

HyQube V2.0 – Noise Survey

Document Control

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001	Simon Robb	Initial issue	Data available	27 Jun 25

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HyQube V2.0 – Noise Survey

1.Scope

This survey was conducted at fuel cell systems Smitham Bridge Hungerford in the yard with A HyQube V2.0 Serial #007. This survey assessed the noise exposure during 4 specific modes of operation:

1. Idle- Power applied (not boosting)
2. Boosting
3. Full vent of system
4. Vent (partial) - representative of normal operation from an operator's perspective.

Normal use

Some of the data collected is done so under conditions that are expected under normal operating conditions such as attendance with power on or during re-fuel and shutdown.

Maintenance mode

The full venting cycle is only expected during maintenance operations which is not expected during normal operations such as re-fuelling and general customer use. Only FCSL staff are authorised to complete this element.

Limitations

This survey shall not cover personal dose and points calculations (i.e. against the HSE ready reckoner) where the intent of this survey is to generate awareness of the noise levels in these modes of operations with a view to inform.

Further information: [Daily noise exposure ready-reckoner](#)

2.Introduction

All risks within the workplace are to be managed under the general duties of [Health and Safety at Work etc. Act 1974](#) & [The Management of Health and Safety at Work Regulations 1999](#). Exposure to noise is to be treated with the same import as allow other hazards and risk where [The Control of Noise at Work Regulations 2005](#) puts a duty on the employer to manage noise in the workplace so that all staff remain safe and free from unnecessary exposure to noise leading to ill health such as noise induced hearing loss and temporary threshold shift and tinnitus. Where noise is generated above 80dD(A) a noise survey is mandatory and has raised the requirement for this survey.

The control of noise at work regulations 2005 introduces 3 noise action levels where actions are to be taken:

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1. **Above 80d(A) - LEAV** (Lower exposure action value)- A noise survey/assessment is required
2. **Above 85dB(A) - UEAV** (Upper exposure action value) - Mandatory hearing protection required in areas affected
3. **Above 87 dB(A)- ELV** (Exposure limit value) – Level does not consider of PPE and where this level is breached controls must be put in place to reduce exposure levels back down below the ELV and where possible the UEAV.

HSE Guidance: [Noise at work: A brief guide to controlling the risks INDG362](#)

2.1 Guidance

dB Scale (decibel)

The dB scale is used as the difference in sound levels from the limit of hearing to the threshold of pain is considerable where a common numerical system would be difficult to interpret. For every 3 dB increase or reduction, the **sound intensity** is doubled or halved respectively. i.e. 83 dB(A) is twice as loud as 80 dB(A).

2.2 Weighting

For noise level measurement concerning human hearing, the A weighted scale is used as the human ear is more sensitive to some frequencies more than others. With this considered the A weighted scale is not necessarily linear where certain higher frequencies are perceived louder by the ear, they will be given higher levels/readings accordingly which is intrinsic to the scale itself and does not need to be calculated afterwards (human hearing is especially sensitive between 3-5Khz)

[ISO 226:2023 - Acoustics — Normal equal-loudness-level contours](#)
[Fletcher Munson Curve- Equal Loudness](#)

2.3 Time weighted average

This refers to the amount of time a person can safely be exposed to a noise level.

The safe limit for exposure to sound levels as per the dB scale halves for every 3 dB raised as can be seen below. **Note** that the exposure action values must be consulted in the first instance.

Sound Level	Max Exposure time
80	8 hours
83	4 hours
86	2 hours
89	1 hours
92	30 minutes
95	15 minutes
98	7.5 minutes
101	3.75 minutes
104	1.88 minutes

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Daily noise exposure ready-reckoner

3.Executive Summary

During idle the Hyqube generates up to 51 dB(A) which represents an insignificant exposure level to any potential users' bystanders and the local environment. Idle presents a persistent low noise level generate by machine internals.

The boost cycle sees noise levels elevated to a maximum of 94 dB(A) at on the rear side where the compressor unit is installed where at the point of use remains below 75 dB(A). Noise is generated by the compressor cycling on and off at regular intervals where noise levels recorded are during the loudest phase of the cycle.

