	40.7%	1.4	1.9%	25.2	33.6%
SM	0.1	1%	3.5	35%	0.2	0.7%	12.1	40.3%	1.9	2.5%	25.7	34.3%
NBW	0.1	1%	3.5	35%	0.2	0.7%	12.1	40.3%	1.3	1.7%	25.1	33.5%
WHV	0.0	0%	3.4	34%	0.1	0.3%	12	40.0%	1.5	2.0%	25.3	33.7%
Tm	0.1	1%	3.5	35%	0.2	0.7%	12.1	40.3%	2.0	2.7%	25.8	34.4%
SSL	0.1	1%	3.5	35%	0.4	1.3%	12.3	41.0%	3.9	5.2%	27.7	36.9%
GLPD	0.0	0%	3.4	34%	0.1	0.3%	12	40.0%	1.5	2.0%	25.3	33.7%
PHP	0.1	1%	3.5	35%	0.5	1.7%	12.4	41.3%	4.0	5.3%	27.8	37.1%
HSW	0.2	2%	3.6	36%	0.7	2.3%	12.6	42.0%	4.0	5.3%	27.8	37.1%
LSW	0.1	1%	3.5	35%	0.4	1.3%	12.3	41.0%	2.6	3.5%	26.4	35.2%
NDH	0.1	1%	3.5	35%	0.4	1.3%	12.3	41.0%	1.7	2.3%	25.5	34.0%
AQS	10				30				75			

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Water Audits

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Noise Assessments, Chimney Height Calculations and Dispersion Modelling, Water and Waste Audits

Water Audits

There are two areas of assessment to consider:

1) Water use – concerning resource use and **efficiency,** typically addressed by assessing water use and installation activity (e.g. throughput) to develop indicators which can be assessed against benchmark values in sector guidance or BREF or BAT Conclusions (where available).
2) Releases to water - impact assessment of **release** on receiving bodies (i.e. other water bodies to include inland water ways, ground water and sewers).

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Water Audits

Water Efficiency Audits

- Water is used in many LA-IPPC permitted activities as a raw material, for cleaning, treatment, cooling, 'domestic' and other uses.
- Reduction of water use reduces use of a natural resource and may prevent or reduce emissions /discharges to the environment. It may also provide direct cost savings to the operator for purchase and/or discharge / disposal. So indirect benefits may include reduction in energy use and reduced quantities of liquid effluent.

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Noise Assessments, Chimney Height Calculations and Dispersion Modelling, Water and Waste Audits

Water Audits

Water Efficiency Audits

- Audits include the identification of all sources of water at the activity (mains and abstractions); assessment of water use can be from metering, review of water charges or mass balances. The audit should develop 'benchmarks' to assess use against reference installations in BREF or SG notes or BAT conclusions (where available). The audit data can be used to develop a water management plan.

Generic BAT for LA-IPPC activities includes:

- Regular review of water use (water efficiency audit);
- Metering of mains and abstracted water used in installation and sub-processes;
- Development of water use benchmarks and monitoring of installation to track changes;
- Identify opportunities to reduce water use through a water management plan.

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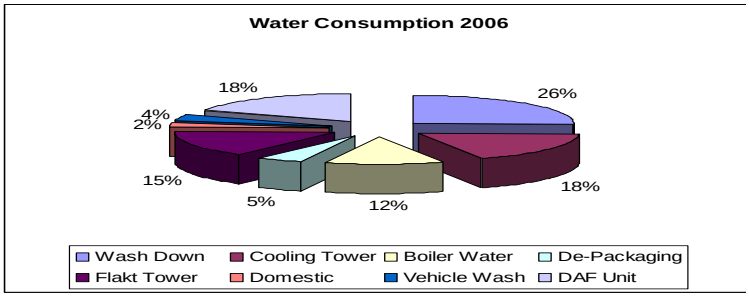
Water Audits Example

Water Usage

The site used 142,391 m^3 of potable water in the period January – December 2006. This equates to 1.65 m^3 of water per tonne of raw material processed. This usage per tonne figure has increased over the past two years due to the introduction of white water onto the DAF unit and mains water onto the odour control tower to help maintain compliance with sewer and odour discharge respectively. Water is an expensive commodity and is always used efficiently and recycled where practical.

