PREVENTION. CARE. RECOVERY.
Te Kaporeihana Āwhina Hunga Whara

Occupational noise levels

A collection of reported measurements

Introduction

The purpose of this document is to provide an evidence base on noise measurements for Ear Nose and Throat (ENT) specialists who are assessing occupational noise-induced hearing loss. It captures noise levels found across various economic sectors and reported in a range of different publications, both in New Zealand and elsewhere.

The core material comes from a report of the New Zealand Department of Health prepared in 1986. A copy of this report was kindly made available by John Gilbert, ENT specialist from Timaru. The report summarized noise level measurements across the country. Noise levels published internationally have been added to this.

Furthermore, a number of ENT specialists have generously shared reports of local noise surveys they've collected over the years.

Many of the noise levels included in this document are historic. Older measures can be useful when assessing people's noise exposure over their working lives.

This is a living document and we hope to update it as further information becomes available. Any contributions of reported noise levels will be gratefully received and included in future updates.

Other recommended sources of information are:

NIOSH (the US National Institute of Occupational Safety & Health)

https://www2a.cdc.gov/nioshtic-2/BuildQyr.asp?s1=noise&f1=&t1=&Adv=0*

Noise Navigator Sound Level Database (Berger et al, 2016)

https://multimedia.3m.com/mws/media/888553O/noise-navigator-sound-level-hearing-protection-database.pdf

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Contents

Transportation

Category	Device/Activity	Leq (dBA)	Peak	Source
Aircraft				
Hawker Siddeley: cockpit	Landing	75		NZ DoH (1986)
	Taking off and climbing	85		NZ DoH (1986)
	Descending & landing	77		NZ DoH (1986)
Hawker Siddeley: cabin	Taxiing	74–79		NZ DoH (1986)
	Taking off (full-power)	93–96		NZ DoH (1986)
	Climbing	90–92		NZ DoH (1986)
	Cruising	82–90		NZ DoH (1986)
	Descending	79–80		NZ DoH (1986)
	Landing	76		NZ DoH (1986)
Commercial aircraft	Commercial aircraft	76–92		Bray (1974)
	In cabin -prior to take-off	60–65		Ozcan & Nemlioglu (2006)
	In cabin -during flight	80–85		Ozcan & Nemlioglu (2006)
	In cabin -landing	75–80		Ozcan & Nemlioglu (2006)
	Aircraft cabin (jet)	82–93		Clark & Bohne (1984)
	Aircraft cabin (jet)	80		Berger et al (2015)
	Aircraft flyover (300m)	92–102		Clark & Bohne (1984)
Turbo-fan aircraft	At takeoff power at 200 ft	118		Federal Interagency Committee on Noise (1992)
Turbo-prop aircraft	In cabin	80		Berger et al (2015)
Jet	Flyover at 1000 feet	103		Federal Interagency Committee on Noise (1992)
Boeing 707 or DC-8 aircraft	At 1 nautical mile before landing	106		Federal Interagency Committee on Noise (1992)
Boeing 737 or DC-9 aircraft	At 1 nautical mile before landing	97		Federal Interagency Committee on Noise (1992)

Category	Device/Activity	Leq (dBA)	Peak	Source
Propellor plane	Propeller plane flyover at 1000 ft	88		Federal Interagency Committee on Noise (1992)
Small planes	Single-engine cabin	88–90		Hughes & Koonce (1986)
	Single-engine cabin	87–96		Harling (1987)
Helicopters	Hughes 500 helicopter (6 hours/day)	106		NZ Dawes (1988)
	Helicopters	93–112		House (1975)
	Bell J-2A helicopter at 100 ft	100		Federal Interagency Committee on Noise (1992)
Hovercraft	Griffon max speed	97		Berger et al (2015)
Aircraft construction/ maintenance	Singapore	92		Gerges et al (2001)
Maintenance workers	Average daily exposure	70–91	119	Smedje et al (2011)
Hangar / Mt Cook	AC Inverter	91		NZ DoH 1986
	Speedline 8" grinder	92		NZ DoH 1986
	Pneumatic 4" grinder	94		NZ DoH 1986
	Linisher	80		NZ DoH 1986
	Ground power unit	83		NZ DoH 1986
	Rivet gun	105		NZ DoH 1986
	Air drill	88		NZ DoH 1986
Air NZ Base Workshops	De Souter air drill	81		NZ DoH 1986
	Linisher: underload	88		NZ DoH 1986
	Linisher: running	88		NZ DoH 1986
	De Souter 301 drill rotary filing	96		NZ DoH 1986
	De Souter 301 circular saw (underload)	99		NZ DoH 1986
	De Souter air drill	95		NZ DoH 1986
	Rivetting	100–108		NZ DoH 1986
	Mach jigsaw (portable) cutting metal	109		NZ DoH 1986
	Soft riveting	98		NZ DoH 1986
	Pehoka metal saw: running	83		NZ DoH 1986
	Pehoka metal saw: underload	106		NZ DoH 1986
Carpenters' workshop	Thicknesser	92		NZ DoH 1986
	Router	93		NZ DoH 1986
	Radial arm saw	95		NZ DoH 1986
	Buzzer	95		NZ DoH 1986
	Skill saw	90		NZ DoH 1986
	Dyco circular saw	97		NZ DoH 1986
Airport				
	Aircraft cabin (jet)	82–93		Clark & Bohne (1984)

Category	Device/Activity	Leq (dBA)	Peak	Source
	Aircraft flyover (300m)	92–102		Clark & Bohne (1984)
Cargo area	Ambient	50		NZ DoH (1986)
	Door warning horn	90		NZ DoH (1986)
	Forklift: idling	65–73		NZ DoH (1986)
	Lees forklift: underload	84–89		NZ DoH (1986)
	Working hoist	87		NZ DoH (1986)
	Lees tug: idling	67		NZ DoH (1986)
	Lees tug: underload	84		NZ DoH (1986)
	Lees tug: underload with trailer	90		NZ DoH (1986)
Tarmac area	Ambient	58–82		NZ DoH (1986)
	Ground power unit	97		NZ DoH (1986)
	Unloading forward locker	88		NZ DoH (1986)
	Argosy aircraft	109		NZ DoH (1986)
	Friendship plane: arriving on tarmac	100		NZ DoH (1986)
	Friendship	102		NZ DoH (1986)
Boeing 737	Running up engines before stopping on tarmac	104		NZ DoH (1986)
	Unloading near locker	95		NZ DoH (1986)
	Unloading forward locker	88		NZ DoH (1986)
	Boeing 737	95–112		NZ DoH (1986)
Tarmac loading	Boeing 737: inside forward locker	80		NZ DoH (1986)
	Boeing 737: outside forward locker	87		NZ DoH (1986)
	Boeing 737: inside rear locker	83		NZ DoH (1986)
	Boeing 737: outside rear locker	93		NZ DoH (1986)
	Boeing 737: under plane tail	95		NZ DoH (1986)
Marshaller	Tarmac marshaller	90–94		NZ DoH (1986)
Engineer	Tarmac engineer	92–101		NZ DoH (1986)
Control tower		<85		NIOSH (1998)
Road transport				
Sirens	Car siren	92–95		NZ DoH (1986)
	Fire station siren	114		NZ DoH (1986)
	Bicycle horn	143		McMillan & Kileny (1994)
Cars	Inside car, windows closed, 30 mph	68–73		NPC website (undated)
	Car passenger	60–90		EPA (1974)
	Car 65 mph at 25 ft	77		Federal Interagency Committee on Noise (1992)
Car wash	Car wash at 20 ft	89		Federal Interagency Committee on Noise (1992)
Motorcycles	Honda 30093 (wheeled)	85		NZ DoH (1986)
	Motorcycle with helmet	80–110		McCombe et al (1994)

Category	Device/Activity	Leq (dBA)	Peak	Source
	Motorcycle, no helmet	98–120		Binnington et al (1993)
	Motorcycle at 25 ft	90		Federal Interagency Committee on Noise (1992)
Buses	Driver's position	75–82		Zannin (2008)
	Inter-city bus	74–84		Bray (1974)
	Range of different bus types/sizes	74–79		Bruno et al (2013)
Trucks	Truck drivers[1]	78–89		Seshaqiri (1998)
	Truck - heavy at 15-20 m	77+		EPA (1974)
	Truck - Sleeper cab	79–84		Casali et al (1998)
	Diesel truck 40 mph at 50 ft	84		Federal Interagency Committee on Noise (1992)
	CH Mack at 80 km/hr	79		NZ: Sherwen (1996)
	RB Mack at 80 km/hr	85		NZ: Sherwen (1996)
	Mack Midliner at 80 km/hr	76		NZ: Sherwen (1996)
	Mack R686 at 80 km/hr	85		NZ: Sherwen (1996)
	International S-line 1987 at 80 km/hr	85		NZ: Sherwen (1996)
	International S-line 1993 at 80 km/hr	80		NZ: Sherwen (1996)
Refuse trucks	Dump truck	78		Utley & Miller (1985)
	Compactor	90		Utley & Miller (1985)
	Concrete vibrator	90		CDC (2005)
	Concrete mixer truck at 50 ft	75		Alfredson & May (1978)
	Concrete pump at 50 ft	81		Alfredson & May (1978)
Truck MoT testing	180 hp Bedford truck test	82		NZ Dawes (1985)
Forklift	Forklift truck (operator)	84		NZ DoL (2002)
	Lansing forklift	75–82		NZ Dawes (1988)
	Komatsu diesel forklift	83–85		NZ Dawes (1988)
Railway				
Trains	Subway	80–114		EPA (1974)
	Diesel locomotive at 15-20 m	87–102		EPA(1974)
	Intercity rail	60–75		Bray(1974)
	Diesel train 45 mph at 100 ft	83		Federal Interagency Committee on Noise (1992)
Train crew	Crew average	92		Kryter (1991)
	Diesel engine	84–89		Kilmer (1980)
	Horn	92–111		Kilmer (1980)
	Brake (vented into cab)	85–115		Kilmer (1980)
Passengers		72–91		EPA (1974)

