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SOCOTEC

East Kilbride

Noise Assessment

- Noise Assessment Why?

Legal Requirement –
Control of Noise at Work Regulations 2005.

Assess, control

Protect workers health

Noise Assessment

Need to determine employee exposure

All exposure

Noise from operation

Background Noise

Variable Noise

Personal Noise
Dosebadges
Need to explain why to worker
Need co-operation
Ensure good selection covering all tasks

Noise Assessment

Spot noise
Individual Machines
Individual tasks
Allows noise mapping to be done
Identify areas where high exposure likely
Allows frequency data to be obtained.

Need information regarding
Shift length
Typical or atypical day
Exposure times to different operations
Hearing protection details
Any HPZ
Note other sources, plant, machinery

All results and background used to determine
Is worker likely to be exposed above LEAV, UEAV
Consider peak exposures
Determine likelihood of damage to unprotected hearing

Identify areas where noise can be controlled at source

Enclosures

Segregation of worker and sources

Switch off when not in use

Sound insulation

If risk still exists
Select suitable hearing protection
Plugs or muffs
Protect to 70 dB(A)
Risk of overprotection

Consider need for health surveillance
When to review or repeat survey
Signage and warnings

Training and information for all employees.

SUMMARY OF REQUIREMENTS

Identify hazards
Quantify Risks
Eliminate or control
Train
Review.

BAE SYSTEMS

Buying an LEV System

Content of the Session

- BAE
- Reality of buying an LEV and the failings
- HSE Procurement model - BAE Procurement model
- Competency
- Solutions Assessment
- Control Strategy – Benchmarking
- Specifications
- Supplier Proposals
- Validations

Buying an LEV System

BAE Systems Air – Samlesbury

- Samlesbury is at the forefront of aircraft manufacturing with the main focus being on the F-35 Lightning II and Typhoon programmes.
- Key Facts:-
  - Investment in Samlesbury development by BAE Systems in recent years is £750m.
  - Machining investment includes suppliers from Switzerland, Germany, US, Japan, Spain, Canada and UK.
  - Approximately 5,000 employees.
  - Site area of 351 acres.
  - Number of LEV systems 308
  - Specialist capabilities: -
    - Advanced manufacturing technology.
    - Carbon fibre composites.
    - Super plastic forming/diffusion bonding.
    - Additive Manufacturing

Buying an LEV System

The Reality

- Systems not meeting design standards
- Systems non- compliant to HSG 258
- Vital information not available
- No system design
- No benchmarks
- No Commissioning Report
- Poor Competency of the installers
- No Monitoring of the system
- No operator or maintenance training

Buying an LEV System

Failings and Implications for the End User

Focus on the equipment not on the control of the contaminants unfortunately - its an after thought.

Employers over reliance on the supplier and receiving poor advice from suppliers and 3rd Parties.

Do you consider the Hood 1st or Last ??

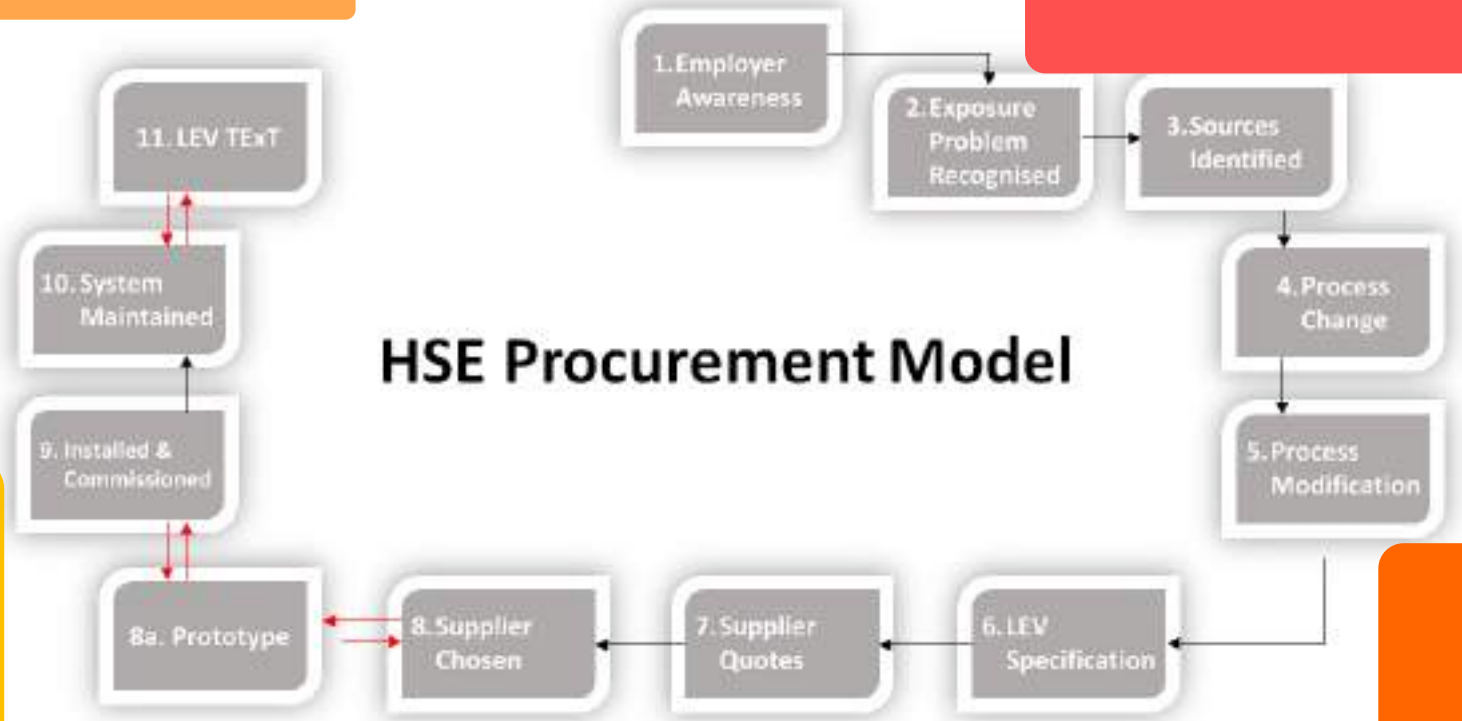
The customer - Just tell me what I need !!

You are the expert – I will leave it to you

Buying an LEV System

BAE Process

Business Need / Validation



Review

Delivery, Implementation & Validation

Solution Definition & Approval

Solution Assessment

Buying an LEV System

BAE Procurement Procedure / Process

- Approved Suppliers
- SSIP
- 3rd Party assessments
- Review Experience
- Risk Assessments and Method Statements
- Safety Performance
- Qualifications
- CDM Regulations- Principle Designer- Principal Contractor
- Scoring / Weighting

Buying an LEV System

Competency- The Main Problems

- Suppliers, employers and employees, are over-optimistic about LEV capabilities.
- Poor Knowledge and skills amongst duty holders and suppliers
- Employer's don't appreciate the extent of exposure risk from their processes
- Employers are often mislead and mis-sold
- LEV design, often the LEV hood is not matched to the process and source(s) causing exposure
- LEV commissioning, rarely done thoroughly

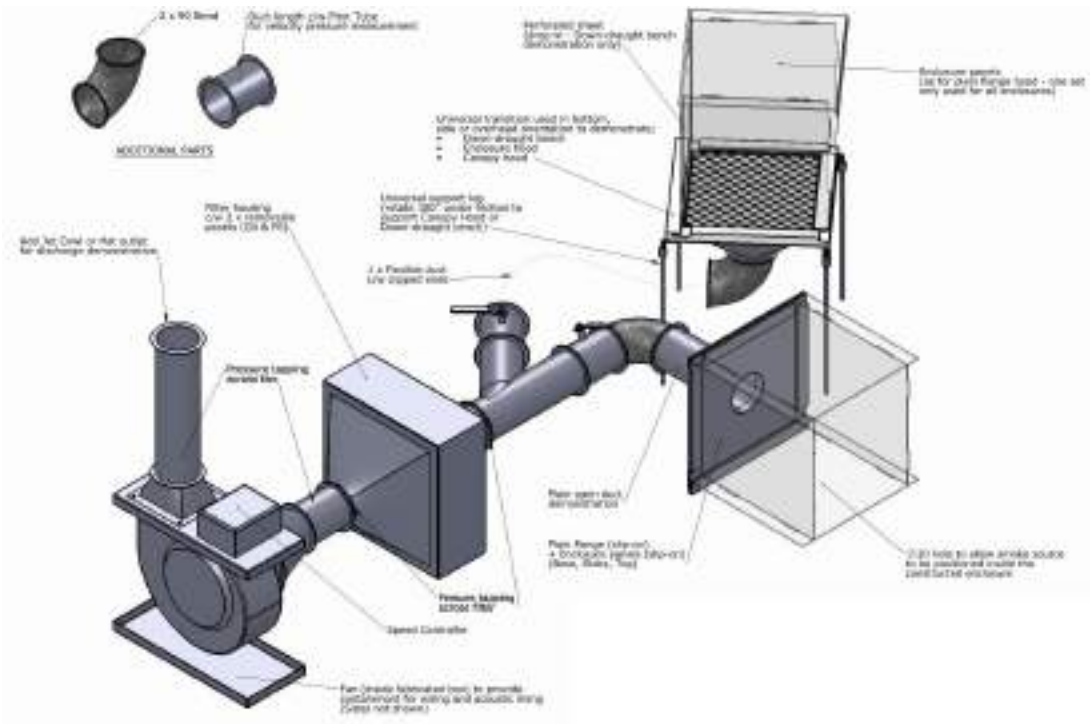
Guidance

- Knowledgeable Expert to develop concept and technical design
- Detailed Design maybe developed by the system supplier
- Expert / suppliers competency – P602
- Is this enough !!

Buying an LEV System

- Safety department attended a 1 day LEV awareness course 2016
- 18 Safety team attended BOHS W505 course 2016 & 2018
- Involvement of the SHE department in the LEV project has develop knowledge and awareness.
- LEV specialist attending P601 – Thorough Examination and testing qualification 2017
- LEV specialist attending P602 – Basic Design principles of LEV systems qualification 2018
- LEV 6 X 1 day courses for Maintenance 2019, understanding principles, COSHH, DSEAR, fault finding, testing.
- LEV 6 x1 day courses for Project Engineers / Project Managers / Safety Team 2019 , understanding design requirements and key components

BAE Competency



BAE SYSTEMS

Buying an LEV System

Solutions Assessment

- Exposure Assessment- COSHH- DSEAR
- Testing of the material
- Air Monitoring
- Level of control required
- WEL within HSE EH40 – ALARP
- Focus on the Hood Design
- ATEX- Equipment Categories

Buying an LEV System

Operational Considerations

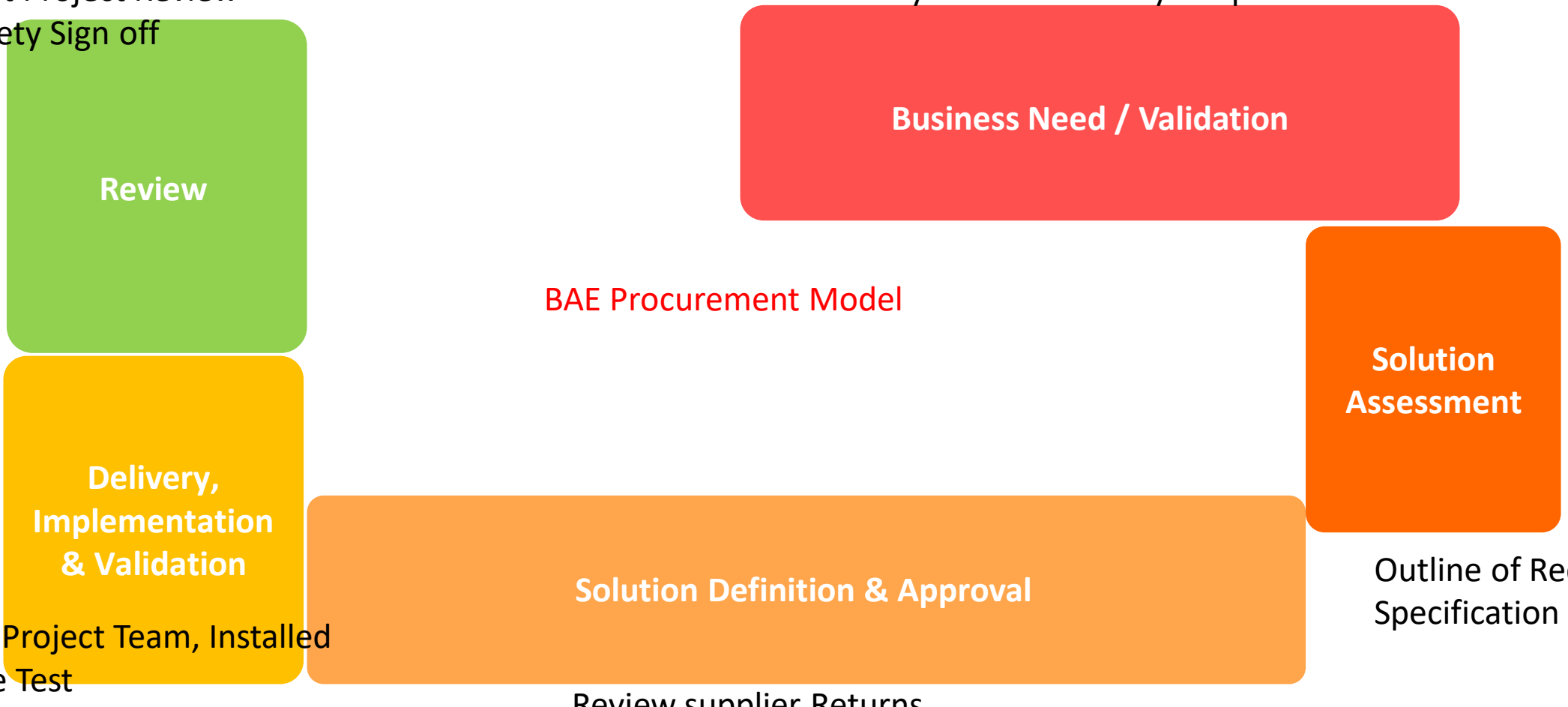
- Permanent work platforms – Working at Height Regulations and EPA Technical Guidance Note M1
- Working platforms are required to Maintain plant- fans – filters
- Access to test and sample
- Access for internal ductwork inspections
- Plant resources, Electrics, Floor space, Maintenance.
- Environmental regulations, Fire regulations, CDM
- Future expansions,
- Ergonomics, lights, make up air, energy, noise

Stacks with Sampling Platform
(Courtesy Mechon)

Buying an LEV System

Post Project Review
Safety Sign off

Technical Safety Committee- Key People



Outline of Requirements, Specification

CDM, Project Team, Installed Article Test

Review supplier Returns

Planning Phases

Business Need & Validation

Awareness: are you aware of the potential health risks within your industry?