Venting generates the most significant noise levels with a full vent cycle generating over 90dB(A) which would normally only occur under maintenance conditions. A partial vent which is normal during standard re-fuelling procedures generates 83dB (A) at the machine face and 79.5dB(A)at the point of re-fuelling. Venting only occurs for approx. 10 seconds where referring to the table at 2.3 deems that this whilst high level exposure is above the 87dB(A) upper exposure limit remains reasonable and safe considering its duration. The type of noise generates by the venting go f of the white noise type where if unprepared may catch bystander unaware due to the transient nature of it.

4.Survey Health

	Idle	Boost	Vent-Full	Vent-Partial
Noise Level	49 dB(A)	74 dB(A)	91 dB(A)	83 dB(A)

Note: Max values at 0m distance from HyQube from the operators' position (refer to table at 2.3)

Note: Whilst high noise levels are present during vent process. Exposure time remains minimal (table at 2.3 refers)

5.Responsibilities

Task	Responsible	Accountable	Consulted	Informed
Conduct Survey	SHEQ Manager	SHEQ Manager	Engineering Director Head of Operations	Principal Engineers Project Managers
Operate HyQube during assessment	EC&I Engineer	Principal EC&I Engineer	SHEQ Manager	Engineering Director

Responsible (R):

The person or team who performs the work or executes the task.

Accountable (A):

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The person who is accountable for the successful completion of the task and has the authority to make decisions.

Consulted (C):

People whose input and expertise are needed before a decision is made or a task is completed.

Informed (I):

People who need to be kept up to date on the progress, decisions, and outcomes of the task or project.

6.Document Owner and affected departments

SHEQ

Operations

Engineering

Warehousing

7.Related Associated Documents

[The Control of Noise at Work Regulations 2005](#)

[Noise at work: A brief guide to controlling the risks INDG362](#)

[Daily noise exposure ready-reckoner](#)

8.Definitions

dB- Decibels (logarithmic unit used to measure sound intensity/loudness)

9.Precautions

Where red actions are awarded, it is incumbent on the duty holder to ensure that they are managed to reduce exposure levels to within action value levels as prescribed by: [The Control of Noise at Work Regulations 2005](#)

10.Methodology

10.1Measurement

This survey was completed using a Class II instrument – Sound level meter.

Serial Number	Instrument Class	Calibration date
2411064950	IEC 61672-1 Class II	Jun 25

During the test scenarios below the sound level meter was positioned within the auditory receptive zone of the assessor to ensure the data is representative of real-world exposure of a person at the ear. Readings were taken at distances, 0,1 and 2 metres on all 4 external edges of the Hyqube; front face, operators' side, back, far side to ensure full coverage was obtained.

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Full vent – conducted by discharging 500 bar from the system until empty.

Partial Vent – conducted by discharging 300 bar from the system as expected during normal operation post re-fuelling

10.3 Criteria

Referencing [The Control of Noise at Work Regulations 2005](#) readings are taken to understand how noise levels generated may affect workers and member of the public and what control measures are required to effectively manage the noise exposure

Noise level	Action
>85 dB(A)	Mandatory hearing protection required. Options reduce noise must be explored
>87dB(A)	Exposure must be reduced (irrespective of PPE) Source must be managed to reduce, i.e. containment/isolation etc.

10.4 Materials /Equipment

Sound level Meter Class II P/N: 193-8698

V2.0 HyQube

Hearing Protection 30dB reduction

11.Main findings

11.2 Noise level Scenarios

Idle

Idle				
Distance	Front Face	Operator side	Rear Side	Far Side
0m	51	49	47	49.5
1m	49	47	N/A	46
2m	N/A	N/A	N/A	N/A

Boost

Boost				
Distance	Front Face	Operator side	Rear Side	Far Side
0m	83	74	94	81
1m	75.7	73	84.9	76
2m	N/A	68	75	N/A

Vent - Full

Vent- Full				
Distance	Front Face	Operator side	Rear Side	Far Side
0m	91	91	91	91
1m	90.5	90.5	90.5	90.5
2m	80	78	78	78

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Vent - Partial

Vent- Full				
Distance	Front Face	Operator side	Rear Side	Far Side
0m	83	83	84	83
1m	79	79.5	77	77
2m	N/A	N/A	N/A	N/A

Conclusion

During normal operation the HyQube V2.0 generates noise levels between 49 dB(A) at Idle and 91 dB(A) during a full venting cycle where the maximum foreseeable noise level at the operator side expected during a partial vent cycle is 79.5 dB(A). This falls below the requirement to introduce additional controls for occupational health and safety though at other areas the noise may be able to impact bystanders or impact the local environment which *may* require further consideration but is not at this stage advised or recommended. Environmental Noise Regulations should be consulted for assurance.