1. Made worse by use of radio (+2.8 dB), window open (+1.3 dB)

Category	Device/Activity	Leq (dBA)	Peak	Source
Racing cars				
Stock car racing	6m from track	99–109	109	Rose et al (2008)
	46 m from track	96–104		Rose et al (2008)
	Spectator (in stand)	96		Kardous & Morata (2010)
	Driver (during practice)	114		Kardous & Morata (2010)
	During racing[2]		>140	Kardous & Morata (2010)
	Race team			Kardous & Morata (2010)
	Race team - pits	130		Kardous & Morata (2010)
Sea transport (See also fishing)				
Motorboats	Motorboat	74–114		EPA (1974)
	Motorboat	65–105		Campbell (1972)
Ships	Roll-on roll-off vessel	86–89		NZ Dawes (1981)
	Freighter	79–84		NZ Dawes (1981)
		77–83		NZ Dawes (1980)
	Container ship	78–82		NZ Dawes (1987)
Port operations				
Equipment	Straddle crane (Otago)	87		NZ Dawes (1987)
	Straddle crane (Auckland)	92–93		NZ Dawes (1981)
	Lees loader	87		NZ Dawes (1987)
	Side loader with standard cab	86	125	NZ Dawes (1987)
	Side loader with soundproofed cab	85	126	NZ Dawes (1987)
	Butting machine	94	134	NZ Dawes (1987)
Depot	Enclosed warehouse	91		NZ Dawes (1987)
	Container crane hut	84–85		NZ Dawes (1987)
Pointers		87		NZ Dawes (1987)

2. 12–21 hours/week intense noise, 40 weeks/year

Manufacturing

Category	Device/Activity	Leq (dBA)	Peak	Source
Overall average	All manufacturers (Singapore)	92		Gerges et al (2001)
Brush manufacture				
	Brush handle cutting area	98–104		NZ DoH (1986)
	Varnishing/painting area	77		NZ DoH (1986)
	Assembly area	81–86		NZ DoH (1986)
Clothing manufacture				
Wool	Woollen mill	82–97		NZ Dawes (1985)
		86–89		NZ Dawes (1977)
		85–98		NZ Dawes (2002)
Sewing	Straight sewing	79		NZ DoH (1986)
	Twin needle (cover stitch machine)	82		NZ DoH (1986)
	Rees auto pocketer (Eagle)	77		NZ DoH (1986)
	Safety stitch	84		NZ DoH (1986)
	Tacker	82		NZ DoH (1986)
	Overlocker (safety stitch)	78		NZ DoH (1986)
Knitting machines		80–95		Gerges et al (2001)
Miscellaneous	Button cutter	99		NZ DoH (1986)
	Sewing machine	79		NZ DoH (1986)
	Cloth cutter	79		NZ DoH (1986)
	Staplegun – small	86		NZ DoH (1986)
	Staplegun – large	93–99		NZ DoH (1986)
	Nail gun	98		NZ DoH (1986)
	Forklift	96		NZ DoH (1986)
Electrical work				
	Flow soler: hot air leveler	81		NZ DoH (1986)
	Board cleaning machine	82		NZ DoH (1986)
	XL-3 computer driller	80		NZ DoH (1986)
	Workshop ambient	78–5–81		NZ DoH (1986)
Footwear manufacture				
	Rough rounding	88		NZ DoH (1986)
	Outside stitcher	95		NZ DoH (1986)
	Seat piece nailer	92		NZ DoH (1986)
	Eyelet beater	79		NZ DoH (1986)

Category	Device/Activity	Leq (dBA)	Peak	Source
	Tile sorting & inspection	82		NZ DoH (1986)
	Banbury mixer	82–90		NZ DoH (1986)
	Mill room	90–92		NZ DoH (1986)
	Water wash conveyor	86		NZ DoH (1986)
	PVC chopper & slitter	90–96		NZ DoH (1986)
	Outside colander: feeding in, blower, conveyor, take-off	82–89		NZ DoH (1986)
	Small extruders	77		NZ DoH (1986)
Furniture manufacture				
	Overall noise levels	<85		NZ Dawes (1982)
	All equipment operational (ie not normal operation)	87.5		NZ Dawes (1982)
Glass manufacture				
	Glass factory	95	113	Gerges et al (2001)
	Fibreglass factory	92	101	Gerges et al (2001)
	Background noise	66		NZ DoH (1986)
	Makita hand sander	91		NZ DoH (1986)
	Glass drill	88		NZ DoH (1986)
	Ebor polisher – operator's position	83		NZ DoH (1986)
	Ebor polisher – nearest work table	77		NZ DoH (1986)
	Pencil edging machine - operator's position	91		NZ DoH (1986)
	Rough arising machine - operator's position	97		NZ DoH (1986)
	Circular saw (using glass)	90		NZ DoH (1986)
	Slow grindstone	80		NZ DoH (1986)
	Waste glass breaking	87–100		NZ DoH (1986)
	Shifting crane (length of building)	77		NZ DoH (1986)
	Hammering crate to shift glass	103		NZ DoH (1986)
	Hammering nails into crates	91		NZ DoH (1986)
	Hammering crowbar to open crates	97		NZ DoH (1986)
Glass products				
	Corrugated band saw		99	NIOSH (1972)
	Inflation of containers		106	NIOSH (1972)
Laundry				
	Generic		104	NZ DoH (1986)
	Boilerhouse	74–84		NZ DoH (1986)
	Washing machines: 800 lb on	86		NZ DoH (1986)
	Washing machines: 400 lb on	82		NZ DoH (1986)
	Washing machines: 100 lb adding steam	86		NZ DoH (1986)
	Washers	85–88		NZ DoH (1986)
	Unloading extractors	81		NZ DoH (1986)
	Dry cleaning machine: air leak covered	83		NZ DoH (1986)

Category	Device/Activity	Leq (dBA)	Peak	Source
	Dry cleaning machine: with air leak/s	86		NZ DoH (1986)
	Drier	87		NZ DoH (1986)
	Air hoist	93		NZ DoH (1986)
	Feeding ironer (noise from wash area)	80–84		NZ DoH (1986)
	Steam press	77		NZ DoH (1986)
	Folding area	81		NZ DoH (1986)
	Hand pressing area	83		NZ DoH (1986)
Metal manufacturing / engineering				
Basic metal industry	Average (Singapore)	92		Gerges et al (2001)
	Light engineering (UK) daily exposure	85–93		Hughson et al (2002)
	Structural metal products average (Singapore)	93		Gerges et al (2001)
	Metal cans & products Average (Singapore)	94		Gerges et al (2001)
	Metal forging & stamping Average (Singapore)	93		Gerges et al (2001)
	Fabricated metal products Average (Singapore)	92		Gerges et al (2001)
Roofing/shed construction	Galvanising (peak level hammering)	72	95	NZ Dawes (1985)
	Machine shop	70–80		NZ Dawes (1985)
	Welding dept	72–88	95–102	NZ Dawes (1985)
	Manager's office	50		NZ Dawes (1985)
Shipbuilding	Shipbuilding & repair Average (Singapore)	95		Gerges et al (2001)
	Shipyard	92	134	Gerges et al (2001)
	Ship building blacksmith's shop - daily exposure	90–95		Hughson et al (2002)
	Ship building heavy fabrication - daily exposure	88–99		Hughson et al (2002)
Sheet metal workers		87–90	115	Thierry & Meyer-Bisch (1988)
	Buffers	91–95		NZ DoH (1986)
	Compressors	80		NZ DoH (1986)
	Air compressors	85		NZ DoL (2002)
Metal drills	Air drill	81–96		NZ DoH (1986)
	Drill press	80–85		NZ DoH (1986)
	Electric drill	88–92		NZ DoH (1986)
	Large drill press with borer	89		NZ DoH (1986)
	Radial drill	81–91		NZ DoH (1986)
	Tanner drill	74		NZ DoH (1986)
	XL-3 computer driller	80		NZ DoH (1986)
Metal grinders	Angle grinder	94–103		NZ DoH (1986)
	Balonger (brake linings)	89–91		NZ DoH (1986)
	Grinding joint	102–110		NZ DoH (1986)