Recognise Exposure Problems: which processes and activities could cause exposure consider maintenance

Identify Potential Sources: understand the characteristics of the exposure source, including the type of contaminant (dust, fume, vapour etc.), how it causes exposure, where and how dispersed is the exposure and how it is ranked in importance to other sources of exposure

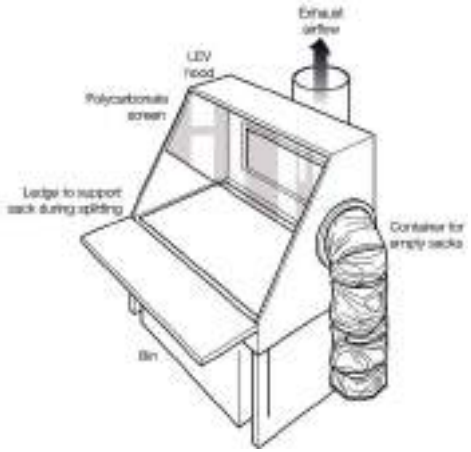
Planning Phases

Solution Assessment

Process Change

The term **process** includes the activities that creates exposure

- The first step would be to **substitute** or **eliminate** the hazardous substance;
- Alternatively, **move** the process to a location where employees are no longer exposure, or exposure is **reduced**.



Process Modification

- **Modify** the process to accommodate **effective control**
- **Reduce the quantity** and **quantity rate** of the emission
  - wet wipes versus soaked rags
  - low pressure, low flow on spray guns
  - limit application area for spraying
  - Vacuum in place of sweep
- Combine sources into single location or control system

Buying an LEV System

Exposure Benchmarking

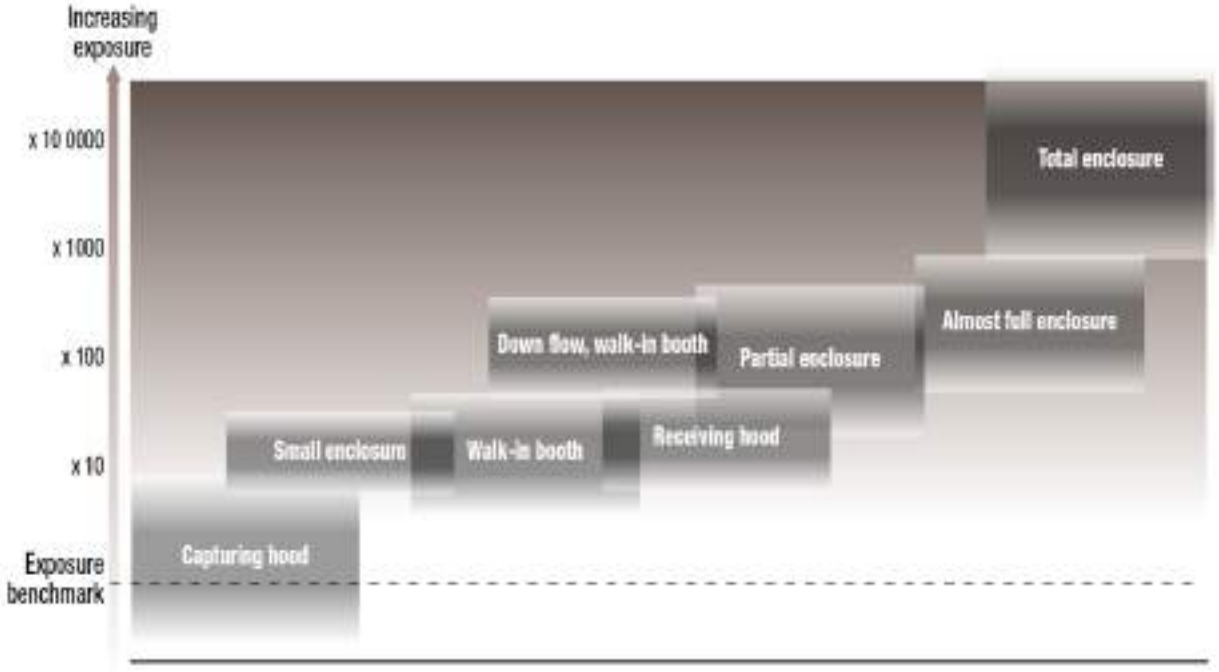


Figure 9 Effectiveness of various types of LEV

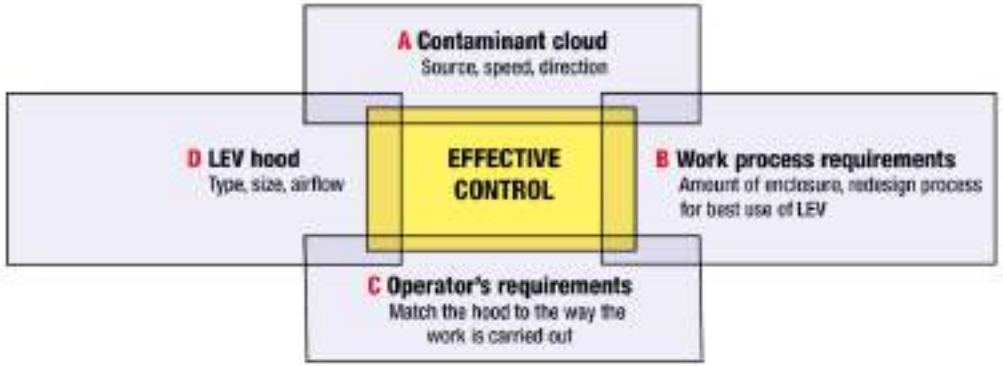
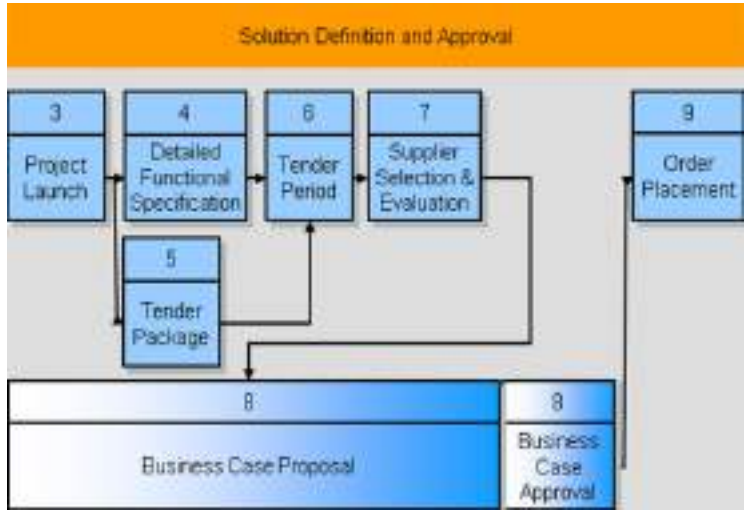


Figure 8 Developing effective LEV for more complex systems

Solution Definition & Approval

Planning Phases



Developing an LEV Specification

- Ideally use a knowledge expert to develop the concept and technical design
- Understand capture zones, working zones and breathing zones
- The detailed design may be developed by the system supplier (yet using the expert to validate)
- Any specification should set out the operational, functional and performance requirements of the system
- The specification should detail the process, exposure sources and operator requirements
- The specification should cover relevant standards, quality of workmanship, manuals , log books and commissioning requirements

Supplier Quotes and Selection

- Ensure that supplier is experienced in LEV installations and is not a building services contractor (may only be possible if an expert is able to valid the design and installation)
- Understand the suppliers' competencies for design, installation and testing

Buying an LEV System

How do BAE select an LEV Supplier

- Invite potential suppliers to site
- Invite 3 tenders- proposals
- Provide a drawing of the area and the processes to be controlled
- Provide a specification for the work to be done
- Inform potential suppliers about the materials , processes, any environmental or fire and explosion requirements.

Buying an LEV System

Supplier Proposal and Evaluation

- Key Objectives- Equipment Type, Operational , Functional , Performance
- Feasibility – Concept
- Tender Pack
- Objective- WEL Benchmark
- Equipment list to be supplied
- Process flow- materials
- Cost estimates
- Performance measures- Adherence, Quality, Relationships
- Previous Customer Concerns

BAE SYSTEMS

Buying an LEV System

Validation of Proposal

- Operation -Function
- Performance
- Equipment
- Monitoring
- Cost
- Energy
- Access

Problems identified from Validations

- Filter Type
- Duct sizes
- Explosion Valve
- DSEAR
- Monitoring

Planning Phases

Delivery, Implementation & Validation

Prototypes

- Develop a prototype hood for complex or new processes and gain feedback from operatives
- Prototypes may also confirm effectiveness of control
- There may be potential to reduce system costs by confirming reduced airflow conditions in a prototype hood

Installation & Commissioning

- Ensure that all components within the system are supplied and installed (**including airflow monitors and Filter monitoring**)
- Verify that there is sufficient services (such as power and compressed air) for any installation
- Verify that all plant is assembled correctly
- Check that any fans are rotating in the right direction
- Ensure that all setting dampers are locked in position (tamper-free)
- Does commissioning demonstrate that the system adequately control all process sources? Witness the commissioning. Sufficient makeup air. Smoke tests
- Ensure that you always receive an LEV commissioning document

Planning Phases

Review

Maintenance

- Ensure that you have a user manual for the system
- Ensure that all operatives are trained in the use of the system
- A logbook is required for the operative to record weekly visual inspections
- Ensure that only competent persons carry out service and maintenance work
- The system is to be retested against the original commissioning data and after any remedial or rectification works
- Ensure that any airflow indicators remain calibrated

Thorough Examination & Test (TExT)

- Under Regulation 9 of the COSHH Regulations, all control systems need to be tested at least once every 14 months (subject to limited process exceptions, which require more frequent tests)
- Evaluate that inspection procedures and what checks are being done
- Ensure that the examiner is able to test and examine the system when it is in operation and when the process is active
- Ensure that procedures are in place to review inspection reports and implement service and repair works based recommendations by the examiner

Buying an LEV System

Key Messages for Designers / Suppliers

Designers/Suppliers need to provide LEV which matches and controls all the processes and sources causing exposure, comes with adequate instructions and instrumentation and is effectively commissioned.

Client engagement

Explain Key responsibilities

Request the information Required

Help the employer to get the right type of LEV

Provide a clear quotation that covers what the employer (client) needs

Match the LEV hoods to control the processes and sources

Provide a Commissioning Report

Provide a User Manual and Log Book

Provide Air-flow indicators

BAE SYSTEMS

Buying an LEV System

Key Messages for Employers / Client

The End User- Client needs to demand an LEV that works, has adequate instructions, and is effectively commissioned and instrumentation.

Work out which jobs and activities cause contaminants

Write down what the LEV needs to do

Get the right type of LEV to control exposure

Involve your employees in LEV design or selection

Make sure the LEV is installed properly and works effectively

Make sure the LEV has airflow indicators

Make sure the supplier provides a User Manual and Log Book

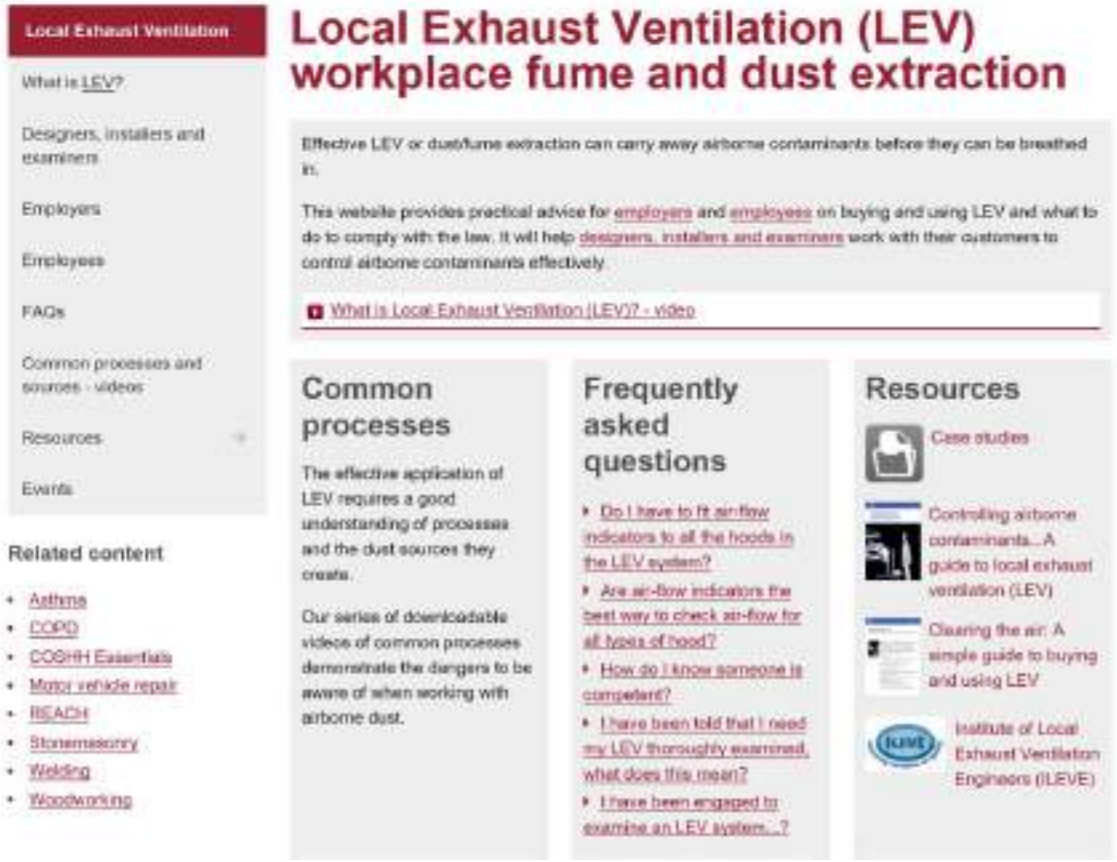
Employers, buying LEV systems, need to be clear in writing, about the processes and sources to be controlled by LEV and the degree of LEV control needed.

