DUTY HOLDER CONFERENCE

From Source to Atmosphere

Commissioning considerations

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Where we are going

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Why it matters

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Design considerations

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Commissioning

SOURCE — ATMOSPHERE

Capture at source, release at the stack

11,000

lung disease deaths a year linked to past exposures at work

28,000 to 36,000

deaths a year attributed to long-term exposure to air pollution

HSE summary statistics 2025. COMEAP.

	Workplace	Environment
Who	Trained adults	The whole community
How long	~8 hours a day	Continuous
Judged against	EH40 limits	EPR and AQS

Three routes to the duty holder: health effects, community concern and legal obligation.

WHY IT MATTERS

The substance changes the answer

Vapours and VOCs	Dusts & particles	Combustion gases	Mists and fumes
Coating, degreasing, printing	Woodworking, grinding, machining	Ovens, engines, oxidisers	Acid mists, metal fumes, plating

Same system, different answer

- Each group disperses differently and is judged against a different limit.
- Two identical systems handling different substances can need different stacks.
- The substance decides the target the design must meet.

Which limits and who enforces them

The Environmental Permitting Regulations (EPR) 2016 set the framework.

Part A(1) · Environment Agency

- The larger installations. Permits cover air, water and land.
- Requires an air emissions risk assessment, modelling where screening cannot answer, and a case for best available techniques.

Part B · local authority

- Smaller processes, air only. Paint shops, foundries, woodworking, surface treatment.
- Conditions cover abatement and filtration, stack height and discharge arrangement, and periodic testing.

Environment Agency Air Emissions Risk Assessment

Limit values

Air Quality Standards Regulations 2010. Legally binding.

Objectives and targets

AQSR target values and Air Quality Strategy objectives.

Assessment levels

Set by the Environment Agency where no standard exists.

DESIGN CONSIDERATIONS

Set the discharge at design stage

1 **Stack height**

Set by calculation, then corrected for the buildings around it.

2 **Exit flow and velocity**

Fixes momentum. Narrowing the stack raises it.

3 **Emission controls and abatement**

Lowers the emission rate, and the height required.

4 **Process siting and margin**

Moving the plant changes every receptor distance.

When it is set

- Pollution risk assessment: discharge is identified.
- Stage 2: height, velocity, abatement and arrangement are proposed.
- Stage 3: where design is refined, including abatement selection.

Optimise all parameters together and confirm whether abatement is required.

Done **while feasibility and budgets are still being set** rather than as a surprise later.

Three documents, three questions

HSG258 Current	**Is the system controlling exposure as designed?**	Hood, ducting, air cleaner, air mover and discharge. Discharge is one of the five.
D1 1993. Withdrawn 2016	**How tall and how fast?**	Height from emission rate, buoyancy, momentum and building geometry, and a minimum exit velocity. (1). First pass method. Its 1993 tables must be replaced with current values.
M1 EA measurement-location guidance	**Can the emission be measured?**	Current measurement-location guidance: stable flow, correct ports and permanent access.

(1) MINIMUM EXIT VELOCITY

By heat release: 10 m/s below 0.1 MW. 15 m/s above 1 MW. Pro rata between.

By momentum: 10 m/s below 10. 15 m/s above 100. Whichever is greater governs.