Water Usage – Breakdown

The pie chart below shows the specific consumptions of water across the site's activities. Incoming water is metered and measured on a daily basis. Other water now metered and measured on site includes boiler feed water, soft water, wash down water, cooling tower, DAF unit and de-packaging. Some of the other figures are estimated based on mass balance calculations and known usage rates.



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Water Audits Example

Water use is measured and monitored on a daily basis to ensure that it is being used efficiently. Where practical and appropriate the site re-uses and re-circulates water in various parts of the process. The bleed-off from the main cooling tower and the clean discharge from the DAF unit is collected and used in the filter house vacuum pumps. Wash down water is now used on the effluent and De-pack rotary screens to aid in the treatment of effluent as well providing white water to the DAF unit. The Flakt tower consists of make up soft water from the centrifuge and mains water, helping reduce levels of mains water used on the Flakt Tower.

For 2007 we are now in the process of monitoring mains water consumption for the DAF unit and the vacuum recycle pumps on the filters. This again will provide us with information on where water is used and where we can reduce these levels.

Currently the majority of the roof and surface water is discharged to sewer via the site drainage system. Some roof water however, is collected and re-used where only low quality water is needed.

Site housekeeping is a very important issue in terms of minimisation of odour and cannot be compromised by the implementation of water saving objectives. All staff are made aware of the correct procedures for routine cleaning and the importance of turning off water supplies, hoses etc when not in use. The awareness training also includes the importance of using brushes and squeegees prior to hosing any spilled materials.

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Water Efficiency Audits

Sector-specific BAT for LA-IPPC processes includes:

- Use of a two bath system for cleaning to minimising use of cleaning water (SG6);
- Cooling water top-up should be provided with a water meter (SG4);
- Use vacuuming, scraping or mopping instead of hosing down (SG1);
- Trigger controls on hoses, lances and washing equipment to stop the water flow when not actively in use (SG1).

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Water Release

Water Release Modelling

- The Environment Agency risk assessment tool (formerly ‘H1’) allows a screening assessment of impacts of substances and effluent released to surface water including rivers, estuaries and coastal waters.
- This should be used to provide the necessary modelled information to support a permit application to identify which impacts may be significant and require further assessment and potentially conditioning in a permit as upgrading requirements.

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Water Release

Water Release Modelling

- Environmental Agency Guidance "Risk assessments for your environmental permit" (formerly 'H1') is a chemical specific assessment which is appropriate where the chemical composition of an effluent is 'simple'. The assessment has 5 stages:

1. Calculate a process contribution;
2. Screen insignificant emissions;
3. Identify need for detailed modelling;
4. Assess need for assessment against local environmental quality criteria;
5. Summarise consequences of emissions to water.

This is essentially the same approach as for air emissions.

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Water Release

Water Release Modelling

- More complex models include 2-dimensional hydrodynamic models to assess dispersion of pollutants in the vicinity of discharges to rivers and more complex situations such as estuarine or marine water bodies.

  You would normally expect the Environment Agency to provide comments on the impact to the aquatic environment for an A(2) permit application / variation due to substantial change. Reg 59 Environmental Permitting (England and Wales) Regulations 2016 (As amended) places duties on the EA to comment, and on the LA to impose the required conditions or more strict conditions where appropriate.

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Waste Audits

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Waste Audits

- Waste minimisation audits are a key management tool to allow the permit operator to demonstrate to the regulator that waste minimisation is effective The General Guidance Manual defines waste minimisation as: “a systematic approach to the reduction of waste at source, by understanding and changing processes and activities to prevent and reduce waste”.
- Further more; ‘In the context of waste minimisation… ..waste relates to the inefficient use of raw materials and other substances at an installation’.
- Therefore, as well as minimising waste production, optimising resource / raw material efficiency also needs to be taken into account.