Employers (duty holders) to be much clearer in preparing written specifications and HSG 258 will help suppliers provide what is needed.

BAE SYSTEMS

Buying an LEV System

ILEVE Institute of Local Exhaust Ventilation Engineers
BOHS The Chartered Society for Worker Health Protection
LEV 2020 Extracting the Best Practices
Tuesday 25th February 2020 | Hilton East Midlands Airport



Local Exhaust Ventilation

What is LEV?
Designers, installers and examiners
Employers
Employees
FAQs
Common processes and sources - videos
Resources
Events

Related content

- Asthma
- COPD
- COSHH Essentials
- Motor vehicle repair
- REACH
- Stonemasonry
- Welding
- Woodworking

Local Exhaust Ventilation (LEV) workplace fume and dust extraction

Effective LEV or dust/fume extraction can carry away airborne contaminants before they can be breathed in.

This website provides practical advice for employers and employees on buying and using LEV and what to do to comply with the law. It will help designers, installers and examiners work with their customers to control airborne contaminants effectively.

What is Local Exhaust Ventilation (LEV)? - video

Common processes

The effective application of LEV requires a good understanding of processes and the dust sources they create.

Our series of downloadable videos of common processes demonstrate the dangers to be aware of when working with airborne dust.

Frequently asked questions

- Do I have to fit air-flow indicators to all the hoods in the LEV system?
- Are air-flow indicators the best way to check air-flow for all types of hood?
- How do I know someone is competent?
- I have been told that I need my LEV thoroughly examined, what does this mean?
- I have been engaged to examine an LEV system...?

Resources

Case studies

Controlling airborne contaminants...A guide to local exhaust ventilation (LEV)

Clearing the air: A simple guide to buying and using LEV

Institute of Local Exhaust Ventilation Engineers (ILEVE)

LEV information for employers

Many employers buy LEV to protect workers' health but find that it doesn't work. This may be because it's the wrong type or because it's not properly installed or maintained.

This website will help employers develop a systematic and critical approach to buying and using LEV to avoid expensive mistakes and control exposures effectively.

Key messages for buying LEV

- Work out which jobs and activities cause exposure.
- Write down what the LEV needs to do - get a reputable supplier to advise you .
- Get the right type of LEV to control exposure.
- Involve your employees in LEV design or selection.
- Make sure the LEV is installed properly and works effectively
- Make sure the LEV has airflow indicators (or equivalent).
- Make sure the supplier provides a User Manual and Log Book (or equivalents).

Resources

Clearing the air: A simple guide to buying and using LEV (PDF)

Time to clear the air! - A workers' pocket guide to LEV (PDF)

Useful calculator for LEV assessors

Health and Safety Executive

Clearing the air: A simple guide to buying and using local exhaust ventilation (LEV) 4 of 9 pages

LEV Noise Control Best Practice…
… is far too rare

LEV Noise Control Best Practice…

… is far too rare

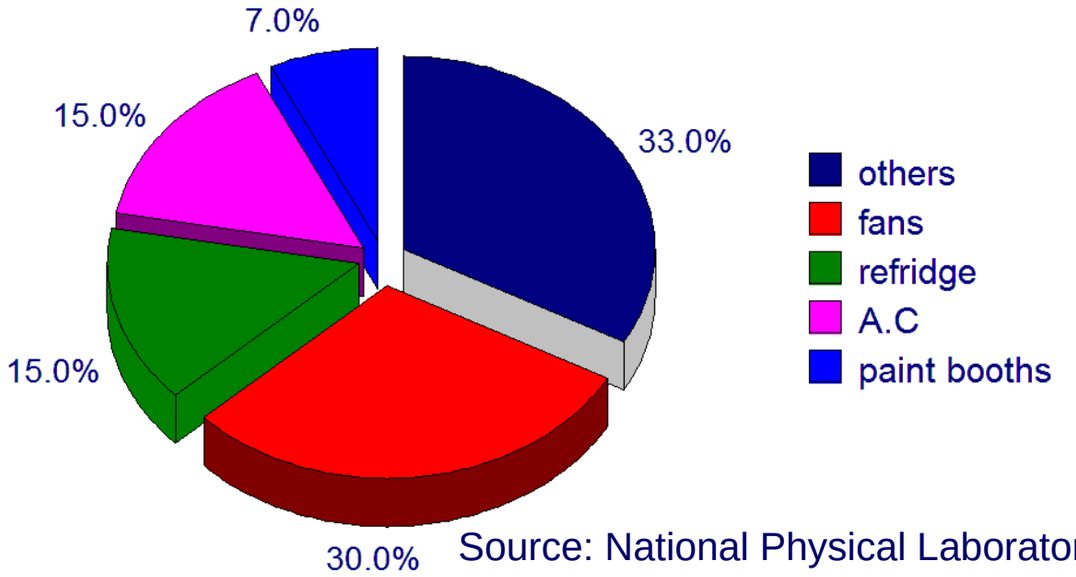
Occupational Noise

- Health – NIHL + tinnitus + 9% increased risk of dementia etc…
- PPE – direct and indirect costs
- Hassle – risk management, policing, claims, audiometry…

HSE "…these regulations are concerned with controlling noise, not measuring it ..."

Environmental Noise

The vast majority of noise complaints re industrial premises are due to fans. Environmental noise kills 200,000 people per annum in Europe and is the 2nd largest health risk in Western Europe.

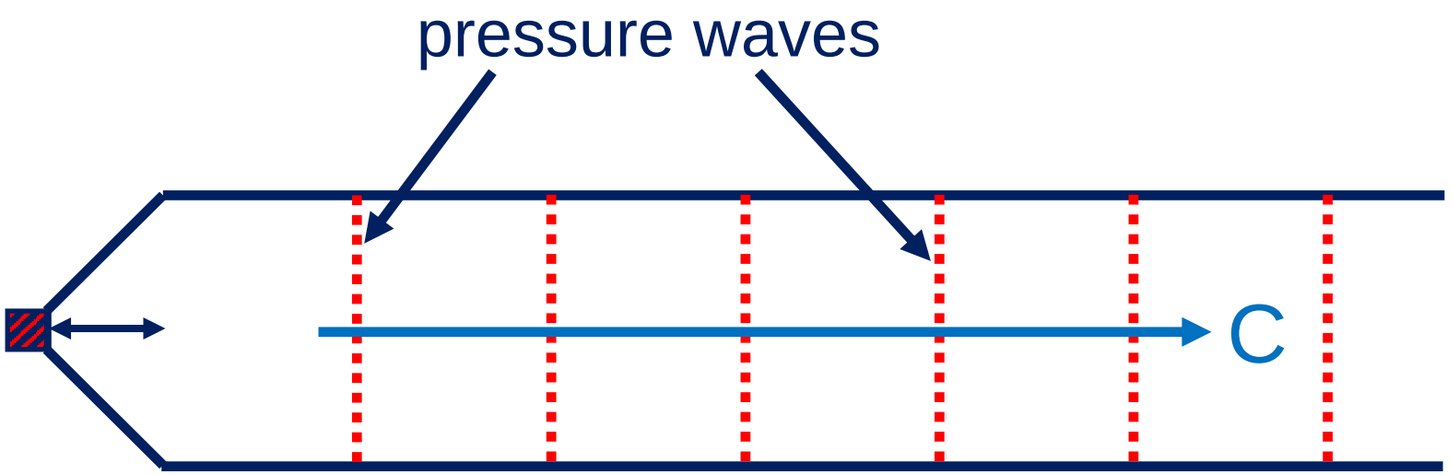


Source: National Physical Laboratory

The regulators say that 80% - 90% of environmental noise reports are inadequate…

Axial fan - centrifugal fan

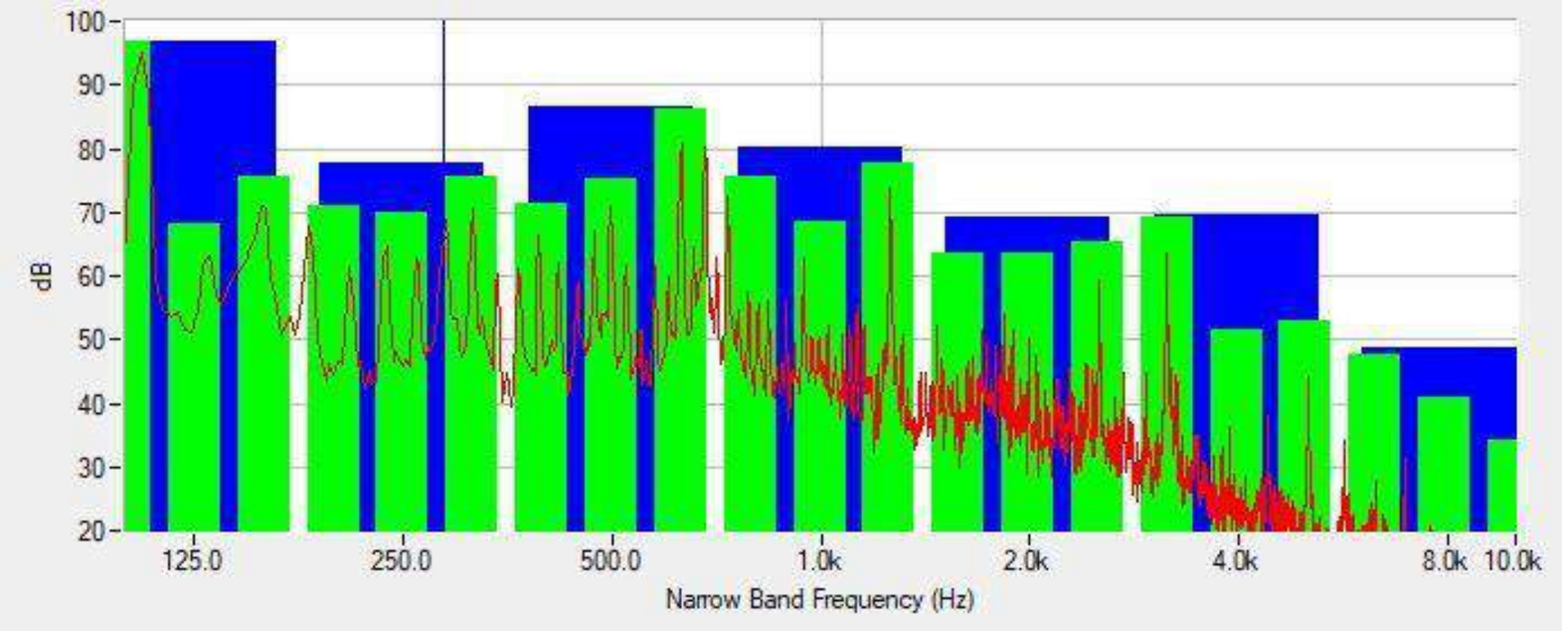
Sound in ducts

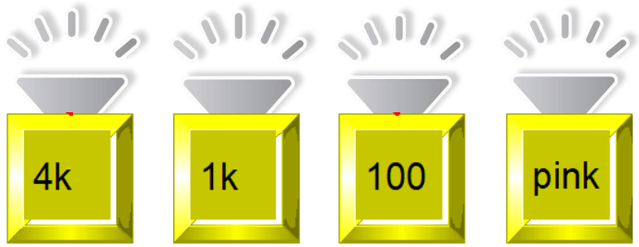


no decay with distance – you get out nearly everything you put in

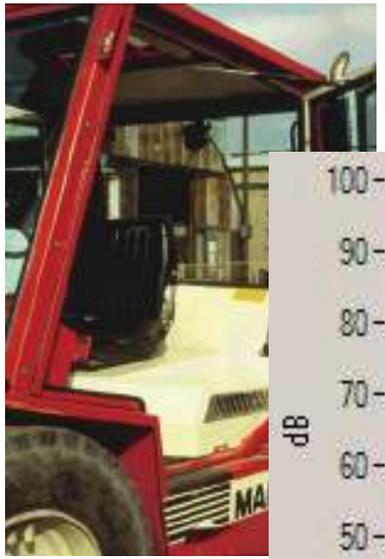
Broadband and Tonal Analysis Comparisons