Category	Device/Activity	Leq (dBA)	Peak	Source
	Hard grinder	98		NZ DoH (1986)
	Linishing belt grinder	95–100		NZ DoH (1986)
	Disc grinder	99		NZ DoH (1986)
	4” hand grinder	85		NIOSH (1972)
Metal hammers	Steel	90		NZ DoH (1986)
	Drum/tank	113		NZ DoH (1986)
	Needle hammer	107		NZ DoH (1986)
	Steam hammer	93–104		NZ DoH (1986)
	Hammering sheetmetal	108		NZ DoH (1986)
Metal lathes	7” and 10” lathes	83–88		NZ DoH (1986)
	C & C lathe	98–102		NZ DoH (1986)
	Garnathi lathe	80		NZ DoH (1986)
	Gurutzpe lathe	84		NZ DoH (1986)
	Herbert lathe	91		NZ DoH (1986)
	Victor lathe with borer	83–90		NZ DoH (1986)
	Turret lathe	90		NIOSH (1972)
Metal presses	18-ton press	90		NZ DoH (1986)
	30-ton press	97		NZ DoH (1986)
	40-ton press	99		NZ DoH (1986)
	80-ton press	80		NZ DoH (1986)
	100-ton press	86		NZ DoH (1986)
	200-ton press	88		NZ DoH (1986)
	Clicking press	98		NZ DoH (1986)
	Hydraulic press	87		NZ DoH (1986)
	Power press	89–91		NZ DoH (1986)
	Slotter press	80		NZ DoH (1986)
	Automatic punch press	95		NIOSH (1972)
Metal saws	Automotive bandsaw	79–80		NZ DoH (1986)
	Bandsaw (cutting aluminium)	102		NZ DoH (1986)
	Bench saw	96		NZ DoH (1986)
	Circular saw	92		NZ DoH (1986)
	Cut-off saw	87–94		NZ DoH (1986)
	Hacksaw	72–83		NZ DoH (1986)
	Jigsaw	99		NZ DoH (1986)
Sundry devices	Bennie cutting machine	82–102		NZ DoH (1986)
	Air chisel	96		NZ DoH (1986)
	Pneumatic chisel	101		NIOSH (1972)
	Air cleaning	91		NZ DoH (1986)
	Air spanner	97		NZ DoH (1986)
	Arc welding	76–86		NZ DoH (1986)
	Welding	74–76		NZ DoH (1986)
	Bench buzzer	98		NZ DoH (1986)
	Blade sharpener	83–85		NZ DoH (1986)
	Crane operator	85		NZ DoH (1986)

Category	Device/Activity	Leq (dBA)	Peak	Source
	Cropper/bunce	82		NZ DoH (1986)
	Guillotine	74–95		NZ DoH (1986)
	Knife sharpener	78		NZ DoH (1986)
	160" steel mill	98		NIOSH (1972)
	Milling machine	91		NIOSH (1972)
	Nibbler (Trum PF)	81		NZ DoH (1986)
	Polisher	97		NZ DoH (1986)
	Riveting machine	110		NIOSH (1972)
	Saw rettother	81–94		NZ DoH (1986)
	Stamping	99		NZ DoH (1986)
	Threading machine	91		NZ DoH (1986)
	Rotary file	95		NZ DoH (1986)
	Jiffy hi-speed metal cutter	91–114		NZ DoH (1986)
	Dye plate roller	81–118		NZ DoH (1986)
	Pullmax metal nibbler	85–102		NZ DoH (1986)
Whiteware assembly	Dishwasher line[1]	66–78		NZ Dawes (1983)
	Electric range line[2]	72–76	[3]	NZ Dawes (1983)
	Element line[3]	76–80		NZ Dawes (1983)
	Enamel plant	82–86		NZ Dawes (1983)
	Metal presses & forming	78–89		NZ Dawes (1983
Engravers				
	Computer engraver	67–83		NZ DoH (1986)
	Cutting brass	92		NZ DoH (1986)
	Pantograph machine	74		NZ DoH (1986)
Foundry				
	Steel foundry	90–104		NZ Dawes (1984)
	Foundry	93	127	Gerges et al (2001)
		90		NZ DoH (1986)
Drop forging	Hammer operators - on-time[4]	108	120–140	Taylor et al (1984)
	off-time	93–98		Taylor et al (1984)
	Press operators	99	110–120	Taylor et al (1984)
	Background rumbler	88		NZ DoH (1986)
	Baling wire	96		NZ DoH (1986)
	Continuous casting	88		NZ DoH (1986)
	Cut-off saw	90		NZ DoH (1986)
	Extrusion bay by press	89		NZ DoH (1986)
	End rounder	94		NZ DoH (1986)
Fettling	Generic	100–110		EAHSW (2005)
	Grinder	95		NZ DoH (1986)
	Snogging grinder	87–88		NZ DoH (1986)

1. Intermittent noise up to 98 dBA
2. Intermittent noise up to 98 dBA
3. Intermittent noise up to 104 dBA
4. Intermittent noise 84-89 dBA

Category	Device/Activity	Leq (dBA)	Peak	Source
	Electric grinder	93		NZ DoH (1986)
	Bandsaw	93		NZ DoH (1986)
Furnaces	Centrifugal	93		NZ DoH (1986)
	Scrap melting	90		NZ DoH (1986)
	Inductomatic	90		NZ DoH (1986)
	Basic oxygen furnace	91		NIOSH (1972)
	Blast furnace	100		NIOSH (1972)
	Coke oven	83		NIOSH (1972)
	Electric furnace	112		NIOSH (1972)
Lathes	Lathes: No 4 (stainless steel can grinding)	122		NZ DoH (1986)
	Lathes: Lift	87–92		NZ DoH (1986)
	Lathes: Linisher	88		NZ DoH (1986)
	Metal cleaning pneumatic chipper	106		NZ DoH (1986)
Metal finishing	Belt polisher	97		NZ DoH (1986)
	Polishing machine	91–98		NZ DoH (1986)
	Bracket polisher	108		NZ DoH (1986)
	Kettle polisher	94		NZ DoH (1986)
	Tube polisher	83		NZ DoH (1986)
	Compressed air lifter	89		NZ DoH (1986)
	Mould: bench	79–92		NZ DoH (1986)
	Mould: floor	84		NZ DoH (1986)
	Moulding machine	96–100		NZ DoH (1986)
	Moulding machine stop start CT1	101		NZ DoH (1986)
	Moulding machine stop start CT3	94		NZ DoH (1986)
	Trim round cut-off	88		NZ DoH (1986)
	Trimming saw	92		NZ DoH (1986)
Rumbling	Generic	89–111		EAHSW (2005)
Panel shop				
	sheet metal work	93		HSE
	Air chisel	111		NZ DoH (1986)
	Pneumatic air saws/chisels	<= 107		HSE
	Hammering bumper (with 10 lb hammer)	104		NZ DoH (1986)
	Panelbeating with small hammer on vehicle	106		NZ DoH (1986)
	Panelbeating with small hammer on free-standing metal	105		NZ DoH (1986)
	Hammer and dolly	105		NZ DoH (1986)
	Air grinder	103		NZ DoH (1986)
	Grinding bumper	100–102		NZ DoH (1986)
	Air sander	93–102		NZ DoH (1986)
	Belt sander	97–98		NZ DoH (1986)
	Brush sander	82–96		NZ DoH (1986)
	Orbital sander	88–99		NZ DoH (1986)
	grinders/orbital sanders	97		HSE

Category	Device/Activity	Leq (dBA)	Peak	Source
	Steam cleaner	79		NZ DoH (1986)
Welding	Generic	88–93		NZ DoH (1986)
	Operating a welder	85		NZ DoL (2002)
	CO2 welding arc	91–95		Hermanns (1982)
	Inert gas-metal arc	95–102		Hermanns (1982)
	Plasma cutting	98–110		Hermanns (1982)
	Slag chipping	92–105		Hermanns (1982)
	Tungsten inert gas	65–74		Hermanns (1982)
	Welding arc	84–92		Hermanns (1982)
	welding/flame cutting	93		HSE
Paint shop	Air gun	109		NZ DoH (1986)
	Air sander	92		NZ DoH (1986)
	Electric buffer	97		NZ DoH (1986)
	Polisher	88		NZ DoH (1986)
	Powder coating department	76–80		NZ DoH (1986)
	Spray booth	80		NZ DoH (1986)
	Spray painting section	81–90		NZ DoH (1986)
Machinery				
	Generic	93		Gerges et al (2001)
	Electrical machinery & appliances	91		Gerges et al (2001)
	Electronic products & components	90		Gerges et al (2001)
Packaging				
	Packaging machines	83–87		NZ DoH (1986)
	Mixer	84		NZ DoH (1986)
	Regranulator machine	86–94		NZ DoH (1986)
	Extrusion area	78–85		NZ DoH (1986)
	Conversion area	80–86		NZ DoH (1986)
	Paper shredder	66–68		NZ DoH (1986)
	Plastic packing	83	112	Gerges et al (2001)
	Metal packing	92	119	Gerges et al (2001)
Plastics manufacture				
	Blow moulding machine No.2 line	81		NZ DoH (1986)
	Control panel	84		NZ DoH (1986)
	Packer (ambient)	80		NZ DoH (1986)
	Stapler	83		NZ DoH (1986)
	Little grinder(with PVC waste material)	107		NZ DoH (1986)
	Big grinder: operator position	106		NZ DoH (1986)
	Big grinder: ambient	101		NZ DoH (1986)
Paper products				
	Paper mill	92	130	Gerges et al (2001)
	Bag and handle former	89		NIOSH (1972)
	Paper cutter	96		NIOSH (1972)
	Paper coating/laminating, daily noise exposure	84–88		Hughson et al (2002)