3 m height: where it comes from and what it means

Where the convention came from

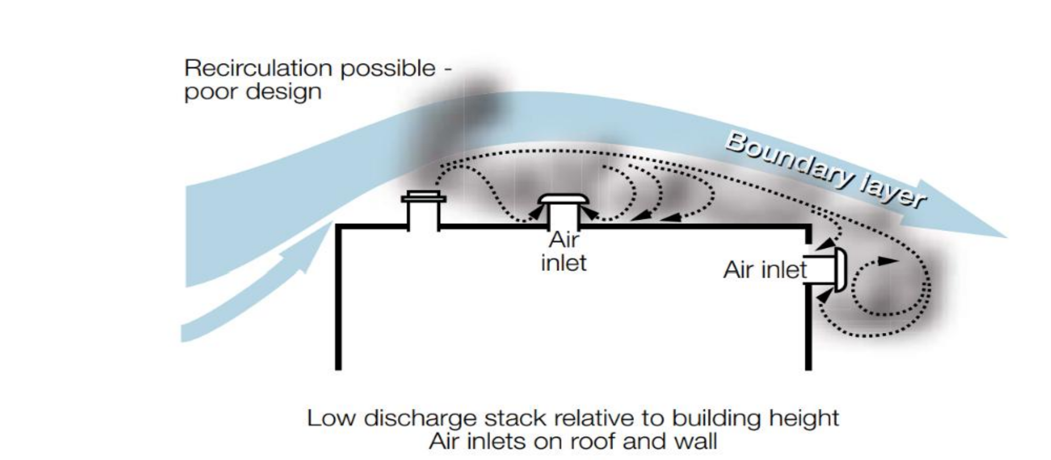
Earlier HSE guidance said stacks **may** need extending to 3 m or more. Became rule of thumb.

D1 sets clearances, not heights

- 3 m above any accessed area (6.2.2)
- 3 m above windows and inlets, 5Um (6.2.5)
- Never below a building within 5Um (6.2.4)
- Rounded up to the nearest metre (5.4.7)

What the current guidance sets

- HSG258: discharge should be well above the highest point of the building.
- EA screening: <3 m above the building is treated as 0 m effective release height.



No general guidance sets a universal 3 m minimum above every roof.

Specific permits, process guidance or regulator requirements may stipulate a height.

The height must be justified by calculation and assessment.

What D1 does with the same building

DESIGN BASIS, IDENTICAL IN BOTH CASES

8 m ridge, 30 m wide	**2.0 m³/s at 20 °C**	**0.4 m**	**20 °C discharge**	**0.5 g/s**
Building	Extract flow	Stack diameter	Discharge temp.	Max. release rate

Only the substance changes. Flow, geometry and maximum release rate remain identical. §6.2 clearances assumed not to govern.

CASE 1 · MTBE (methyl tert-butyl ether)

INPUT
Guideline concentration
9.2 mg/m³
one fortieth of current EH40 STEL

CALCULATED
Pollution Index
54

D1 ANSWER
2 m
above the ridge
10 m total

CASE 2 · FORMALDEHYDE

INPUT
Guideline concentration
0.1 mg/m³
listed in D1 Table 1

CALCULATED
Pollution Index
5,000

D1 ANSWER
8 m
above the ridge
16 m total

Screening decides whether to model

STAGE 1 → **STAGE 2** → **DETAILED MODELLING**

Is the emission significant?

Purpose: Determine emissions significance

Process Contribution vs relevant environmental standard

✓ Impact **insignificant** → Screen out

What is already in the atmosphere?

Purpose: Considers background pollution levels

Predicted Environmental Concentration

✓ Impact **insignificant** → No further assessment

What screening cannot answer

Real meteorology, real geometry, real receptor distances.

Could support a shorter stack than D1.

Output feeds back into the design.

Abatement changes the emission, not the duty

Technique	Removes	Key residual / limitation
Bag, cartridge and HEPA	Particulate	Gas and vapour phase generally unaffected
Activated carbon	Selected VOCs and odorous compounds	Finite capacity. Not particulate control
Wet scrubbers	Soluble gases and reactive acid gases	Poorly soluble VOCs may remain. Liquid effluent
Thermal oxidiser	VOCs (by destruction)	Combustion products remain; NOx or acid gases may form

What still has to be assessed

- Permit and planning requirements
- Exposure to anyone working near discharge
- Minimum stack clearances and discharge
- Bypass and emergency scenarios
- Emission monitoring and testing requirements

An abated discharge still must clear its surroundings.

A D1 height can still require modelling

SCREENING EXAMPLE: same building and airflow; formaldehyde reduced to 0.006 g/s.