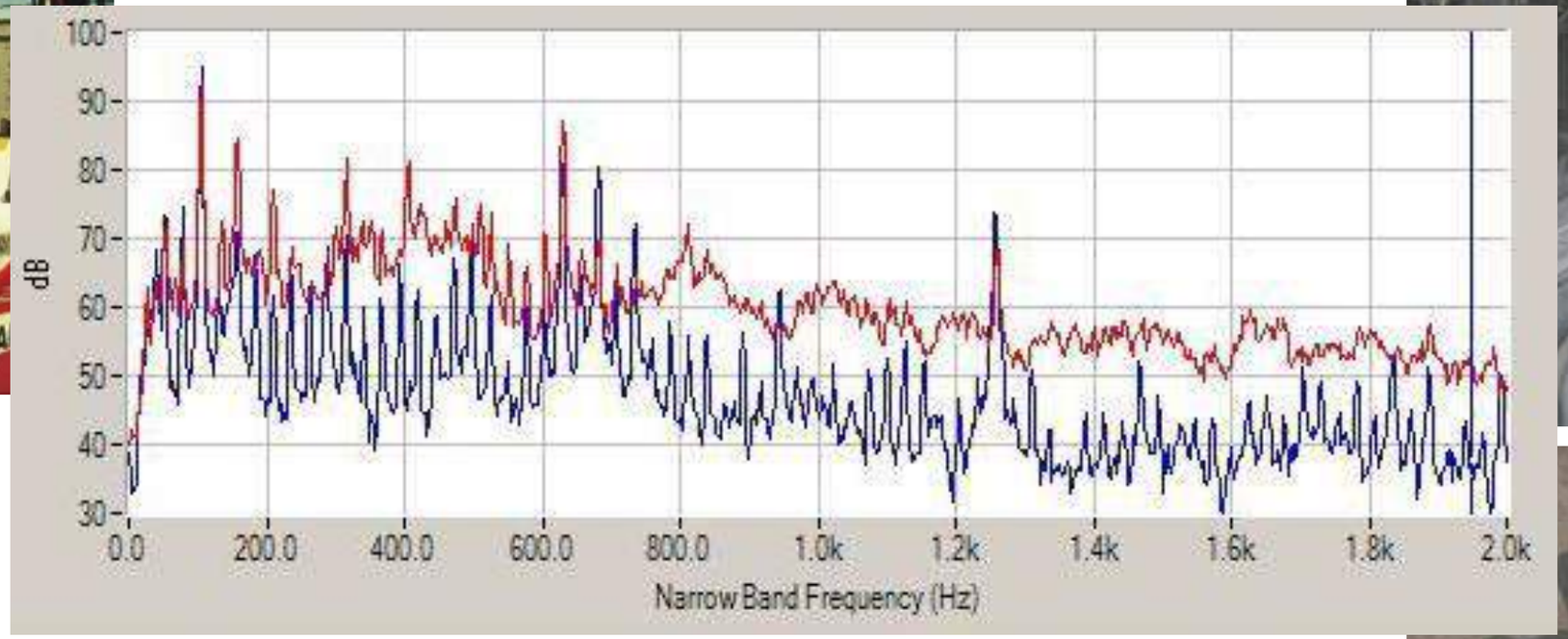
2 types of fan noise – broadband and tonal

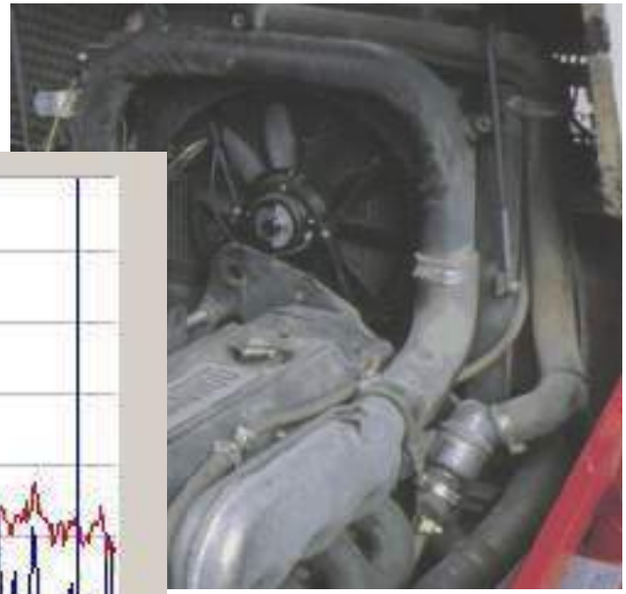




Manitou Fork Lift Noise Reduction





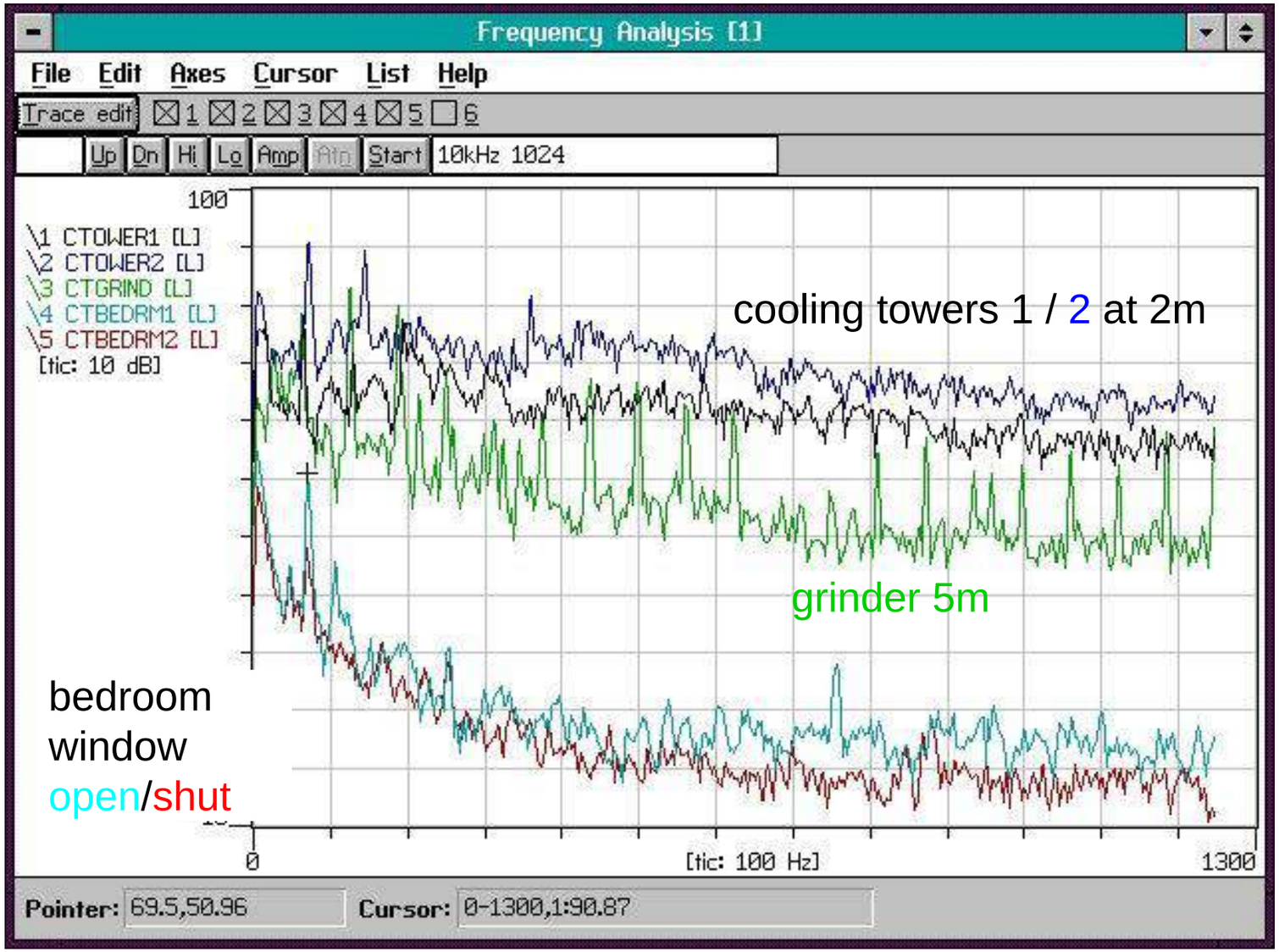


6dB(A) quieter – but sounds noisier….