Category	Device/Activity	Leq (dBA)	Peak	Source
Pulp mill	General operation areas	70–93		NZ: Sherwen (1996)
	Chip bin hydraulic pack	95		NZ: Sherwen (1996)
	Boiler operator	99	131	NZ: Sherwen (1996)
	Groundwood mill	96	138	NZ: Sherwen (1996)
	Nucon	89	126	NZ: Sherwen (1996)
	Paper machine	88–91	123–139	NZ: Sherwen (1996)
	Finishing	83–88	117–131	NZ: Sherwen (1996)
	Fitters	83–88	128–147	NZ: Sherwen (1996)
Hygenex factory	D-line	97		NZ: Sherwen (1996)
	Bretting	78		NZ: Sherwen (1996)
	Interfolder	80		NZ: Sherwen (1996)
	Gemft	79		NZ: Sherwen (1996)
	Rollexina	85–88		NZ: Sherwen (1996)
Steam plant	Control room	67		NZ: Sherwen (1996)
	General operation areas	83		NZ: Sherwen (1996)
Maintenance workshops	General operation areas	55–71		NZ: Sherwen (1996)
	Blade grinder operator station	83		NZ: Sherwen (1996)
Printing & publishing				
	Generic	88–90		EAHSW (2005)
	Generic	89		Gerges et al (2001)
	Background noise	78		NZ Dawes (1981)
	Operators	81–89		NZ Dawes (1984)
	Binder	86		NIOSH (1972)
	Folding machines	85–87		NZ Dawes (1981)
		85		NIOSH (1972)
	Keyboard monotype	84		NIOSH (1972)
	Mono-casting	91		NIOSH (1972)
	Cylinder printer	84		NZ Dawes (1981)
	Printing press	93	119	Gerges et al (2001)
	Newspaper press	97		NIOSH (1972)
	Offset press	88		NIOSH (1972)
	Postcard press	91		NIOSH (1972)
	Small offset press	82		NIOSH (1972)
	Waxer	80–92		NZ Dawes (1981)
	Cutting machines	82–88		NZ Dawes (1981)
Sand				
	Black sand mixer	81		NZ DoH (1986)
	Sand reclaimer	90		NZ DoH (1986)
	Sandblasting	108		NZ DoH (1986)
	Shotblast	84		NZ DoH (1986)
	Shaker	96		NZ DoH (1986)
	Shake out	93		NZ DoH (1986)
	Welding bay (NZIG Synchrowave 500)	91		NZ DoH (1986)

Category	Device/Activity	Leq (dBA)	Peak	Source
Miscellaneous				
	Brewery	96	117	Gerges et al (2001)
	Chemicals/chemical products	92		Gerges et al (2001)
	Porcelain factory	88	128	Gerges et al (2001)
	Cotton spinning mill	93		NIOSH (1972)
	Cotton loom	106		NIOSH (1972)
	Weaving factory	95	119	Gerges et al (2001)
	Textile manufacture	93		Gerges et al (2001)
	Textile manufacture	95		Berger et al (2015)
	Stretch factory	88	114	Gerges et al (2001)
	Copper tube factory	96	136	Gerges et al (2001)
	Non-metal products	94		Gerges et al (2001)

Construction/Workshop

Category	Device/Activity	Leq (dBA)	Peak	Source
Generic				
	Tool shop	87		NZ DoH (1986)
	Joiner's workshop (UK) daily exposure	79–84		Hughson et al (2002)
	Furniture manufacture (Singapore)	93		Gerges et al (2001)
	Construction workers/labourers	84–94		EASHW (2005)
	Construction workers/labourers	83–91		Seixas et al (2012)
	Construction workers/labourers[1]	>=85		UW (2004)
	Plumber	79–92		EASHW (2005)
	Fitter	79–93		EASHW (2005)
	Stone mason	82–99		Hughson et al (2002)
	Insulation workers (manual)	83		Berger et al (2015)
Furniture / joinery				
Borers	Borer	85–87		NZ DoH (1986)
	Multiborer	97–98		NZ DoH (1986)
	Boring machine	94		NIOSH (1972)
Drills	Drill press	87		O'Neil (1986)
	Electric drill	94		McClymont & Simpson (1989)
	Air track drill	110		Eaton (2000)
	Drill	87		CDC (2005)
	Jointer	98–101		O'Neil (1986)
	Moulder	100		NIOSH (1972)
	Buzzer (cutting wood)	82–93		NZ DoH (1986)
	Dovetailer	83–99		NZ DoH (1986)
	Groover	85		NZ DoH (1986)
	Draw groover	87–96		NZ DoH (1986)
	Masonry drill	96		NZ DoL (2002)
Planers	Planer	77–100		NZ DoH (1986)
	Overhead planer	87		NZ DoH (1986)
	Planer	102		O'Neil (1986)

1. Exceeded 85 dBA in 70% of workshifts

Category	Device/Activity	Leq (dBA)	Peak	Source
	Planer	106		NIOSH (1972)
Routers	Router	94–96		NZ DoH (1986)
	Overhead router	91–96		NZ DoH (1986)
	Router	98–108		O'Neil (1986)
	Router	90		Kerr et al (2002)
Sanders	Sander – generic	97		NIOSH (1972)
	Belt sander		95	NZ DoL (2002)
	Belt sander	96		O'Neil (1986)
	Belt sander	90		CDC (2005), NIOSH (2005)
	Portable orbital sander	91		NZ DoH (1986)
	Orbital sander	100		McClymont & Simpson (1989)
	Wolf sander	88		NZ DoH (1986)
Saws:	Breast bench re–saw	99		NZ DoH (1986)
	Circular saw	88–109		NZ DoH (1986)
	Circular saw		99	NZ DoL (2002)
	Crosscut saw	93		NZ DoH (1986)
	Edging saw	100		NZ DoH (1986)
	Framing saw	82		NIOSH (2005)
	Hand saw	91		NZ DoH (1986)
	Formica saw	97		NZ DoH (1986)
	Bench grinder		99	NZ DoL (2002)
	Jigsaw	91		Kerr et al (2002)
	Jigsaw		95	NZ DoL (2002)
	Panel saw	92		NZ DoH (1986)
	Rip saw	97–101		NZ DoH (1986)
	Bench rip saw	96		NZ DoL (2002)
	Sawbench (cutting wood)	94		NZ DoH (1986)
	Skilsaw	96–97		NZ DoH (1986)
	Twin saw	88		NZ DoH (1986)
	Saw: bandsaw	95		O'Neil (1986)
	Saw: cut–off saw	112		NIOSH (1972)
	Cutoff saw	98		Greenspan et al (1995)
	Saw: jigsaw	97		McClymont & Simpson (1989)
	Saw: portable circular saw	113		McClymont & Simpson (1989)
	Saw: power saw	95–112		Clark & Bohne (1984)
	Saw: radial arm saw	102–110		O'Neil (1986)
	Saw: radial arm saw	98		NIOSH (1972)
	Saw: saber	108		O'Neil (1986)
	Saw: skilsaw	108		O'Neil (1986)
	Saw: table saw	92		O'Neil (1986)

Category	Device/Activity	Leq (dBA)	Peak	Source
	Brick saw	94		Burgess & Lai (1999)
	Concrete saw	98		CDC (2005)
Shapers	Shaper	95		O'Neil (1986)
	Shaper	104		NIOSH (1972)
	Spindle holder	90		NZ DoH (1986)
	Spindle moulder	90–93		NZ DoH (1986)
	Splicer	93		NZ DoH (1986)
	Tenoning machine	88–98		NZ DoH (1986)
Veneering	Veneerer	89–100		NZ DoH (1986)
Hammers	Hammer	85		CDC (2005)
	Hammer		131	NZ DoL (2002)
	Rotohammer	84		CDC (2005), Kerr et al (2002)
Compressed air	Compressed air hammer	106–116		Kenney & Ayer (1975)
	Compressed air hammers	94–101		Gerges et al (2001)
	Electric Hammers	88–95		Gerges et al (2001)
	Air compressor	90		CDC (2005)
	Compressed air gun	104		Kerr et al (2002)
	Compressed air gun		120	NZ DoL (2002)
	Air gun	108		CDC (2005)
	Air hammer	110		Bragdon (1971)
	Compresser (silenced) (at 7m)	70		Hong Kong EPD (1989)
	Compressor (standard) (at 7m)	77		Hong Kong EPD (1989)
	Extraction system	70		NZ DoH (1986)
	Shop vacuum	78–92		Clark & Bohne (1984)
	Pneumatic chipper	93–113		Sinclair & Haflidson (1995)
	Chipper, pneumatic	100		Hassall (1979), Olishifski (1975)
	Chipping gun	96		Kerr et al (2002), CDC (2005), UW (2004)
Carpentry				
Concrete	Drop hammer piledriver on steel pile (at 15m)	93		Hong Kong EPD (1989)
	Diesel hammer piledriver on concrete pile (at 15m)	95		Hong Kong EPD (1989)
	Diesel hammer piledriver on steel pile (at 15m)	99		Hong Kong EPD (1989)
	Electric grinder	98		NZ DoH (1986)
Pile drivers	Excavator	80		Greenspan et al (1995), Utley & Miller (1985)
	Bored piledriver using auger (at 15 m)	81		Hong Kong EPD (1989)