D1 · formaldehyde stack calculation

D1 guideline
0.10 mg/m³

Pollution Index
60

D1 RESULT
10 m total
2 m above ridge

Environment Agency screening

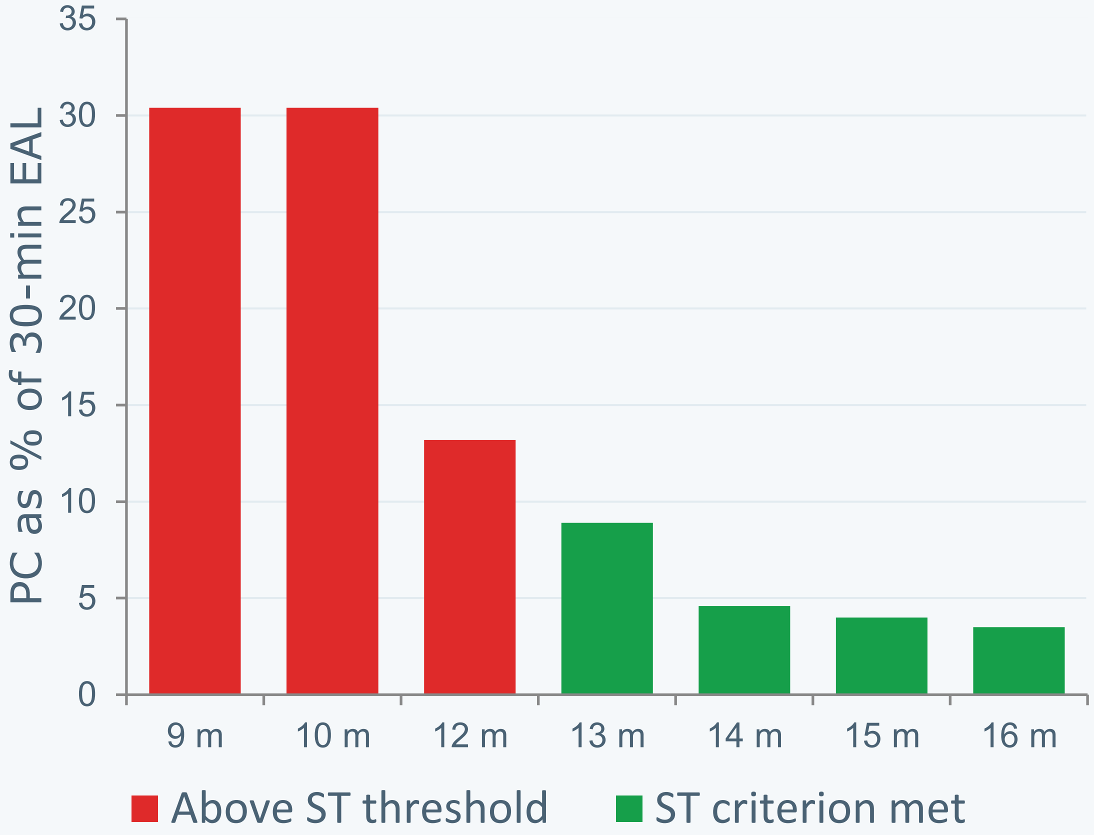
30-min PC
30.4 µg/m³

Stage 1 threshold
10 µg/m³

DOES NOT
screen out
Stage 2 also fails

D1 can calculate a stack only 2 m above the roof. That does not demonstrate environmental insignificance: this example fails both EA screening stages and proceeds to detailed modelling.

Short-term Stage 1 criterion only



What modelling determines

When it is needed

- Screening cannot be cleared at either stage.
- A permit application or variation requires it.
- Several sources, awkward geometry or a constrained roof.
- A shorter stack must be justified.

What it determines

- Predicted concentration at each receptor.
- Where the plume lands, and how often the worst case occurs.
- Which source is driving the result.
- The margin against the standard.

Key design controls it informs

- Stack height and location.
- Exit flow and velocity.
- Emission controls and abatement.
- Process siting and margin of safety.