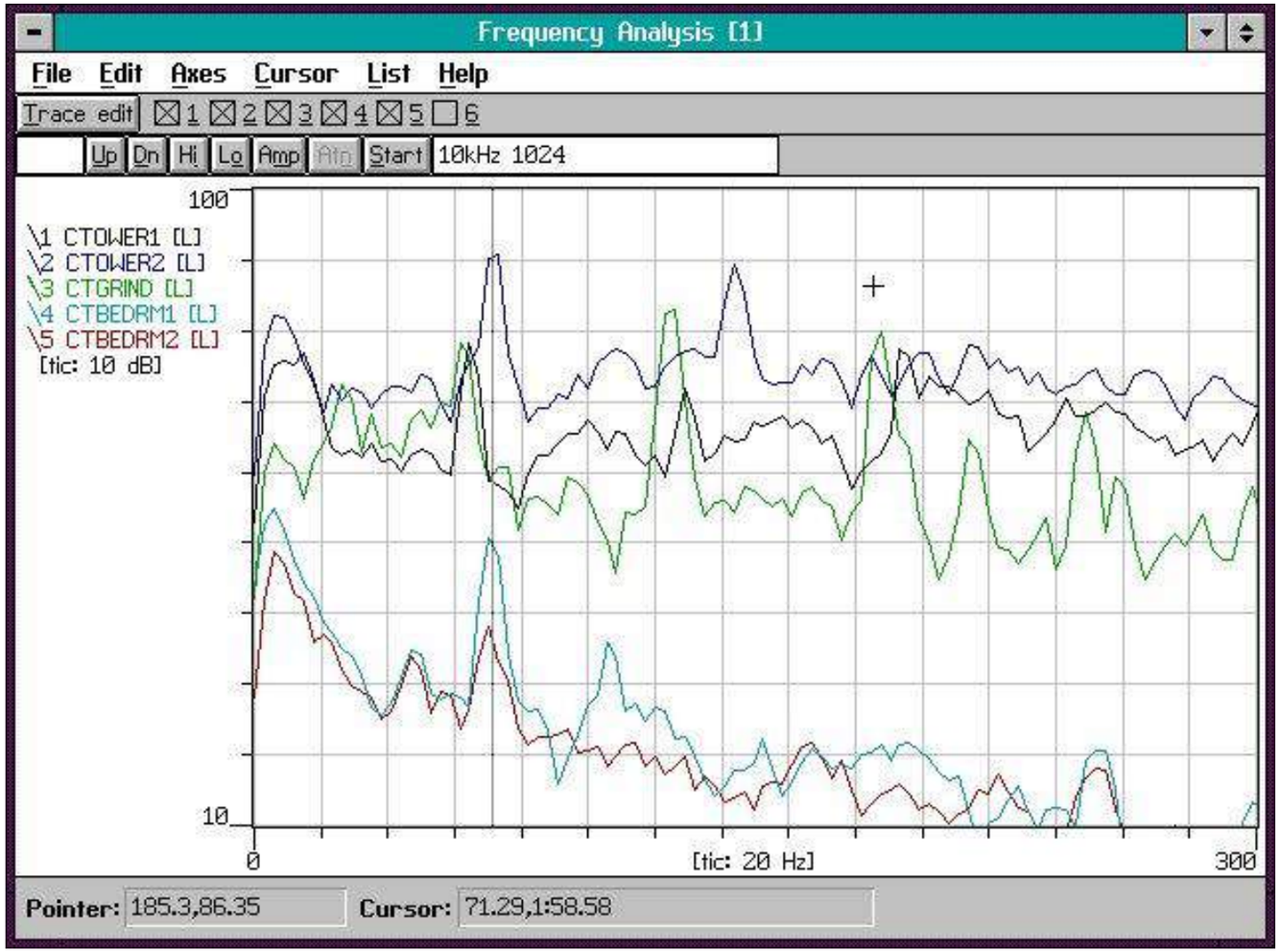
long

short

Cooling Tower Noise Source ID

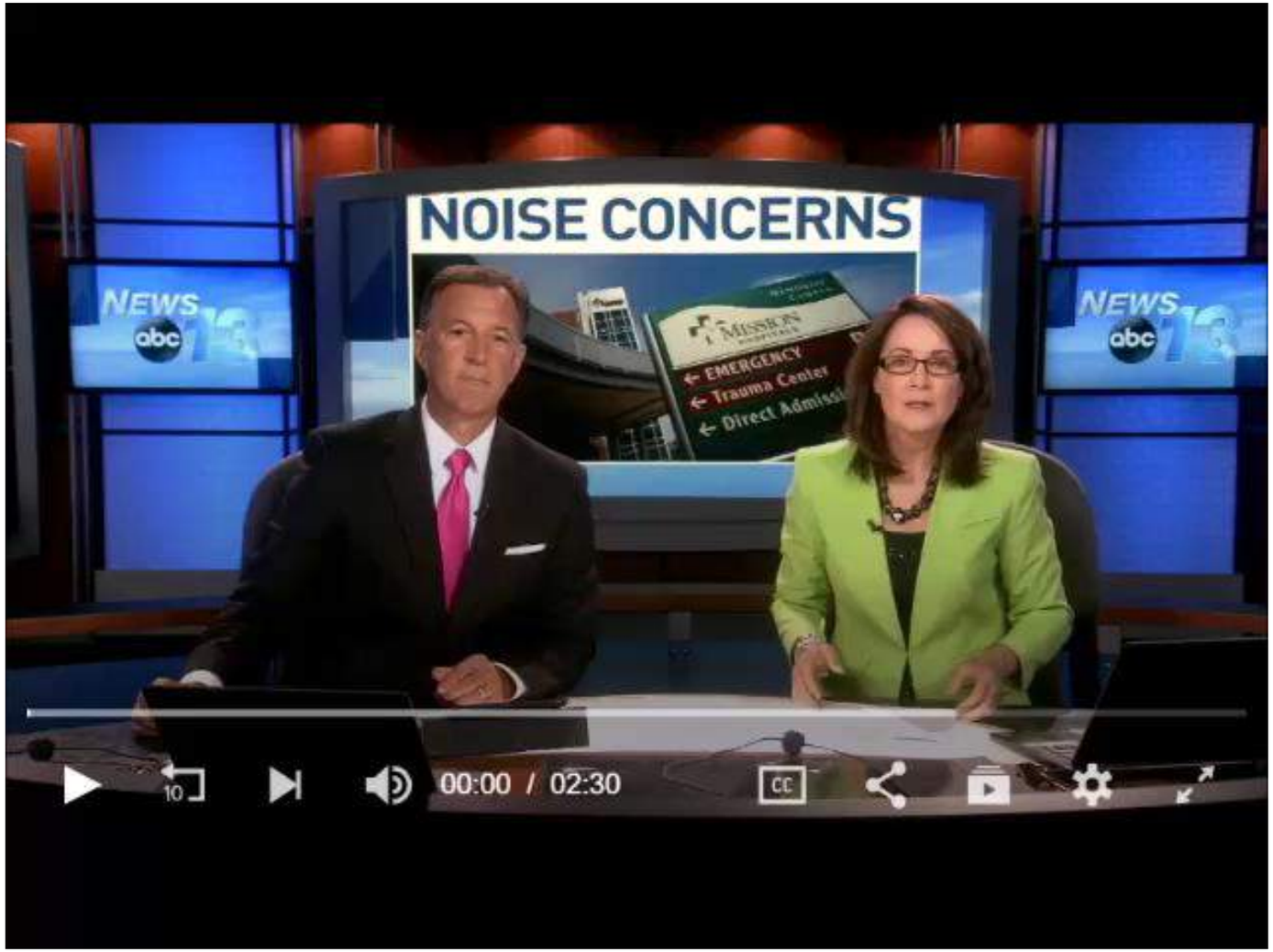


Cooling Towers: Detail

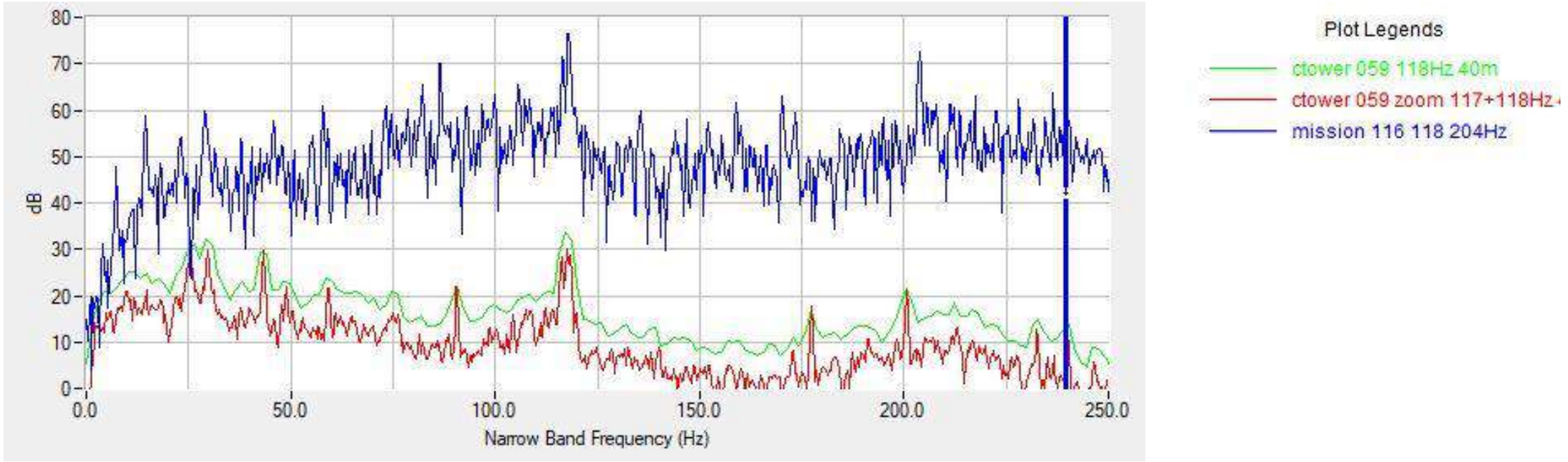


Only 71.3Hz blade pass of fans in tower 1 matches bedroom spectrum - grinder and tower 2 are eliminated as sources

A Classic Noise Complaint Case



Remote Control of Noise: a 2nd opinion



At least 2 off 8 bladed chiller fans running at 2 pole motor speed of 880rpm.

Remote control of fan noise: http://www.invc.com/noise/noise-control/remote-control-of-noise/

Remote Control of Noise: a 2nd opinion

2 cooling towers. Previously wasted $thousands on the wrong sources…

Fan Noise Specification

Typical Fan Noise Data

Do not allow your suppliers to spend your money on noise control without close scrutiny and evidence that they have followed diagnostic best practice

Exhust inlet					800
Connection section	2.4				0
Filter	2.7				96
Filter	2.7				128
Filter	2.7				128
Plenum fan		75.0			1197
General loss					45

*Refers to the fan design case

SOUND POWER LEVELS
(standard: EN13053 ISO/CD 13347-2)

	Lw per octave band (dB)								LwA
Octave band (Hz)	63	125	250	500	1k	2k	4k	8k	dB(A)
Extract connection	69	70	83	68	67	62	56	55	76
Exhaust connection	73	73	90	86	85	78	72	70	89
To surroundings	64	61	72	54	53	50	44	34	64

TOLERANCE

According to EN 13053 the LwA tolerance is 4dB. Octave band tolerances are presented in the tolerance table

	Lw per octave band (dB)								LwA
Octave band (Hz)	63	125	250	500	1k	2k	4k	8k	dB(A)
TOLERANCE	8	6	6	6	6	4	4	7	4

Frequency converters and motors mounted external are not included in the sound power levels

We have <u>never</u> managed to acquire narrow band data from a supplier…

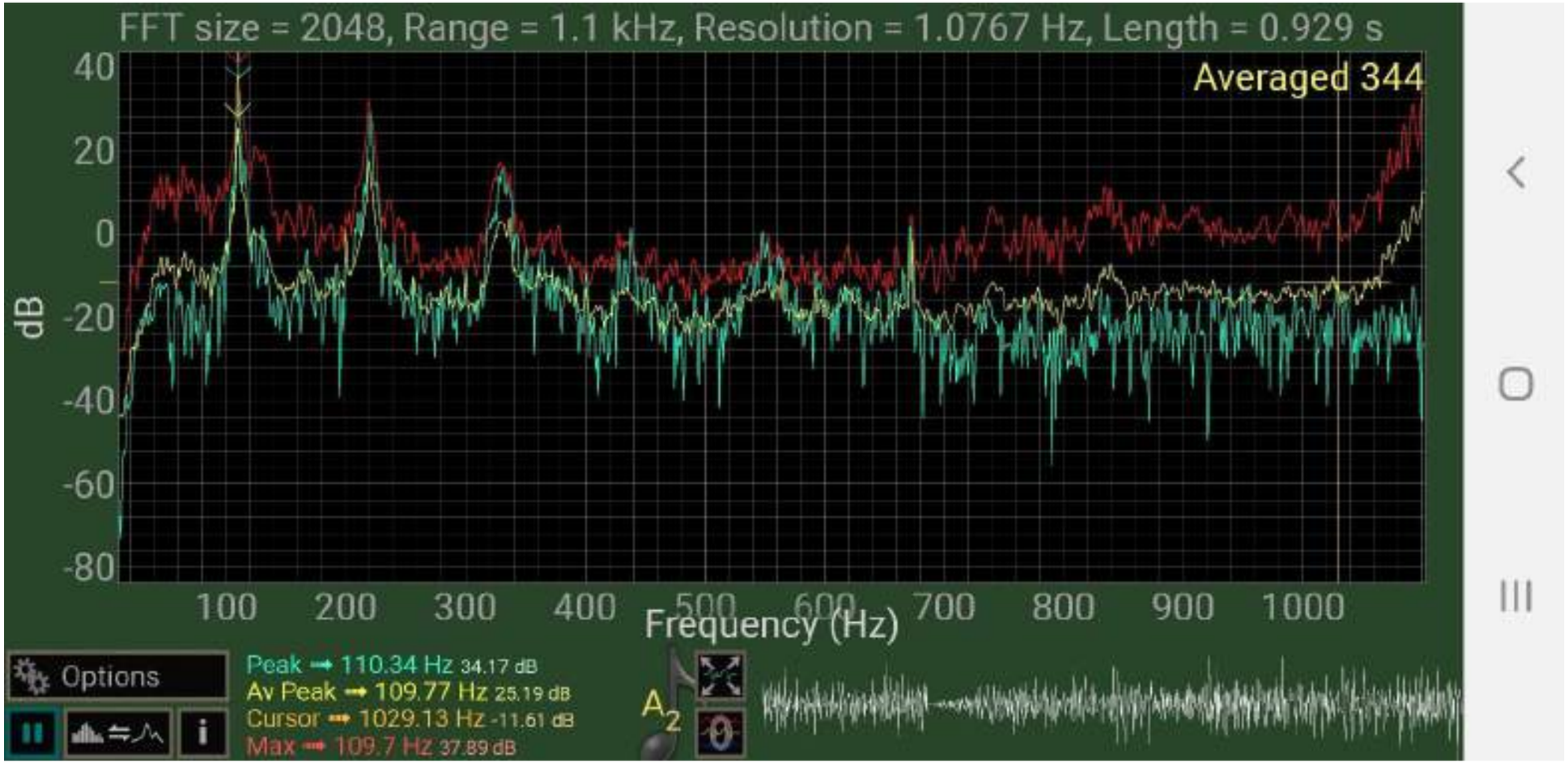
Buy Quiet: *http://www.invc.com/noise/noise-control/buy-quiet/*

BS414: 2014: Character Corrections

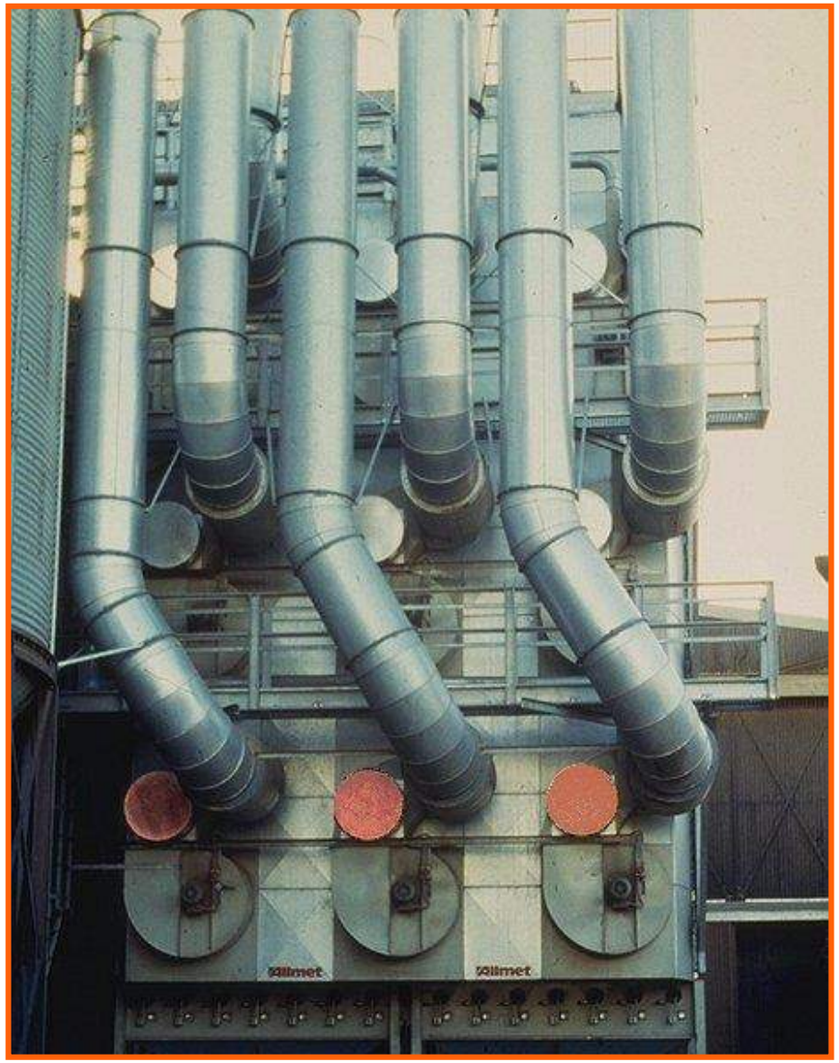
Industrial noise character	Perceptibility		
	Just	Clearly	Highly
Tonality	+2	+4	+6
Impulsivity	+3	+6	+9
Intermittency	0	+3	+3
Other character	0	+3	+3

Smartphone Tonal Analysis Example

Spectrum Analyser: www.keuwl.com/SpectrumAnalyser
Android Play Store: Spectrum Analyser from keulsoft



Placebo Silencers - attitude



Noise control is **not** a safety issue

- an engineering problem that to be solved by engineering means
- effective noise control must be based on accurate diagnosis, not guesswork

Accurate diagnosis is the key to all noise control

- all the options must be considered, not just conventional high cost palliatives. These should only be used where it can be **proved** that there is no engineering alternative.

What should happen…
Diagnosis and engineering noise control

Fan System Noise Control Options

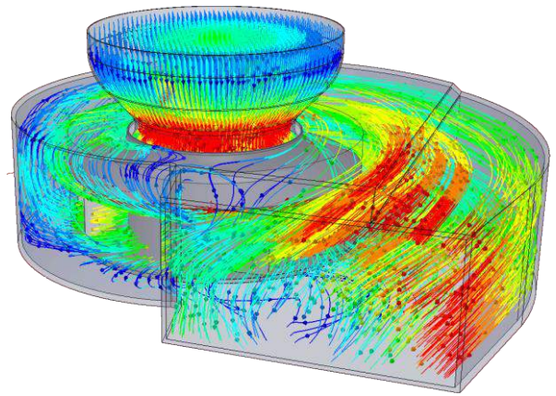
- improve system efficiency – then reduce speed to reduce noise
- evaluate aerodynamic source control technology

  F1 / aerospace CFD - design retro-fit aerodynamic aids can improve efficiency by up to 20% over many conventional silencers
- self financing, green, profitable…

Only if the above is not practical should you consider…

- Silencing
- Enclosures
- Lagging
- Barriers
- Building modifications

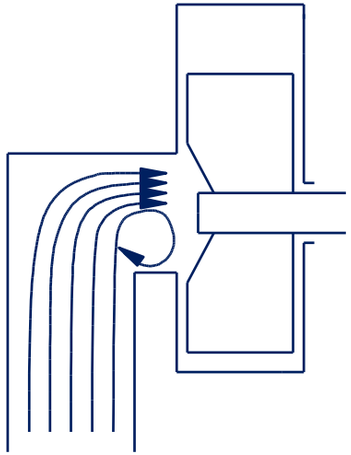
Conventionally, these high cost palliative techniques have been the only measures that are considered….