Category	Device/Activity	Leq (dBA)	Peak	Source
	Forklift	93		Utley & Miller (1985)
	Front end loader	90		Burgess & Lai (1999), Utley & Miller (1985)
	Generator at 50 ft	72		Alfredson and May (1978)
	Double scraper	92		Dobie (1993)
	Grader/scraper	107		Greenspan et al (1995)
	Grinder	87		NIOSH (2005)
	Grinder		97	NZ DoL (2002)
	Asphalt grinder	111		Greenspan et al (1995)
	Jackhammer	102		CDC (2005), Ren (1999), Alfredson and May (1978)
	Jackhammer		105	NZ DoL (2002)
	Manlift	84		CDC (2005)
	Mechanical tamper	90		CDC (2005), Greenspan et al (1995)
	Mechanical tamper at 50 ft	90		Alfredson and May (1978)
	Mobile crane	78		Utley and Miller (1985)
	Motorised wheel barrow	86		CDC (2005)
	Paver at 50 ft	86		Alfredson & May (1978)
	Piledriver at 50 ft	95		Alfredson & May (1978)
	Portaband	83		Ren (1999)
	Power actuated tool	89		NZ DoL (2002), UW (2004), Kerr et al (2002)
	Reciprocating saw	86		NIOSH (2005)
	Road grader	95		Dobie (1993)
	Scraper operator	117		Dobie (1993)
	Scraper at 50 ft	80		Alfredson & May (1978)
	Screw gun	86		Kerr et al (2002)
	Steam roller	85		Utley and Miller (1985)
	Steam roller	84		Kerr et al (2002)
	Stud welder	101		CDC (2005)
	Tile setter	92		Berger et al (2015)
	Vibratory piledriver on steel pile (at 15m)	85		Hong Kong EPD (1989)
	Welding equipment	92		UW (2004)
	Portable welder	84		CDC (2005)

Category	Device/Activity	Leq (dBA)	Peak	Source
Heavy equipment[2]				
Drilling	Earth drilling/moving equipment		120	NZ DoL (2002)
	Core drilling	89–99		Hughson et al (2002)
	Backhoe	85		CDC (2005)
	Bulldozer	87		CDC (2005), Dobie (1993), Alfredson and May (1978)
	Bulldozer		107	NZ DoL (2002)
	Earthmoving bulldozer	110		NIOSH
	Chopsaw	92		Kerr et al (2002), UW (2004)
Cranes	Crane operator		102	EAHSW (2005)
	Tower crane operator	75–87		EAHSW (2005)
	Specialised civil engineering worker	82–95		EAHSW (2005)
	Corrosion protectors	74–107		EAHSW (2005)
Roadworks	Road maker	79–107		Hughson et al (2002)
	Road maintenance	85–94		NIOSH
	Road grader	95		NIOSH
	Double	92		NIOSH
	Scraper	117		NZ DoL (2002)
	Bridge repainting	90–105		NIOSH (1998)

2. see also: *https://www.fhwa.dot.gov/Environment/noise/construction_noise/handbook/handbook09.cfm*

Farming

Category	Device/Activity	Leq (dBA)	Peak	Source
Farming	Daily exposure	85		Williams et al (2015)
	Daily exposure	85–87		McBride et al (2003)
	Dairy farmers[1]			Marvel et al (1991)
	Male farmers (Missouri)[2]			Thelin et al (1983)
Rural dwellers	Friends of farmers[3]			Thelin et al (1983)
Farming families	Adults' occupational exposures[4]	63–92		Milz et al (2008)
	Children[5]	42–86		Milz et al (2008)
Farm vehicles				
Quad (All terrain) vehicles		84 – 87		Depczynski et al (2002)
Motorbikes – 2 wheel		70 – 92		Depczynski et al (2002)
Forklifts		81–88		Depczynski et al (2002)
Farm trucks		83 – 88		Depczynski et al (2002)
Tractors	Tractor	98		NIOSH (1972)
	Tractor	97–114		Simpson & Deshayes (1969)
	Tractor with cabin	75 – 78		Depczynski et al (2002)
	Increase with radio on	3–5 dB		Depczynski et al (2002)
	Others in field	80 – 90		Depczynski et al (2002)
	Tractor without cabin	90 – 93		Depczynski et al (2002)
	Others in field	78 – 86		Depczynski et al (2002)
Tractor drivers		78–103		Holt et al (1993)
	Without cabs	over 90		Holt et al (1993)

1. 65% of farmers had HF loss (cf 37% non–farmers); 37% had midF loss (cf 12% non–farmers)
2. 16.8% of farmers had HF loss (2k>20 dB, 4k>25 dB) cf 6.2% office workers.
3. Male non–farmers who associate with farmers had almost as much HL as farmers.
4. 10/45 exceeded 85 dBA
5. 1/11 exceeded 85 dBA

Category	Device/Activity	Leq (dBA)	Peak	Source
	With cabs[6]	less than 90 dBA		Holt et al (1993)
	Massey Ferguson tractor 2135[7]	98		Holt et al (1993)
	With mower[8]	98		Holt et al (1993)
	John Deere 2350[9]	95		Holt et al (1993)
	With mower[10]	100		Holt et al (1993)
	Landini with sprayer[11]	98		Holt et al (1993)
	Kubota 5400 with sprayer[12]	87		Holt et al (1993)
Bulldozers		97 – 100		Depczynski et al (2002)
Harvesters		75 – 91		Depczynski et al (2002)
	Increase with radio on	2–5 dB		Depczynski et al (2002)
	Others in field	90		Depczynski et al (2002)
	1–row beet puller	94		NIOSH (1972)
	2–row corn–picker	106		NIOSH (1972)
Farm equipment				
Air compressors		77– 95		Depczynski et al (2002)
Angle grinders		96 – 100		Depczynski et al (2002)
	Others in workshop	87 – 93		Depczynski et al (2002)
Augers		89–96		Depczynski et al (2002)
Bench grinders		94 – 104		Depczynski et al (2002)
	Others in workshop	82 –96		Depczynski et al (2002)
Chainsaws		104 – 107		Depczynski et al (2002)
	Others stacking wood	93 – 99		Depczynski et al (2002)
Circular saws		98 – 101		Depczynski et al (2002)
	Others in workshop	84 – 94		Depczynski et al (2002)
Cotton module presses		85 – 88		Depczynski et al (2002)
Orchard	Sprayer	106		Berger et al (2015)

6. 18% of tractors with cabs had noise levels >90 dBA
7. 4–hour TWA* 86
8. 3–hour TWA* 86
9. 4–hour TWA* 85
10. 4–hour TWA* 87
11. 4–hour TWA* 86
12. 7–hour TWA* 86

Category	Device/Activity	Leq (dBA)	Peak	Source
Irrigation pumps		96 – 104		Depczynski et al (2002)
Grain processing	Grain roller mill	85		NIOSH (1972)
Milking sheds				
Dairies	Herringbone bay, in pit	71 – 75		Depczynski et al (2002)
	Generic	85–95		EAHSW (2005)
Milk tanker loading at farm	High flow pump	85		NZ: Sherwen (1996)
	MacEwan pump	88		NZ: Sherwen (1996)
Shearing				
Shearers	Shearers	90		McBride et al (2010a)
	Sorters	87		McBride et al (2010a)
	Pressers	89		McBride et al (2010a)
		84 – 87		Depczynski et al (2002)
	Others in shed	77 – 83		Depczynski et al (2002)
Harvesting				
Cotton pickers		78 – 85		Depczynski et al (2002)
	Increase with radio on	1 – 3		Depczynski et al (2002)
	Others in field (machines idle)	77 – 89		Depczynski et al (2002)
	Others in field (machines turning)	94		Depczynski et al (2002)
Packing shed workers		78 – 82		Depczynski et al (2002)
	Pneumatic conveyor	100		NIOSH (1972)
Pig farming				
Pig handling	suckers	109		Depczynski et al (2002)
Pig sheds	manual feeding	74 – 99		Depczynski et al (2002)
	Feeding pigs	88–92		NZ DoL 1986
	Sows	97–106		NZ DoL 1986
Sundry rural activities				
Farriers	Shoe fitting	98–102		EASHW (2005)
Firearms			140+	Depczynski et al (2002)
Hunters[13]				Axelsson et al (1986)
Fishing				

13. Hunters had worse hearing in the left ear, and at 6k in the right ear than the average.

Category	Device/Activity	Leq (dBA)	Peak	Source
Trawler	Engine room	97–104		Szczepanski Weclawik (1991)
	Engine room[14]	95–105		Levin et al (2016)
	Fish processing	84–97		Szczepanski Weclawik (1991)
	Fishermen[15]			Axelsson et al (1986)
	Crew compartment	62–70		Levin et al (2016)
	Oyster boat	88–91		NZ Dawes (1988)

14. Fishing workers with <5 years experience had HL on average 8.6%, 5–15 years 11%, 15 years+ 13%.
15. Mean PLH 4.6% (51–60 yrs), 12.6% (61–65 yrs). Coastal fishermen working in the rear of the vessel near the outboard motor had worse hearing than the average.