[The Environmental Noise \(England\) Regulations 2006](#)

Declaration

This assessment was conducted in the manner prescribed where the data is representative of the conditions prescribed during normal operations.

Name	Date	Sign
Simon Robb	27 Jun 25	

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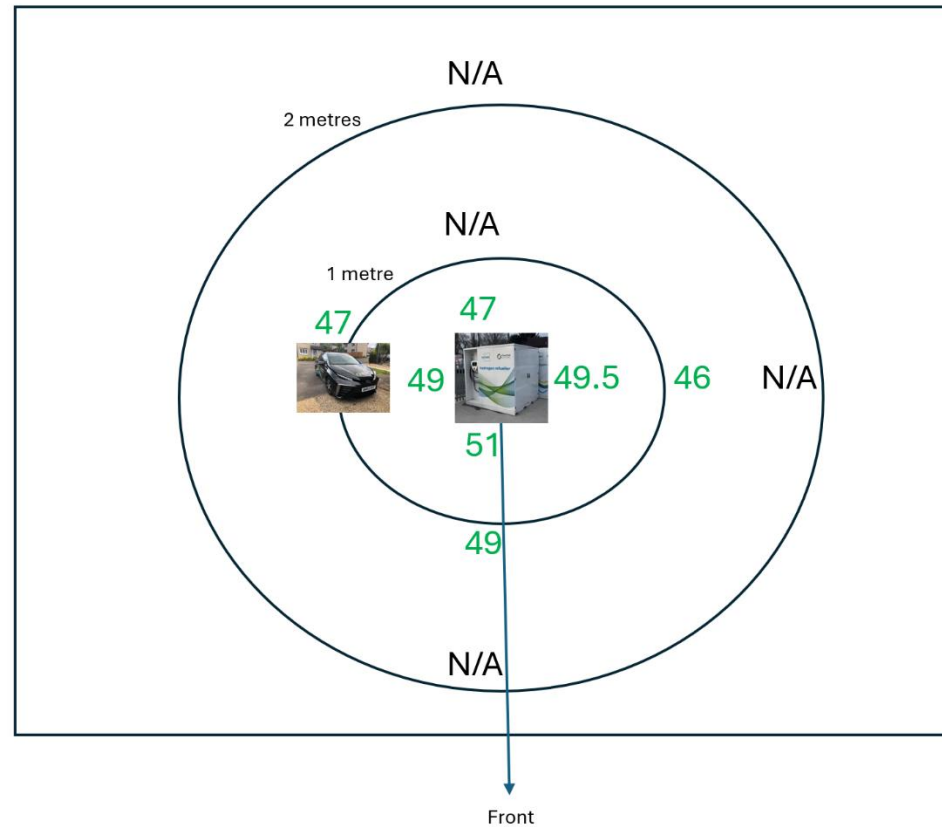
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Annex A – Scenario – Idle

Scenario - Idle

Note: Where noise levels begin, and further reduce below the first action level (80DbA) no further readings have been taken