AN ITERATIVE PROCESS, NOT A SINGLE CHECK

DESIGN › **MODEL** › **REFINE** › **MODEL AGAIN** › **IMPLEMENT**

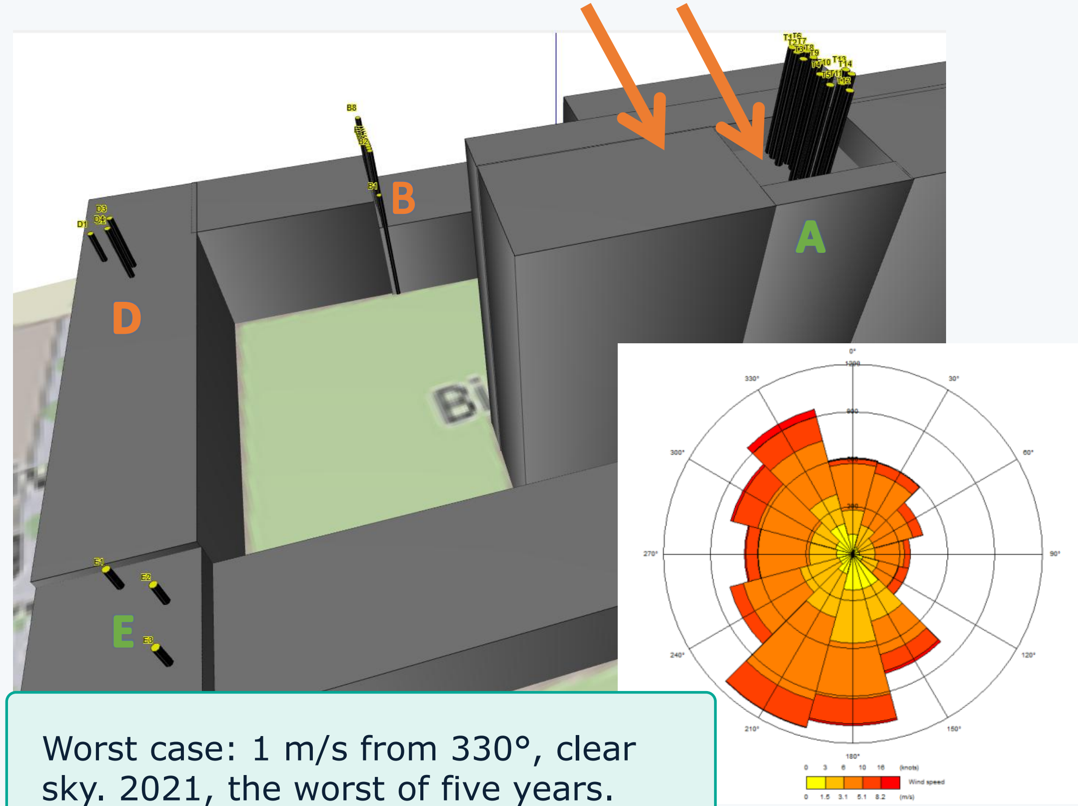
Refining height, diameter, position and abatement on paper costs a fraction once installed updates.

Case study: access to a laboratory tower roof

Twenty-nine stacks, one worst-case substance, a receptor above the roof.

THE ASSESSMENT

- 29 fume cupboard stacks, each at a minimum of 10 m/s.
- Chloroform taken as the worst case, on toxicity and evaporation rate.
- Target set at 10% of the workplace exposure limit on the roof (maintenance access).
- Receptors 1.5 m above the roof, twelve buildings for downwash.