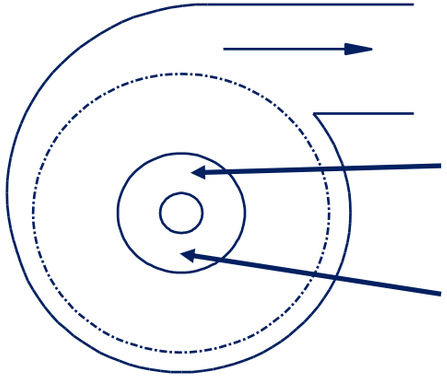


Aerodynamic fan silencing: *http://www.invc.com/noise/noise-control/fan-noise-reduction/*

Centrifugal Fan Installation

NOISY

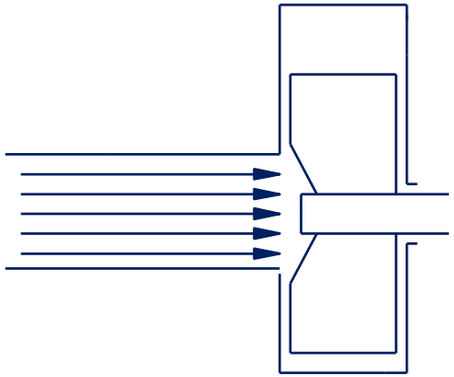


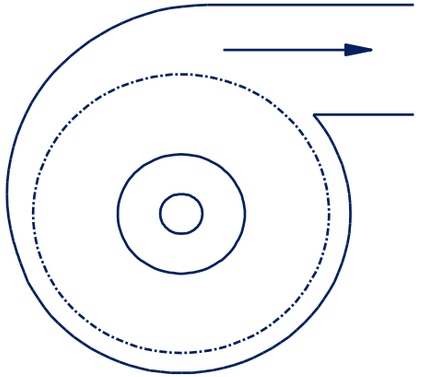


high pressure

low pressure

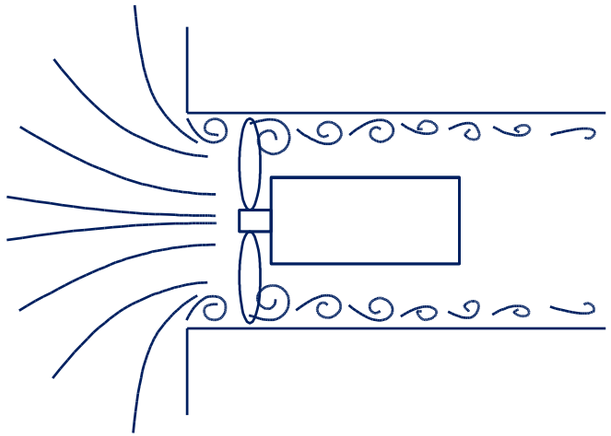
QUIET



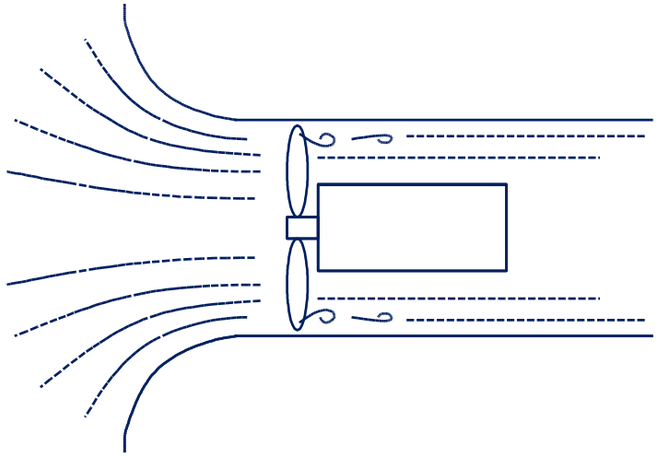


Fan Efficiency

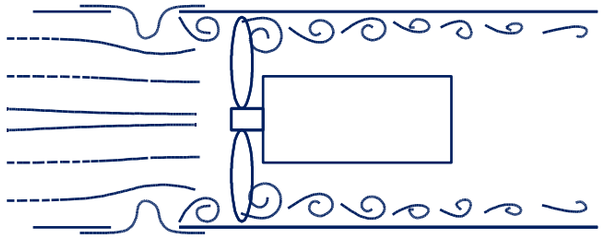
Axial Fan Installations

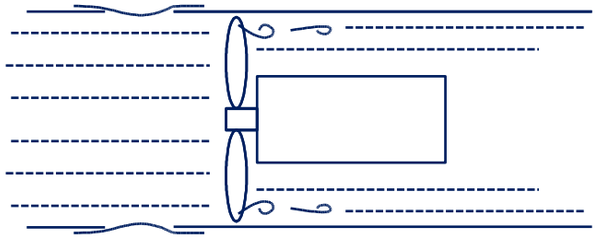


NOISY

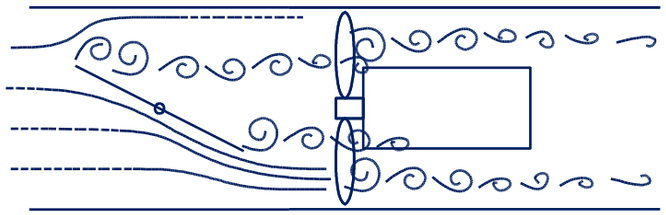


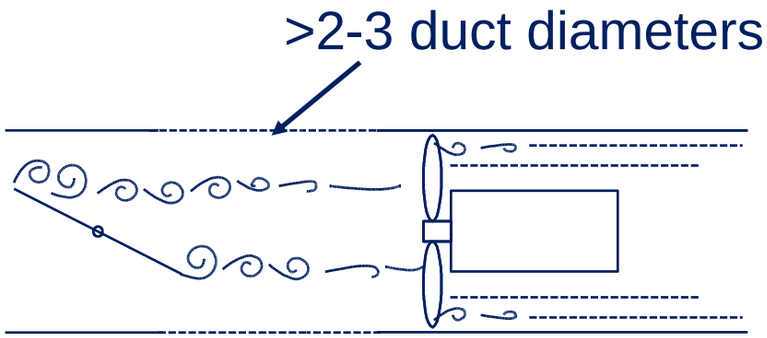
QUIETER



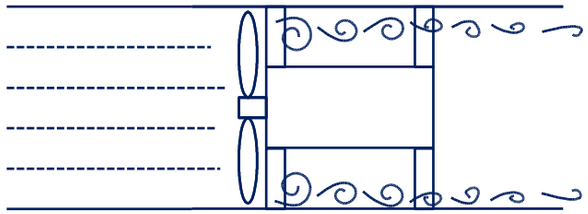


Axial Fan Installations

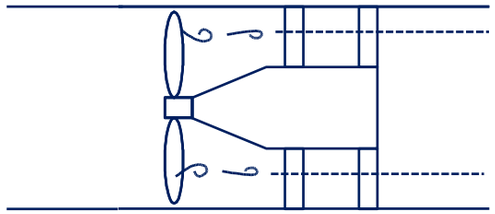




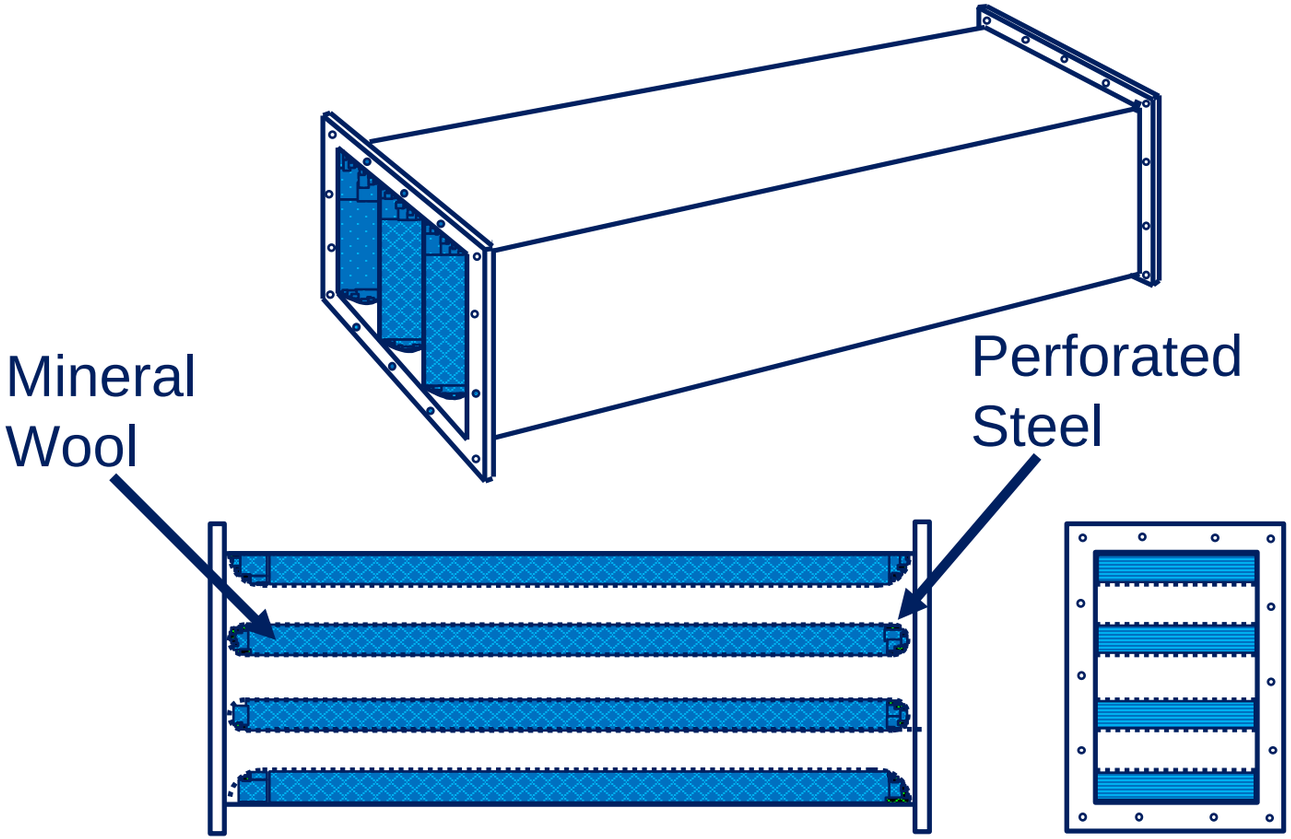
NOISY



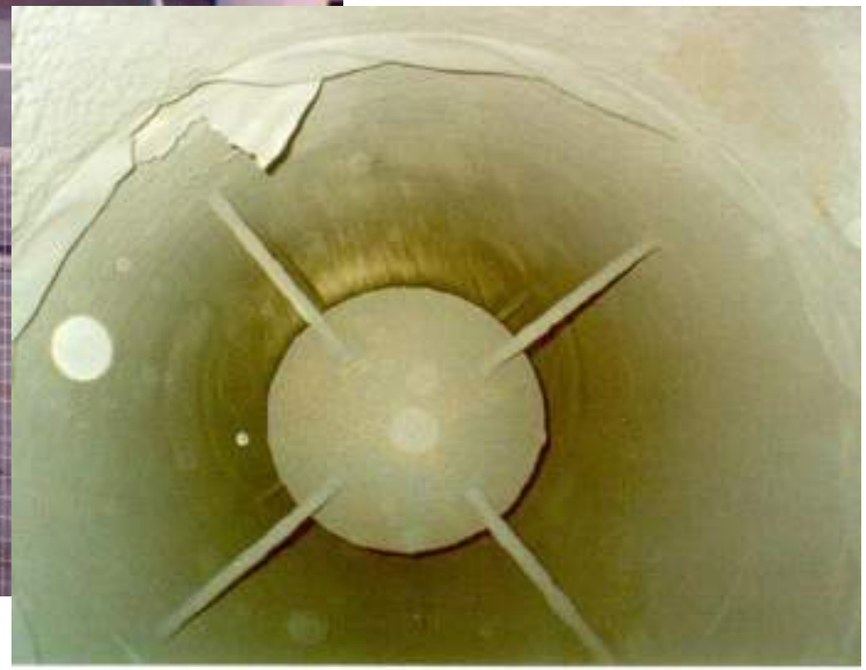
QUIETER



Splitter Silencer

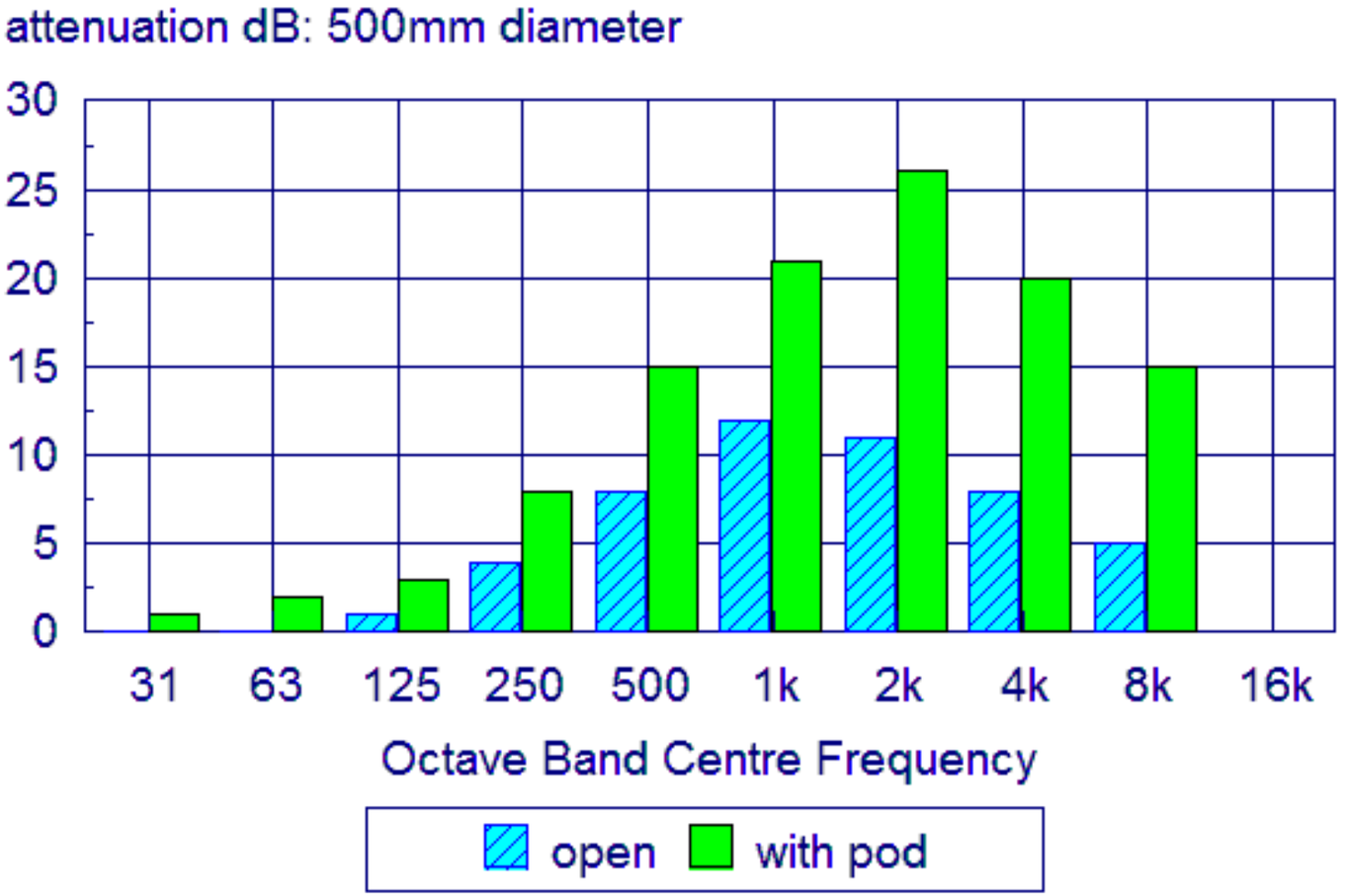


Cooling Tower Silencer