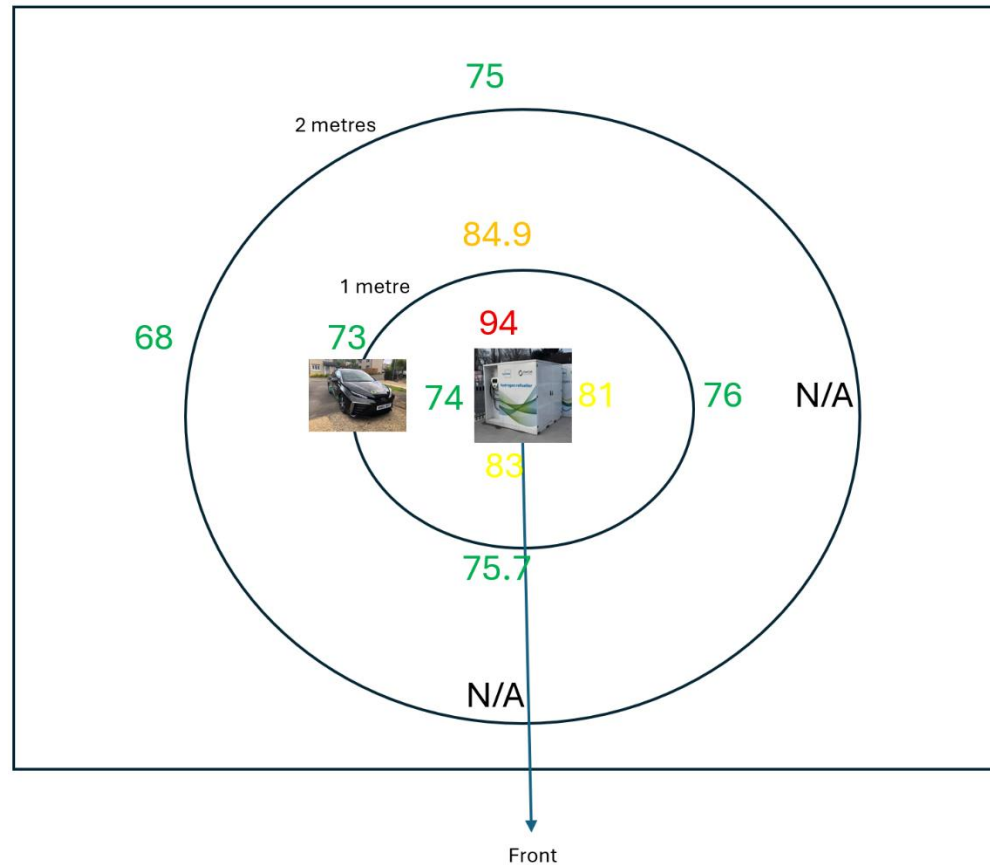


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Annex B – Scenario – Boost

Scenario - Boost

Note: Where noise levels begin, and further reduce below the first action level (80DbA) no further readings have been taken



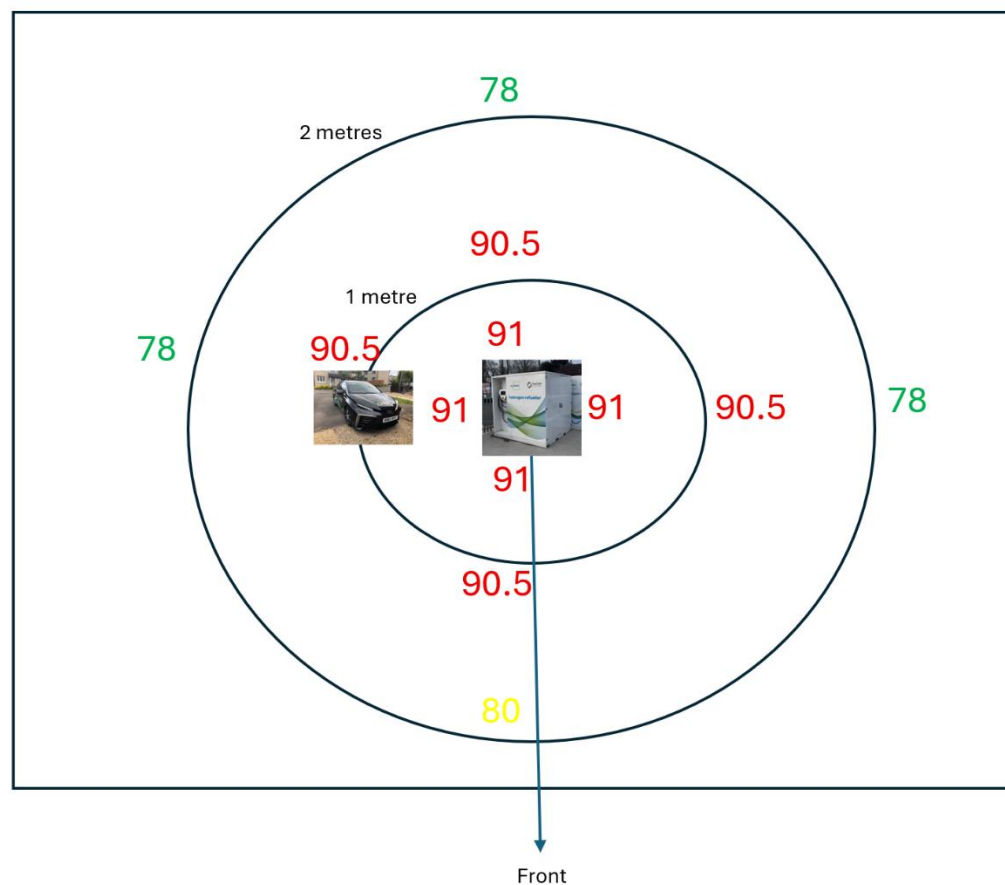
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Annex C – Scenario – Vent Full System (maintenance mode)