Food preparation & packaging

Category	Device/Activity	Leq (dBA)	Peak	Source
Overall food preparation	Sector average (Singapore)	92		Gerges et al (2001)
	Sector daily average exposure (UK)	89–92		Hughson et al (2002)
Bakery				
		85–92		EAHSW (2005)
	Dough mixing room	85		HSE (2013)
	Baking plant	85		HSE (2013)
	De-panning	90		HSE (2013)
	Bread slicing	85–90		HSE (2013)
	Fruit washing	92		HSE (2013)
Fish preparation				
	Batter mixer	87–88		NZ DoH (1986)
	Cutting machine	88		NZ DoH (1986)
	Box erector	87		NZ DoH (1986)
	Packaging line	88		NZ DoH (1986)
	Glue machine	88		NZ DoH (1986)
	Sellotape machine	88		NZ DoH (1986)
Vegetable preparation				
Broccolli line	Loading, leaf stripping cutting	80–84		NZ DoH (1986)
	Plate freezer, packer	85		NZ DoH (1986)
	Blanching area	83		NZ DoH (1986)
	Packing (10 kg)	90		NZ DoH (1986)
Potato line	Peeler	84–91		NZ DoH (1986)
	Cutter	91		NZ DoH (1986)
	Blancher	87		NZ DoH (1986)
	Dryer	88		NZ DoH (1986)
	Fryhouse	87–96		NZ DoH (1986)
	Post-freezer inspection belt	90		NZ DoH (1986)
	Packaging area	94		NZ DoH (1986)
Cannery				
	Can filling machine		100	NIOSH (1972)

Category	Device/Activity	Leq (dBA)	Peak	Source
	Can making operation		95	NIOSH (1972)
	Canning punch press		97	NIOSH (1972)
Packaging				
	Box making	87		NZ DoH (1986)
	Pallet loading	83		NZ DoH (1986)
	Carton taping	86		NZ DoH (1986)
Cake making				
	Pastry dept	81–86		NZ DoH (1986)
	Tin greasing machine	91		NZ DoH (1986)
	Papering machine	84		NZ DoH (1986)
	Fruit washer	88		NZ DoH (1986)
	Sponge mixer	82		NZ DoH (1986)
	Cake mixer	78		NZ DoH (1986)
	Dough break	78		NZ DoH (1986)
	Wrapping machine	77		NZ DoH (1986)
	Moving metal trolley (empty)	83		NZ DoH (1986)
	Pavlova mixer	75–84		NZ DoH (1986)
	Biscuit making	82–90		NZ Dawes (1980)
Confectionery				
	Confectionery factory	82–86		NZ Dawes (1980)
		84–92	125–146	NZ Dawes (2004)
	Confectionery factory	86	106	Gerges et al (2001)
	Confectionery factory	85–95		EAHSW (2005)
	Hopper feed	95		HSE (2013)
	Mould-shakers	90–95		HSE (2013)
	Wrap-bagging	85–95		HSE (2013)
	Boiling	88–90		NZ Dawes (1980)
		85		HSE (2013)
Dairy				
	AMF room	93–94		NZ DoH (1986)
	Production areas	85–95		EAHSW (2005)
	Homogenisers	90–95		EAHSW (2005)
	Bottling lines	90–95		EAHSW (2005)
	Blast chillers	87–95		EAHSW (2005)
	Pneumatics	85–95		EAHSW (2005)
	Milk tanker unloading pumps	89–92		NZ: Sherwen (1996)
	Ammonia freezer compressor room	85–92	107	NZ: Sherwen (1996)
	Protein drier room with fan going	89		NZ: Sherwen (1996)
	Vacuum mix	74		NZ: Sherwen (1996)
Milk powder plant	Packing room	84–93		NZ: Sherwen (1996)
	Shaking bed supply fan	96		NZ: Sherwen (1996)
	Evaporator hall	99		NZ: Sherwen (1996)
Drinks				
	Bottling (UK)	85–97		Hughson et al (2002)

Category	Device/Activity	Leq (dBA)	Peak	Source
	Bottling hall	85–95		HSE (2013)
	Bottle filling/labelling	85–95		HSE (2013)
	De-crating/washing	85–96		HSE (2013)
	Casking/kegging	85–100		HSE (2013)
	Cooperage machines	>95		HSE (2013)
Grain milling				
	Mill areas	85–95		HSE (2013)
	Hammer mills	95–100		HSE (2013)
	Grinders	85–95		HSE (2013)
	Seed graders	90		HSE (2013)
	Bagging lines	85–95		HSE (2013)
Sauce making & bottling				
	Vat room	81–96		NZ DoH (1986)
	Bottling plant: bottles on full	81		NZ DoH (1986)
	Bottling plant: capping	82–88		NZ DoH (1986)
	Bottling plant: labelling machine	80–82		NZ DoH (1986)
	Bottling plant: packing	78–88		NZ DoH (1986)
	Bottling plant: carton sealing	83		NZ DoH (1986)
Meat preparation				
	Brine injector	93		NZ DoH (1986)
Small goods	Sausage maker	90		NZ DoH (1986)
	Emulsifier	91		NZ DoH (1986)
	Bowl chopper	94–98		NZ DoH (1986)
	Mincer	90		NZ DoH (1986)
	Bacon chipper	98–105		NZ DoH (1986)
	Ambient 3m from operational chipper	89		NZ DoH (1986)
	Ambient 4m from operational chipper	92		NZ DoH (1986)
	Linker	91–112		NZ DoH (1986)
	Curing machine	89–105		NZ DoH (1986)
Freezing works				
	General operation areas	85	105	NZ: Sherwen (1996)
	Intestinal room (with radio on)	86–88		NZ: Sherwen (1996)
	Fancy Meats Dept (with radio)	85–88		NZ: Sherwen (1996)
	Pet food	80		NZ: Sherwen (1996)
	Lower slaughter board	85–94		NZ: Sherwen (1996)
	Upper slaughter board	82–86		NZ: Sherwen (1996)
Lairage	Animal noise	80 – 110		British Meat Processors Assn (2014)
Boilerhouse	Boilers	87–94		NZ DoH (1986)
	Pump area	86		NZ DoH (1986)
	Coal bunker	77–80		NZ DoH (1986)

Category	Device/Activity	Leq (dBA)	Peak	Source
Beef house stunning operator	Legging platform	86–98		NZ DoH (1986)
	Pelting machine	87–89		NZ DoH (1986)
	Saw (small cross-cut)	88		NZ DoH (1986)
	MAF stand	87		NZ DoH (1986)
	Washing stand	90		NZ DoH (1986)
	Offal area	77		NZ DoH (1986)
	Hogger	92–98		NZ Dawes (1981)
	Casings	90–92		NZ Dawes (1981)
	Casings – stripping roller	82		NZ DoH (1986)
	Rumbler room	96		NZ DoH (1986)
		88–98		NZ Dawes (1981)
	Boning room	84–91		NZ DoH (1986)
	Flagmaster	88		NZ Dawes (1981)
Mutton board	Background noise	88		NZ Dawes (1981)
	Slaughter pen	84–89		NZ DoH (1986)
	Legging table	86–90		NZ DoH (1986)
	Pelting machine	88		NZ DoH (1986)
	Cutting area	87–90		NZ DoH (1986)
	Between boning tables	87		NZ DoH (1986)
	Vacuum packer	90		NZ DoH (1986)
Pig house	Scalding tanks	94		NZ DoH (1986)
	Scraping table	90		NZ DoH (1986)
	Singeing area	92		NZ DoH (1986)
	Air saw operator	97		NZ DoH (1986)
	De Gambrel & Gambrels freezer (impulse)	94–95		NZ DoH (1986)
	Air knives	90–93		NZ DoH (1986)
	Small goods – liver sorting	84–87		NZ DoH (1986)
	Catwalk between washers in manure dept	92		NZ DoH (1986)
	Fellmongery	84–90		NZ Dawes (1981)
	Engine room	90–94		NZ Dawes (1981)
	Control room door shut	67		NZ Dawes (1981)
	De-hairing Machines	80– 95		British Meat Processors Assn (2014)
	Electric Rotary Saws	<=100		British Meat Processors Assn (2014)
	Cold Store and Chill Store Compressors	70 – 90		British Meat Processors Assn (2014)
	Vacuum Packing Machines	<=95		British Meat Processors Assn (2014)

Category	Device/Activity	Leq (dBA)	Peak	Source
Large Slaughterhouse	Slaughterhouse Scald Area	82		British Meat Processors Assn (2014)
	Slaughterhouse Washing Area	85		British Meat Processors Assn (2014)
	Slaughterhouse Hide Puller	89		British Meat Processors Assn (2014)
	Boning Room	84		British Meat Processors Assn (2014)
	Cutting Room	75		British Meat Processors Assn (2014)
	Chiller Rooms	82 – 92		British Meat Processors Assn (2014)
				British Meat Processors Assn (2014)
Small Boning Plant	General Background	70 – 75		British Meat Processors Assn (2014)
	Near Vacuum Pack Machine	90		British Meat Processors Assn (2014)
	Box Chiller	65 – 70		British Meat Processors Assn (2014)
	Refrigeration Plant Room	85 – 90		British Meat Processors Assn (2014)
	Overall	86		Meat & Livestock Australia (1995)
	Most areas of abattoir	>85	111	Meat & Livestock Australia (1995)
	Knocking areas	98	141	Meat & Livestock Australia (1995)
	Pigs prior to slaughter	104		Meat & Livestock Australia (1995)
	Prebreaker & breaker machines	96		Meat & Livestock Australia (1995)
	Boning room	95		Meat & Livestock Australia (1995)
	Chillers/freezers	95		Meat & Livestock Australia (1995)
	Kill floor	94		Meat & Livestock Australia (1995)
	Air knives	95		Meat & Livestock Australia (1995)
	Paunch processing	90		Meat & Livestock Australia (1995)

Category	Device/Activity	Leq (dBA)	Peak	Source
	Hide pullers	90		Meat & Livestock Australia (1995)
	Packing/boning	88		Meat & Livestock Australia (1995)
	Plant rooms: water pumps	92		Meat & Livestock Australia (1995)
	Plant rooms: air compressors/ chillers	105		Meat & Livestock Australia (1995)
	Plant rooms: boilers	94		Meat & Livestock Australia (1995)
Food venues				
Cafeteria	Dishwasher	78		NZ DoH (1986)
	Vicinity	80–85		NZ DoH (1986)
	Dining area	73–77		NZ DoH (1986)
Restaurant	Workers	80 (69–90)		Green Anthony (2015)