3.2×

9.42 against a 2.97 mg/m³ target

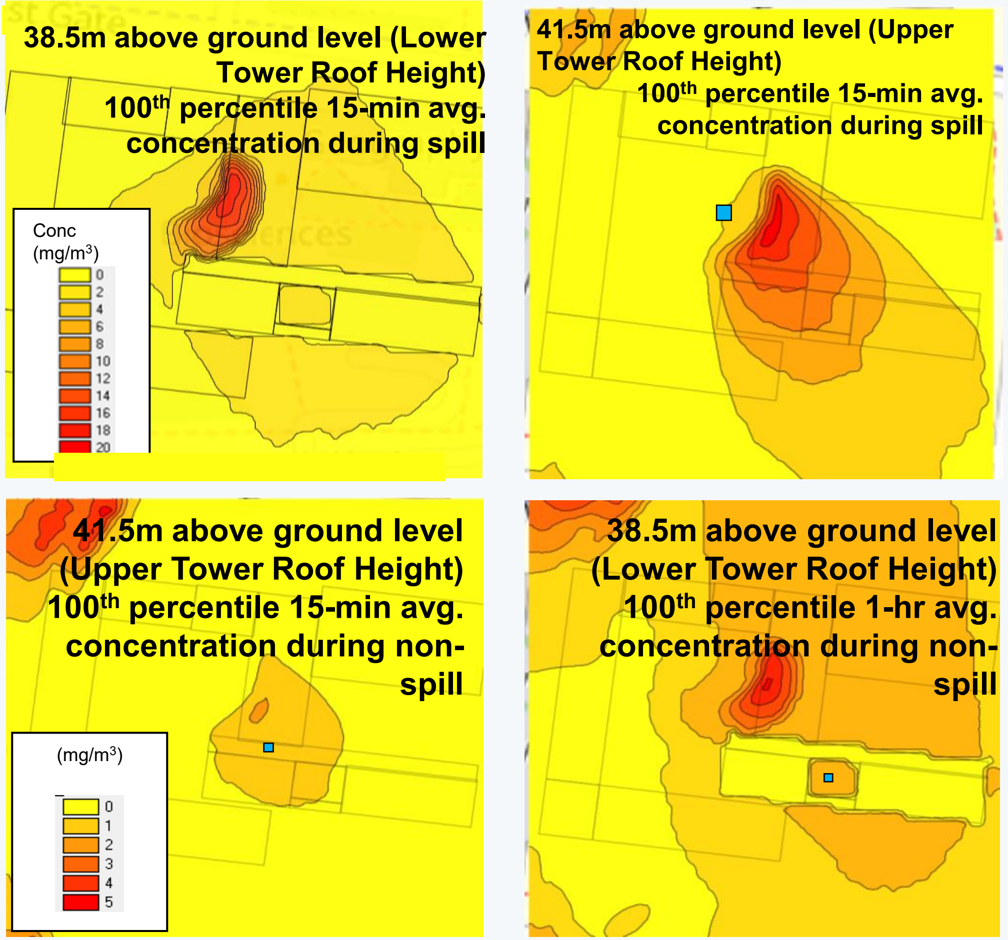
1.0%

of the year exceeded

Worst case: 1 m/s from 330°, clear sky. 2021, the worst of five years. The north-westerly component carries the plume onto the tower.

What the modelling showed

And what it made possible.



1. **The governing stack stood on another building**
   Tower and Building E spill scenarios remained below both roof-access targets; Building D could also drive an exceedance.

2. **The exceedance was conditional, not constant**
   15-minute target exceeded 1.0% of the year and 8-hour target 0.3% and only when a spill met unfavourable weather.

3. **Control could be targeted, not blanket**
   Two of the four buildings stand down during roof access. Routine operation without a spill clears every target.

Other design considerations

Structure

Support and wind loading. Lightning protection and earthing.

Materials

Internal lining and corrosion resistance, for the substance and for condensate.

Thermal and drainage

Drain at the base. Freezing risk. Insulation where buoyancy matters.

Measurement and access

Sampling provision to EA standard. Safe access for testing, inspection and maintenance.

Nuisance control

Noise at the nearest receptor. Visible plume. Interlocks and alarms.

Visual impact

Appearance and planning, particularly on sensitive or listed sites.

A cap undoes the height calculation

WHAT A CAP DOES

- Deflects the plume downwards.
- Removes the vertical momentum the calculation was built on.
- The stack stays as tall as before and performs like a shorter one.

WHAT WORKS INSTEAD

- Offset discharge stack with a drain lip.
- Open vertical discharge or a jet cowl with drain.
- HSG258: avoid rain caps and devices that reduce upward velocity. Never direct the discharge downwards.