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Waste Audits

- Effective waste minimisation and management offers several benefits to the environment:
  - Reduced material for disposal (e.g. to landfill);
  - Reduced use of raw materials and energy;
  - Reduced transport/handling and associated emissions.
- Clearly these also have potential cost savings for operators and the advantage for the operator to designate the permitted activity as “green” and “Environmentally Friendly”.

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Waste Audits

Generic BAT for waste minimisation (from SG notes):

- The operator should record materials usage and waste generation in order to establish internal benchmarks. Assessments should be made against internal benchmarks to maintain and improve resource efficiency;
- **Example permit condition;** “The operator **shall** complete a waste minimisation audit within 18 months of the issue date of this permit and review the waste audit every 2 years thereafter. The methodology used and an action plan for minimising wastes and residues produced by the permitted activity **shall** be submitted to the regulator for approval within 2 months of the completion of the audit”;
- Specific improvements resulting from the recommendations of audits shall be carried out within a timescale approved by the regulator.

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Waste Audits

Waste management is based on the **waste hierarchy:**

- Eliminate;
- Reduce;
- Re-use;
- Recycle;
- Treatment;
- Dispose.

Focussing on the elimination, reduction and re-use generally provides the biggest scope for cost savings for an operator.

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Waste Audits

Essential Elements:

- Identify wastes;
- Quantify waste; mechanisms for monitoring waste flows;
- Assess why wastes arise;
- Identify opportunities to reduce wastes;
- Rank opportunities;
- Recommend options for waste minimisation;
- Action plan for selected options.

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Waste Audits

- Waste audits provide data on the permitted activities process and waste streams. This allows comparison with external benchmarks (industry or BREF) and also allows monitoring of progress at the permitted activity site.
- A waste minimisation audit is often part of an environmental management system (EMS) and forms the first two elements of such a system's continual improvement approach. ***Assess….Plan….Implement….Review***
- A waste minimisation audit should cover **outputs (wastes and residues)** and **inputs (raw materials)** at the permitted activity site. The audit will also review the information gathered to develop an **Action Plan** for optimisation of raw material use and subsequent minimisation of waste and residue production, including recommendations for improvements.

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Waste Audit - Example

Inputs to Process	Rate	Outputs from Process	Rate
Category 3 ABPs	85,855 tonnes	Meat Meal	16,659 tonnes
		Tallow	19,351 tonnes
		Greaves	7,488 tonnes
		Spent Filter Aid	614 tonnes
		De-packaging Plastic	1,107 tonnes
		Used Oil	5 tonnes
Water	142,306m3	Effluent to Sewer	125,523 m3
		Material tankered off site	805 tonnes
		Scrap Metal	36.05 tonnes
		General Waste	32.48 tonnes
Gas	2206 MWh	Combustion Gases	~4000 tonnes
Tallow Fuel	2885 tonnes		
Electricity	9139 MWh		
Cooling Tower Chemicals	3814 kg		
Boiler Chemicals	3270 kg		
Meal Additives	1200 kg		
Filter Aid	336 tonnes		
Cleaning Chemicals	12 tonnes		
Generox Chemical	8 Tonnes		

Fate of the Materials

Meat Meal and Tallow are currently sold as products and are therefore not disposed of as waste.
The majority of greaves is currently being processed. Greaves which cannot be processed is sent to a power station where it is converted into renewable energy.
Spent filter aid is conditioned at an approved plant prior to being sent to landfill.
De-packaging plastic is sent off-site for incineration where the energy is recovered for power generation. We are now only removing bulk plastic in the de-packaging plant, the material is then bulked up and sent to one of our other facilities for processing..
Effluent disposed of to sewer is treated by Thames Water. Interceptor waste is sent to an off-site approved treatment plant.
Used oil is taken to an off-site approved recycling plant.
Scrap metal is taken to an off-site approved recycling plant.
General Waste is taken to a local transfer station before disposal to landfill.
Combustion gases are discharged to atmosphere.

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- Any Questions? Please email EMAQ+ to receive a response emaq@ricardo.com
- Thank You

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