Scenario – Full Vent (500 Bar)

Duration of peak sound pressure level 10-15 seconds

Note: Where noise levels begin, and further reduce below the first action level (80DbA) no further readings have been taken



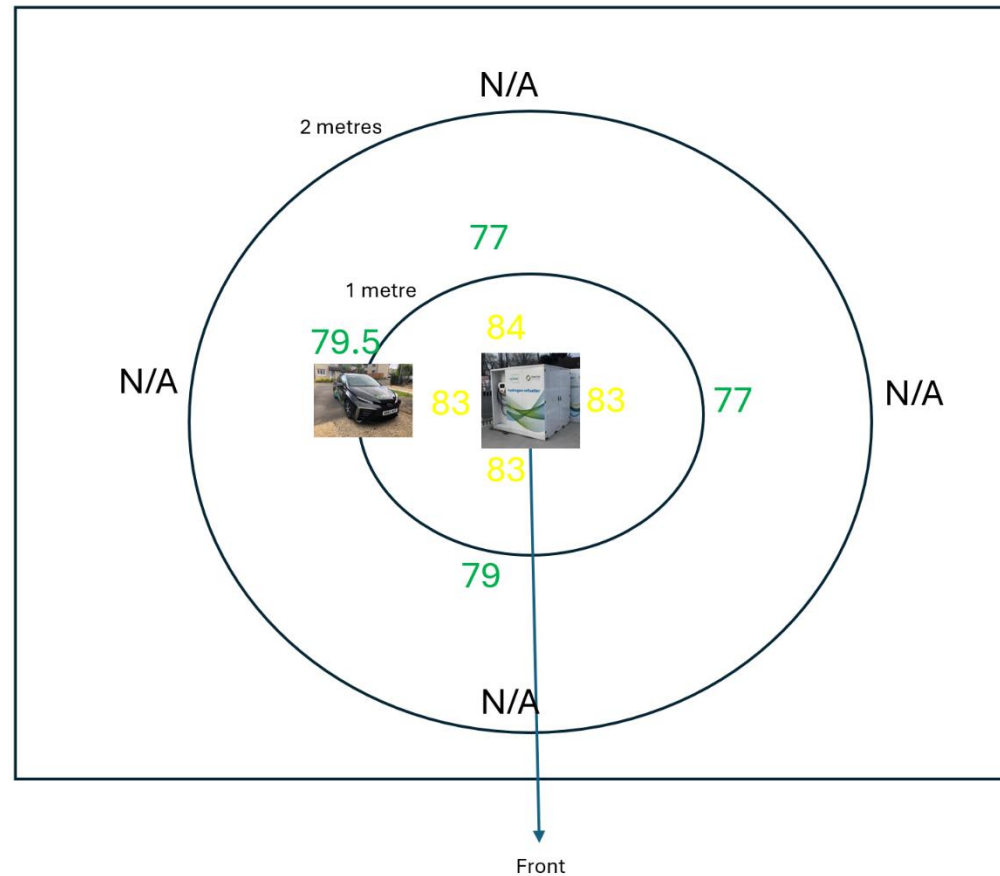
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Annex D – Scenario- Vent Partial (normal operating conditions)

Scenario – Partial Vent (300 Bar)

Duration of peak sound pressure level 10-15 seconds

Note: Where noise levels begin, and further reduce below the first action level (80DbA) no further readings have been taken



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13.Records

This survey is to be filed in FCSL IMS, Records, Surveys