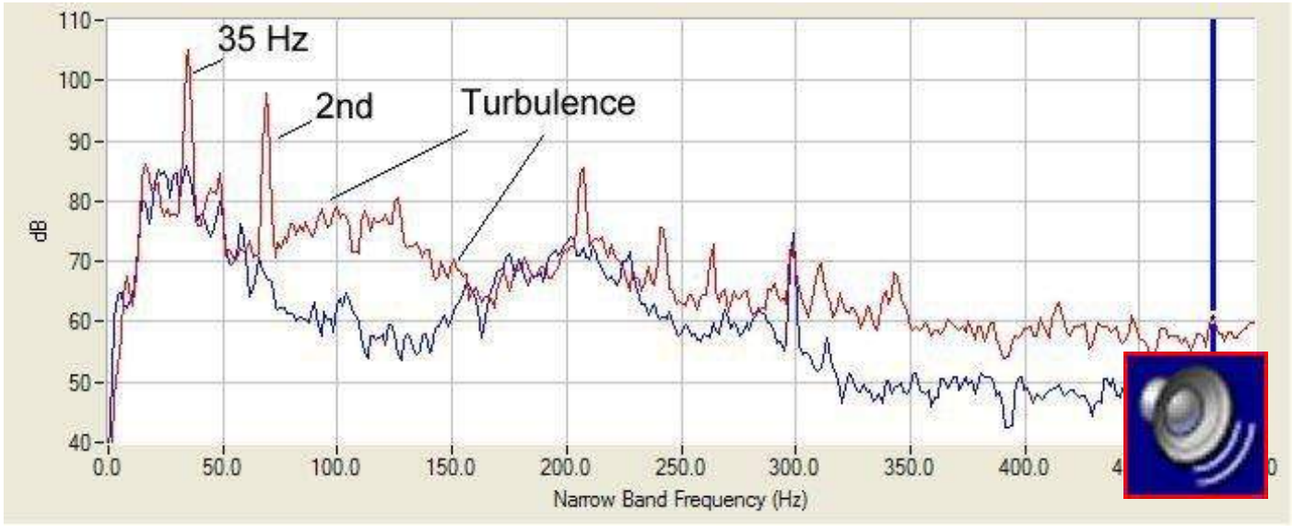


Little attenuation due to material build-up

Circular Silencer Performance



Extract Fan System Duct Resonances

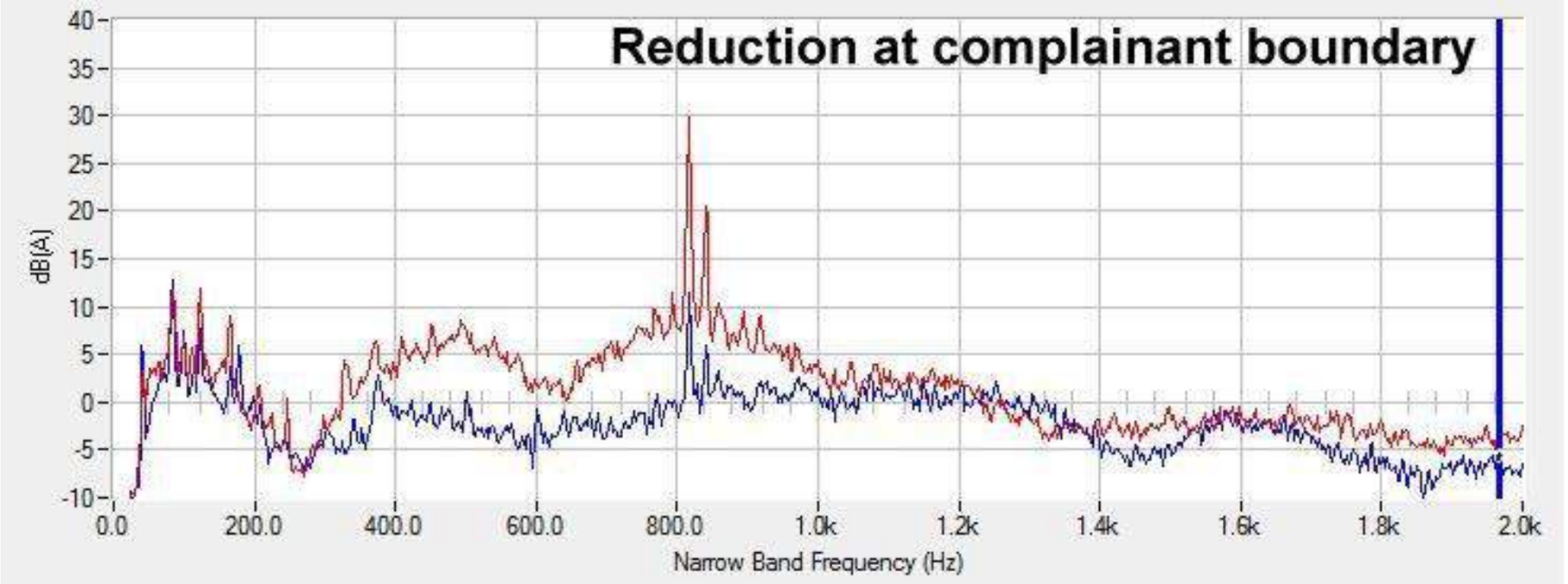


30dB tonal noise reduction
+ improved efficiency

Poultry Farm Fans Diagnosis

- Egg production: tonal noise complaints at 0.5 miles.
- 168 fans, 1.5m diameter, 816Hz tone.
- £40k temporary conventional barrier had been tried – only 6dB reduction. Consultant recommended £100k permanent barrier for negligible benefit.
- Diagnosed as motor vibration radiated by fan frame.
- Laminated brackets plus panels – 13dB attenuation at £40/fan - £6720 total

Poultry Farm Fans



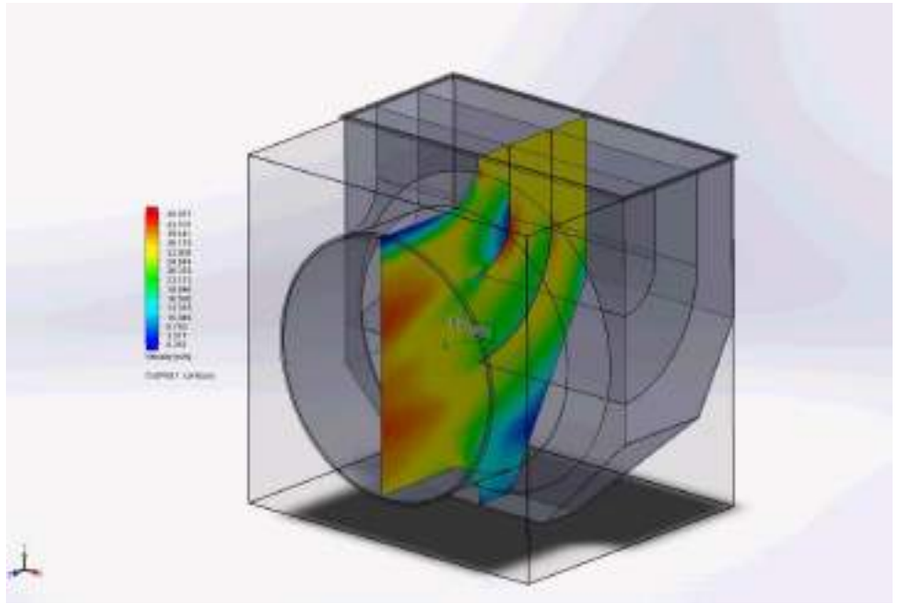
1m

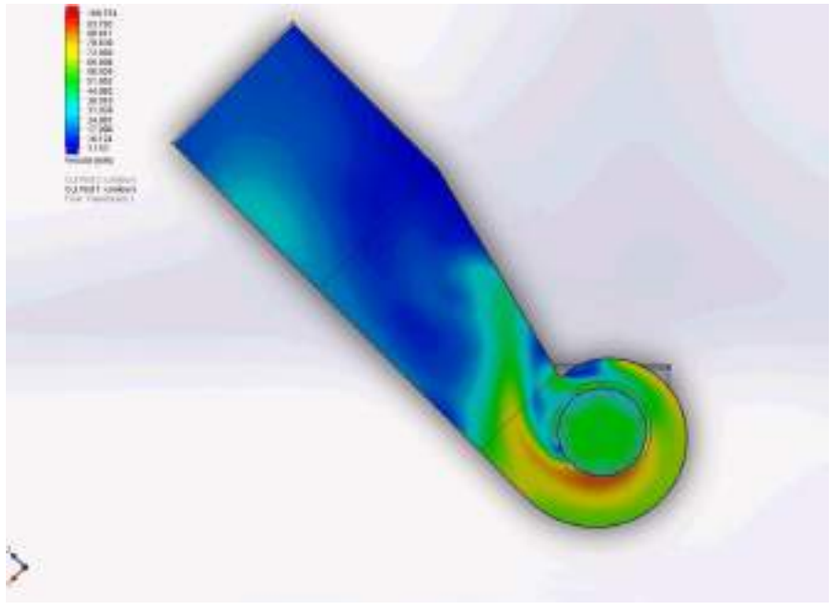
600m

Efficiency: fan speed v noise

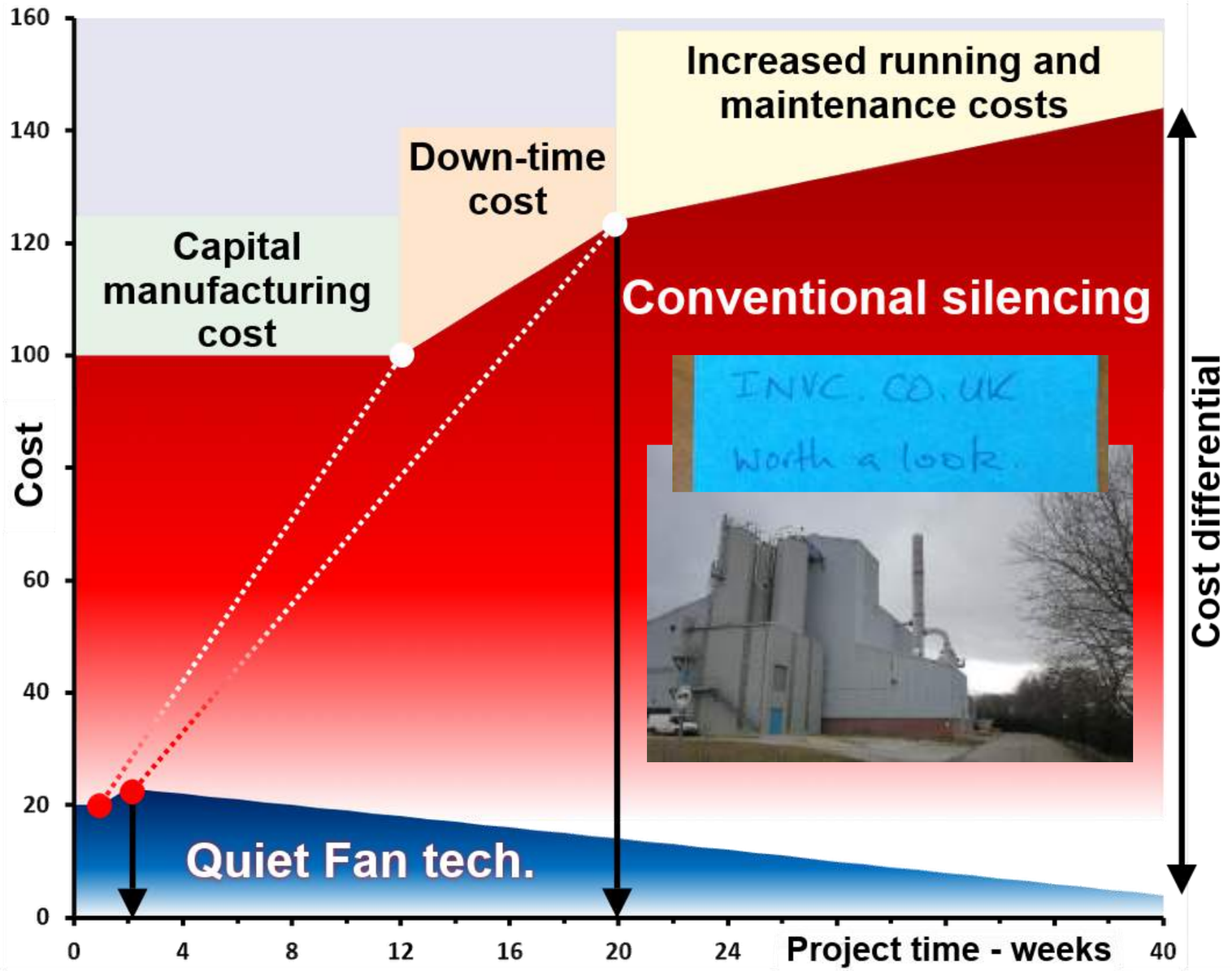
- Variable speed drives + proportional speed control systems