Mining

Category	Device/Activity	Leq (dBA)	Peak	Source
Coal Mining		86–93		Robertson et al 1989
Open pit	Crusher	96		NIOSH (1972)
	Jumbo drill	107		NIOSH (1972)
	Locomotive	85		NIOSH (1972)
	Oxygen torches	120		NIOSH (1972)
	Rotary drill	93		NIOSH (1972)
Underground	Axial vane fan	107		NIOSH (1972)
	Continuous miner	99		NIOSH (1972)
	Conveyor belt	93		NIOSH (1972)
	Jackhammer drill	113		NIOSH (1972)
	Loader - gathering arm	96		NIOSH (1972)
	Loader - roof bolter	103		NIOSH (1972)
	Loader - stopper drill	115		NIOSH (1972)
Haulage	Truck	90–100		Berger et al (2015)
Offshore	Diesel generators	100–120		NIOSH (1972)
	Gas lift compressors	105–110		NIOSH (1972)
	Gas turbines	100–112		NIOSH (1972)
	Pipe noise	95–105		NIOSH (1972)
	Pumps	100–115		NIOSH (1972)
	Valves	104–120		NIOSH (1972)
	Wellhead room	90–95		NIOSH (1972)
Quarry	Road stone daily noise exposure	82–94		Hughson et al (2002)
Oil refinery				
	Can seaming	96		NIOSH (1972)
	Furnace heating distilling columns	100		NIOSH (1972)
	Furnace pumps	103		NIOSH (1972)
	Steam let-down	130		NIOSH (1972)
Power generation				
Hydrostation	Turbine floor	88–94		NZ Dawes (1983)
	Control room	64		NZ Dawes (1983)
	Electricians/mechanics	85+		NIOSH (1998)

Category	Device/Activity	Leq (dBA)	Peak	Source
Compressed gas	Supply depot daily noise exposure	80–90		Hughson et al (2002)
Coal-fired	Power station	85–102		Hughson et al (2002)

Weapons & explosives

Category	Device/Activity	Leq (dBA)	Peak	Source
Guns	M16 at 4.5m		155	Price (1983)
	105mm Howitzer at 5m		164	Price (1983)
	Explosive-actuated tools		150–160	Smith (1971)
Shotguns	12g shotgun		163–173	Odess (1972)
	12g shotgun[1]		146	Staab et al (undated)
	16g shotgun		166–169	Odess (1972)
	20g shotgun		166–168	Odess (1972)
	410g shotgun		164–169	Odess (1972)
Rifles	22 cal rifle		143–158	Odess (1972)
	22 cal rifle[2]		122	Staab et al (undated)
	30 cal rifle		168–172	Odess (1972)
	30 cal rifle[3]		150	Staab et al (undated)
Hunters[4]				Axelsson et al (1986)
	Helicopter 308 rifle shooting	117	>140	NZ Dawes (1988)
Police	Hand-gun exercises, indoor range		157–160	NIOSH (1998)
Military				
Military helicopters	Helicopter (cockpit)	102	111	Berger et al (2015)
	Helicopter (external)	63		Berger et al (2015)
	AH-64, Attack Helicopter	87		US Army (1991)
	Boeing Chinook	104–110		US Army (1991)
	Viper		182	US Army (1991)
Military jet	Take-off from aircraft carrier with afterburner at 50 ft		130	Federal Interagency Committee on Noise (1992)
	Jet take-off (cockpit)	75		Berger et al (2015)
	Jet take-off (external)	133	150	Berger et al (2015)
Carrier	M113	117		US Army (1991)
	M114A1	109		US Army (1991)
Bridge erection boat	steady-state	87		US Army (1991)
Air defense missile	Charparral		145	US Army (1991)

1. Ear difference only below 250 Hz - approx 15 dB
2. Ear difference only at 500 & 1 kHz - approx 15 & 9 dB respectively
3. Ear difference only at 500 & 1 kHz - approx 9 & 7 dB respectively
4. Hunters had worse hearing in the left ear, and at 6k in the right ear than the average.

Category	Device/Activity	Leq (dBA)	Peak	Source
Mine	Claymorette H113 PC		148	US Army (1991)
Army trucks		90–110		US Army (1991)
Armoured personnel carrier	Inside	105	118	Berger et al (2015)
Crane		91–101		US Army (1991)
Ute	CUC-V (Drivers position)	70–96		US Army (1991)
Armoured engineering vehicles		99	99–104	US Army (1991)
Snowmobile		77–92		US Army (1991)
Grenade Launcher		108	142–178	US Army (1991)
Grenade Launch Simulator			126	US Army (1991)
Gun			153–181	US Army (1991)
	mounted		145–179	US Army (1991)
	machine		160–165	US Army (1991)
	Tank		179 –191	US Army (1991)
	Howitzer	112	179–189	US Army (1991)
	Mortar, 81mm		178	US Army (1991)
Pistol	M1911		161–162	US Army (1991)
Rifle			143–188	US Army (1991)
Tank	Bradley	116	80–116	US Army (1991)
	LACY -30 Ton	96		US Army (1991)
	M6OA3 TTS	80–109		US Army (1991)
	Average - inside	106	117	Berger et al (2015)
Tank system (Firing)			151–176	US Army (1991)
Recovery vehicle (for tanks)	steady-state	94–116		US Army (1991)

Gardening/outdoors

Category	Device/Activity	Leq (dBA)	Peak	Source
Garden equipment	Leaf sucker	91		NZ DoH (1986)
	Garden blower	84–92		Clark & Bohne (1984)
	Leaf blower	110		Dobie 2015
	Leaf Blower	95–105		NPC website (undated)
	Plant pot washer	91		NZ DoH (1986)
Lawnmower	Operating lawnmower	91		NZ DoL (2002)
	Masport commander 610 lawnmower	87.7		NZ DoH (1986)
	Masport lawnmaster 500 lawnmower	90.5		NZ DoH (1986)
	Victor rotary lawnmower	91		NZ DoH (1986)
	Electric mower	103		McClymont & Simpson (1989)
	Power lawnmower	80–95		EPA (1974)
	Power mower	96		Federal Interagency Committee on Noise (1992)
	Push Reel Mower	68–72		NPC website (undated)
	Lawn Mower	88–94		NPC website (undated)
	Weed Whacker	94–96		NPC website (undated)
	Pulveriser	95		NZ DoH (1986)
	Trench wacker	98		NZ DoH (1986)
	Back hoe digger	86–96		NZ DoH (1986)
	Hedge cutter	95		McClymont & Simpson (1989)
	Hitachi drill model DMT 13	92–95		NZ DoH (1986)
	Pumphouse	94–106		NZ DoH (1986)
	Hydraulic oil pump	78–84		NZ DoH (1986)
Power tools	Hand-held (operator)	94		NZ DoL (2002)
Chainsaws	Chainsaw CD480	92–108		NZ DoH (1986)
	Chainsaw Echo	107		NZ DoH (1986)

Category	Device/Activity	Leq (dBA)	Peak	Source
	Chainsaw Husqvana	102.11		NZ DoH (1986)
	Chainsaw	103–116		EPA (1974)
	Electric chainsaw	89–93		NZ DoL (2002)
	Circular Saw	100–104		NPC website (undated)
	Air Compressor	90–93		NPC website (undated)
	1/4" Drill	92–95		NPC website (undated)
	Model airplane	106–117		Clark & Bohne (1984)
Groundskeepers				
Groundskeepers	Mean noise exposure[1]	67–103		Balanay et al (2016)
	Equipment & tools[2]	75–106		Balanay et al (2016)
Tree workers				
Tree workers	Time-weighted average	85–98		LaBere-Wickey (2011)
	Tree felling	98		Berger et al (2015)
	Chipper	116		LaBere-Wickey (2011)
	Chainsaw	95		LaBere-Wickey (2011)
	Stump grinder	98		LaBere-Wickey (2011)
	Leaf blower	106		LaBere-Wickey (2011)
	Water truck	97		LaBere-Wickey (2011)
	Maxi-grind	96		LaBere-Wickey(2011)
	Roto-chopper	97		LaBere-Wickey (2011)
Forestry				
Forestry[3]		90		Neitzel Yost (2002)
	Notching stumps	83		Berger et al (2015)
Forest workshop	Carpenter's shop	98 (80–102)		NZ Dawes (1983)
	Plumber's workshop	92 (88–95)		NZ Dawes (1983)
	Hydraulic room	63–88		NZ Dawes (1983)
Wood processing				
	Saw mill	84		Gerges et al (2001)
	Sawmill & other woodmills (Singapore)	93		Gerges et al (2001)
	Paper winder operator	86	142	NZ Timber Mill (2016)

1. 76% exceeded 85 dBA
2. Most between 90-100
3. Worst task & tool: Unbelling chokers on landings, and chainsaws

Category	Device/Activity	Leq (dBA)	Peak	Source
	Load out operator	91	135	NZ Timber Mill (2016)
	Paper production	93		NZ Timber Mill (2016)
	Paper pulp drying	92		NZ Timber Mill (2016)
	Field operator (ie based in plant)	87		NZ Timber Mill (2016)
	Production operators (mostly in control room)	<80		NZ Timber Mill (2016)
	Boiler operator	84–87		NZ Timber Mill (2016)
	Screen house	93		NZ Timber Mill (2016)
	Chemical plant (mostly in control room)	<80		NZ Timber Mill (2016)
	Paper mill – cutter area - open	108		NIOSH (1998)
	- closed	95		NIOSH (1998)