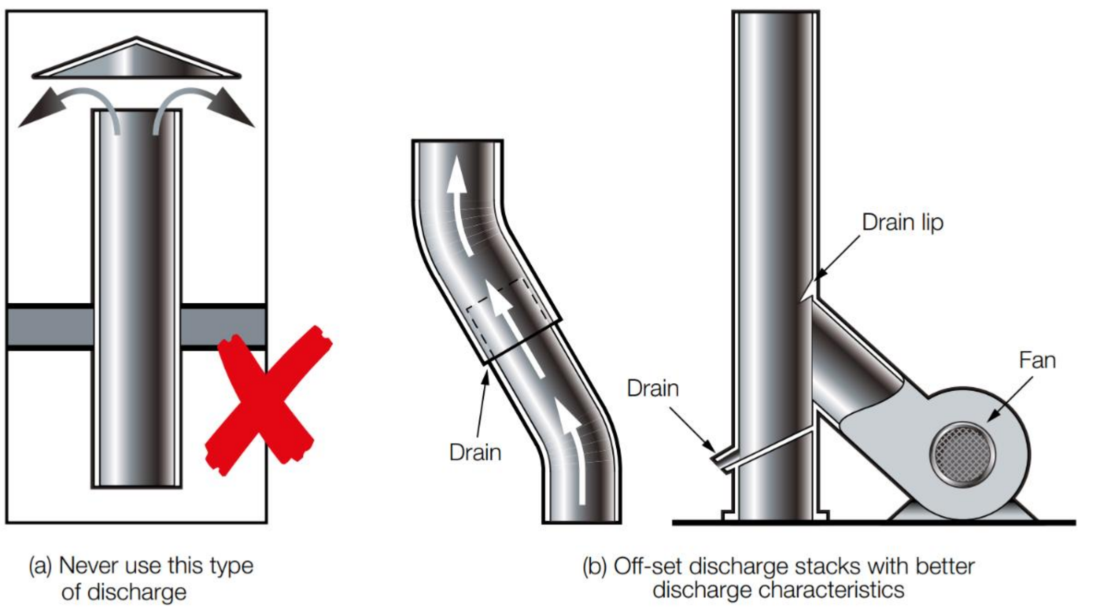


Figure 42 Stack design

Monitoring and verification

Why monitor

- Regulatory compliance against permit conditions.
- Performance verification against the design.
- Early warning of abatement degrading.

Where the sample is taken

- Sampling plane, ports and platform designed to EA measurement-location guidance.
- Safe access required; permanent platform recommended wherever practicable.

How it is tested

- MCERTS performance standards.
- Published reference methods for each substance.

Regular LEV examination and periodic emission testing, done to those standards, are what demonstrate the system is still performing as designed and catch a problem before a limit is breached.

Commissioning the discharge

1. **Air flow matches the design**
   And therefore the exit velocity the height calculation assumed.

2. **The stack matches the design**
   Height, diameter, position and termination as drawn. No rain cap.

3. **Sampling provision to EA measurement-location guidance**
   Plane, ports, platform and access, where monitoring will be required.

4. **Abatement performance verified**
   Pressure drop, media condition and removal efficiency against the specification.

5. **Bypass and failure routes recorded**
   Where each discharges, and how its status is shown to the operator.

The commissioner produces the commissioning report. Relevant performance data is carried into the user manual and logbook as the benchmark for later examination and test.

Best practice summary

Design phase

- Engage the regulator before the design is fixed.
- Establish the height by calculation and record its basis.
- Screen the emission, and model where screening cannot answer.
- Consider abatement, and what it does not remove.
- Fix termination, efflux velocity and position with the height.
- Design in sampling provision and safe access.

Operational phase

- Examine and test thoroughly at the required interval, usually 14 months.
- Test emissions to the standards the permit requires.
- Re-verify exit velocity after any change to flow, filtration or fan speed.
- Keep the calculation and commissioning data available.
- Reassess when throughput, substance or hours change.
- Reference discharge status in roof access arrangements.

Thank you

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Questions