speed reduction	noise reduction dB
10%	2
20%	5
30%	8
40%	11
50%	15





Aerodynamic v Conventional Silencing

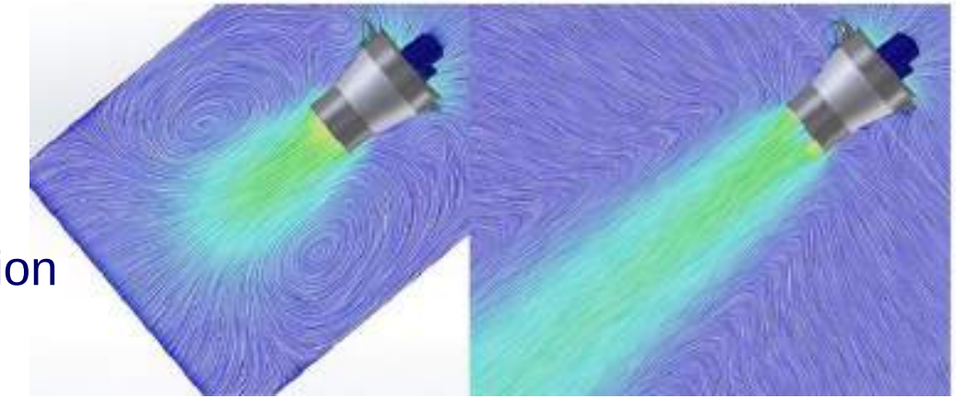


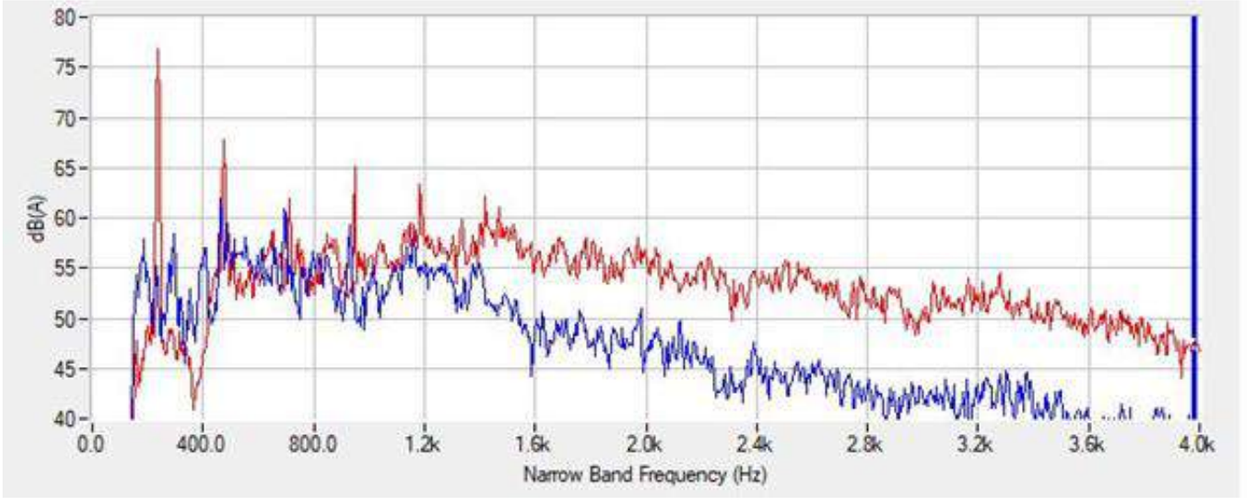
Aerodynamic fan silencing: http://www.invc.com/noise/noise-control/fan-noise-reduction/

Incentive! Axial Dust Fan Development

Redesign of axial dust fan

- 75% reduction (6dB(A)) @ 3m (87dB(A) down to 81dB(A))
- 98% (17dB) off blade pass tone
- 17% increase in velocity at 12m
- 8% increase in air flow
- 16% increase in pressure head
- 7% decrease in power consumption
- …and more to come!





Scrap Can Extract and Chopper Fans

Problem

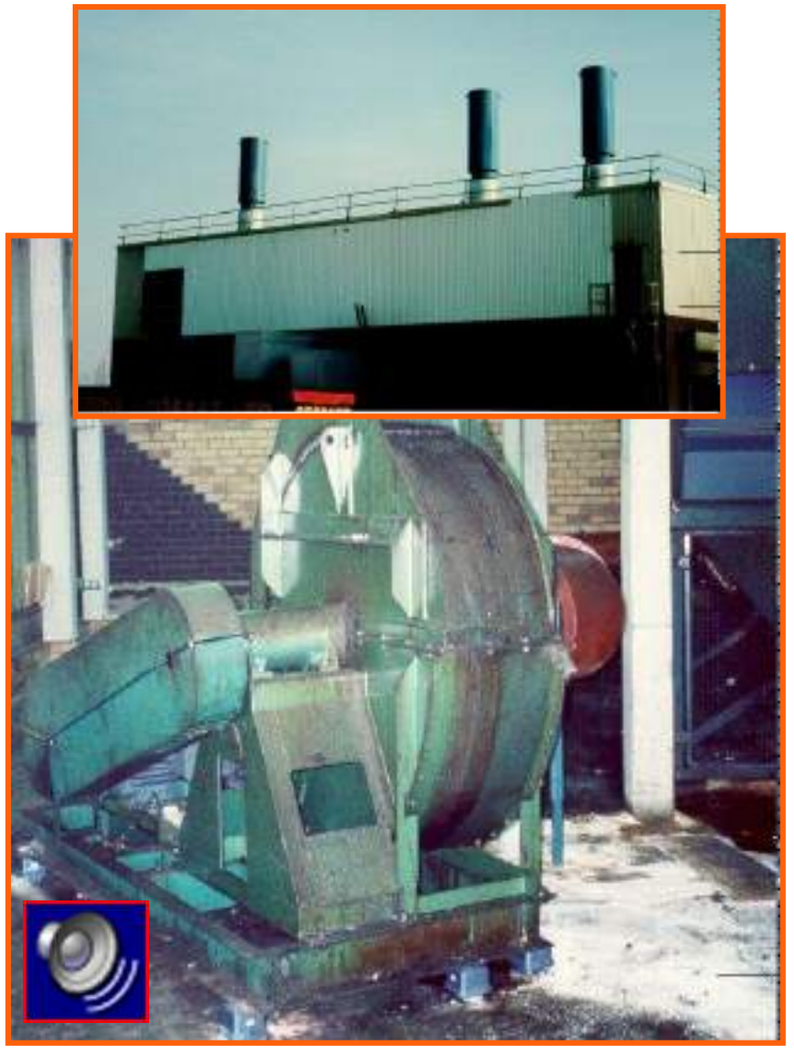
Occupational + environmental noise

Conventional

- silencers, lagging and enclosures
- capital cost > c£35000 + maintenance costs

BPM Engineering

- internal fan aero-modification reduced tones by 23dB and overall noise by 22dB(A)
- cost c £3000 - no maintenance costs (lasts the lifetime of the fans despite passage of cans)

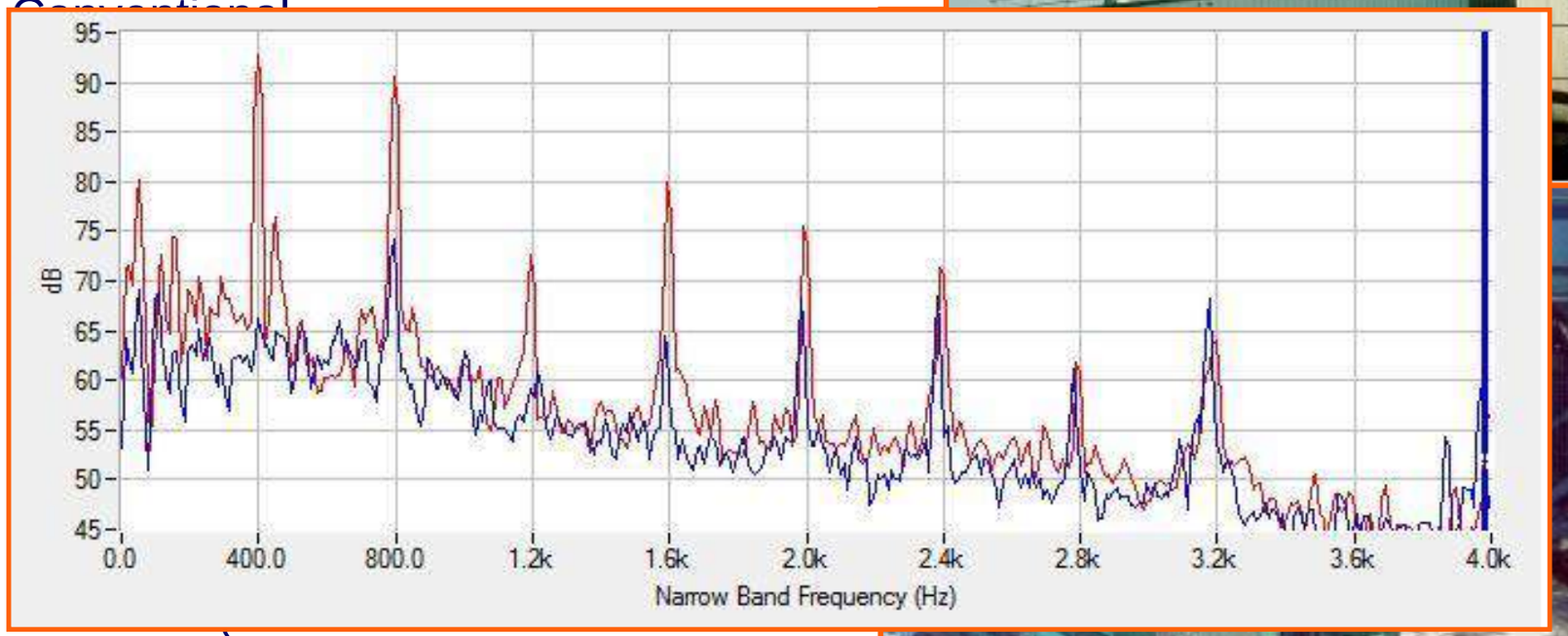


modified fan

Scrap Can Extract and Chopper Fans

Problem

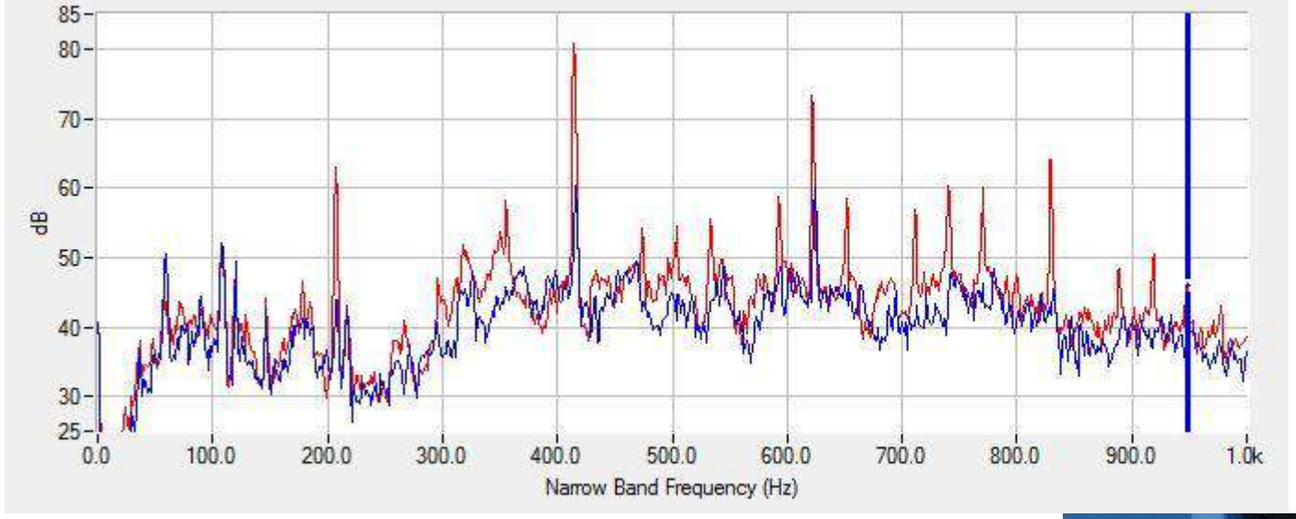
Occupational + environmental noise



despite passage of cans)

modified fan

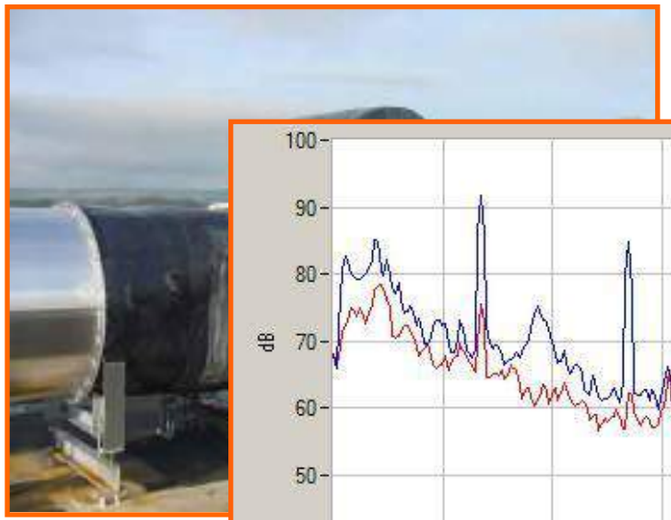
Axial Extract Fans - Canada



- 4 off axial ventilation fans 197Hz blade pass problem tone and harmonics reduced by 20dB at 100m via aerodynamic modifications to fans and ducting. Fan performance increased too…

Remote Control of Noise: a free 2nd opinion

Our noise control technology database is available as an open source resource.




Anywhere...

noise

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