Music/Recreation

Category	Device/Activity	Leq (dBA)	Peak	Source
Games, toys				
Games	Handheld Electronic Games	68–76		NPC website (undated)
	Arcade games	84–111		Davis et al (1985)
	Sporting events	106		Berger et al (2015)
	Pool, indoor, with 150 spectators shouting	74		Berger et al (2015)
	Whistle (sports)		110–112	Berger et al (2015)
Toys	Toy guns at 25 dm		145–160	Hodge & McCommons (1966)
Fireworks				
Fireworks	Cap-guns at 50 cm		143–152	Axelsson & Jerson (1985)
	Firecrackers at 3m		150	Gupta & Vishwakarma (1989)
	Firecrackers at 0.5m		171	Flamme et al (2009)
	Firecrackers at 3m		125–156	Axelsson & Jerson (1985)
Popular music				
Electronic music	Maximum Output of Stereo	100–110		NPC website (undated)
	Personal stereo systems	74–128		Clark (1991)
	Personal stereo	92		Berger et al (2015)
	Personal cassette player	80		Berger et al (2015)
	Walkman on 5/10	94		Chasin (1996)
	Karaoke	92		Berger et al (2015)
	Movie theatre	81		Berger et al (2015)
	Live shows	85		Berger et al (2015)
	Rock/pop concert	104		Berger et al (2015)
	Rock music (live)	89–119		Clark (1991)
	Amplifier rock, 4-6'	120		Chasin (1996)
	Rock music peak		150	Chasin (1996)
Bars, nightclubs	Quiet periods	65–70		Davies et al (2005)
	Busy periods, no music	<=88		Davies et al (2005)

Category	Device/Activity	Leq (dBA)	Peak	Source
	Busy, with music	90–95		Davies et al (2005)
	Dancefloor	<=105		Davies et al (2005)
	Discotheques	95–98		Davis et al (1985)
	Nightclub	98		Berger et al (2015)
Radio announcers	Under headphones	81		Williams & Presbury (2003)
Jazz	Jazz concert	91		Berger et al (2015)
	Rehearsal	96–98		Berger et al (2015)
Classical music				
Symphony orchestras	Overall while exposed[1]	90 (79–99)		Royster et al 1991
	Symphony concert	90		Berger et al (2015)
	Weekly (assuming 15 hr/week)	86 (79–95)		Royster et al 1991
Performance		80–100	<104	Westmore & Eversden (1981)
	Practice time for some bands	100		Westmore & Eversden (1981)
	Normal piano practice	60 –70		Chasin (1996)
	Fortissimo Singer, 3’	70		Chasin (1996)
	Chamber music, small auditorium	75 – 85		Chasin (1996)
	Piano Fortissimo	84 – 103		Chasin (1996)
	Violin	82 – 92		Chasin (1996)
	Violin	84–103		Folprechtova & Miksovska (1978)
	Cello	85 –111		Chasin (1996)
	Cello	84–92		Folprechtova & Miksovska (1978)
	Oboe	95–112		Chasin (1996)
	Oboe	80–94		Folprechtova & Miksovska (1978)
	Bass	75–83		Folprechtova & Miksovska (1978)
	Flute	92 –103		Chasin (1996)
	Flute	85–111		Folprechtova & Miksovska (1978)
	Piccolo	90 –106		Chasin (1996)
	Piccolo	95–112		Folprechtova & Miksovska (1978)
	Clarinet	85 – 114		Chasin (1996)
	Clarinet	92–103		Folprechtova & Miksovska (1978)
	French horn	90–106		Folprechtova & Miksovska (1978)
	Trombone	85–114		Folprechtova & Miksovska (1978)
	Tympani & bass drum	106		Chasin (1996)

1. 52% had noise notch - violinists and violists had significantly worse hearing than others, particularly in their L ears

Category	Device/Activity	Leq (dBA)	Peak	Source
	Xylophone	90–92		Folprechtova & Miksovska (1978)
	Symphonic music peak	120 – 137		Chasin (1996)
Choirs				
Choirs (professional)[2]		<100	110	Steurer et al 1998

2. Found HL mostly in low frequencies - speculated that increase in endolymphatic pressure may have been a factor.

Office equipment

Category	Device/Activity	Leq (dBA)	Peak	Source
General offices		45–60		EAHSW (2005)
	Typing room	70–74.5		NZ DoH (1986)
	Computer print room	80		EAHSW (2005)
	Call centre operator	77		Berger et al (2015)
Copiers/printers	Xerox RX9400: running	69		NZ DoH (1986)
	Xerox RX9400:print mode	73		NZ DoH (1986)
	Xerox RX9400: printing	73		NZ DoH (1986)
	6500 colour copier	66–68		NZ DoH (1986)
	1860 printer	65–67		NZ DoH (1986)
	Computer and printer	61–74		NZ DoH (1986)
	Telex printing	74		NZ DoH (1986)
Other equipment	VDC machine	30–47		NZ DoH (1986)
	Franking machine	74–79		NZ DoH (1986)
	Decollator	72		NZ DoH (1986)
	MICR (cheque coder)	70–81		NZ DoH (1986)
Call centres				
Call centres		50–60		EAHSW (2005)
	For 60% of workstations (under earphones)	>80	96–125	Smagowska (2010)

Healthcare

Category	Device/Activity	Leq (dBA)	Peak	Source
Dentistry				
Post-grad clinic	Chairside	66–81		Dutta et al 2013
	Centre of clinic	66–67		Dutta et al 2013
	Suction alone	69–79		Dutta et al 2013
Undergrad clinic	Suction & high/slow handpieces	67–80		Dutta et al 2013
	Suction alone	63–75		Dutta et al 2013
Mean levels in working clinics		63–81.5		Dutta et al 2013
Clinic	Handpiece cutting acrylic	92.2		Qsaibati & Ibrahim 2014
	Ultrasonic scaler with suction	51.7		Qsaibati & Ibrahim 2014
Dental laboratory	Sandblaster	96		Qsaibati & Ibrahim 2014
	Stone trimmer turned on but not operating	61.8		Qsaibati & Ibrahim 2014
Hospitals				
Operating theatres	Knee surgery	Mostly <85		Broadwater & Brueck (2014)
Hospital wards		62–105		EAHSW (2005)
Boiler house		95		NZ Dawes (1984)
Biomedical lab		<85		NIOSH (1998)

Miscellaneous

Category	Device/Activity	Leq (dBA)	Peak	Source
Education				
	Quiet work	50–60		EAHSW (2005)
	School rooms	60–80		EAHSW (2005)
	Rec areas, sports, music lessons	80–95		EAHSW (2005)
	Preschools	75–85		EAHSW (2005)
	High school technical workshops & swimming pools	90–105		EAHSW (2005)
	High school woodwork room	91		NZ Dawes (1982)
	High school metalwork room	88		NZ Dawes (1982)
Household				
	Food Processor	93–100		NPC website (undated)
	Blender	64–87		EPA (1974)
	Coffee Grinder	84–95		NPC website (undated)
	Handheld Electric Mixer	86–91		NPC website (undated)
	Disposal	67–93		EPA (1974)
	Garbage Disposal	76–83		NPC website (undated)
	Microwave	55–59		NPC website (undated)
	Refrigerator	46–68		EPA (1974)
	Refrigerator	40–43		NPC website (undated)
	Dishwasher	63–66		NPC website (undated)
	Electric Can Opener	81–83		NPC website (undated)
	Vacuum Cleaner	84–89		NPC website (undated)
	Vacuum cleaner	60–86		EPA (1974)
	Washing machine	47–78		EPA (1974)
	Washing machine	65–70		NPC website (undated)

Category	Device/Activity	Leq (dBA)	Peak	Source
	Clothes Dryer	56–58		NPC website (undated)
	Clothes Dryer	50–72		EPA (1974)
	Kitchen Exhaust Fan, High	69–71		NPC website (undated)
	Window Fan on High	60–66		NPC website (undated)
	Window air conditioner	60–73		EPA (1974)
	Forced Hot Air Heating System	42–52		NPC website (undated)
	Bathroom Exhaust Fan	54–55		NPC website (undated)
	Cordless phones (early models)	140		Orchik et al (1987)
	Phone	66–75		NPC website (undated)
	Domestic computer	37–45		NPC website (undated)
	Domestic printer	58–65		NPC website (undated)
	Hairdryer	80–95		NPC website (undated)
	Radio Playing in Background	45–50		NPC website (undated)
	Background Music	50		NPC website (undated)
	Screaming baby	100–117		Dobie 2015
	Alarm Clock	60–80		NPC website (undated)

References

Alfredson, R. (1978). Construction site noise. In D. May (Ed.), *Handbook of noise assessment. NY: Litton Educational Publishing*.

Axelsson, A., & Jerson, T. (1985). Noisy toys: a possible source of sensorineural hearing loss. *Pediatrics*, 79, 574-578.

Axelsson, A. I., & Arvidsson, T. (1986). Hearing in Fishermen and coastguards. In R. J. Salvi, D. Henderson, Hamernik, & V. Colletti (Eds.), *Basic and applied aspects of noise-induced hearing loss*. NY: Plenum Press.

Balanay, J. A., Kearney, G. D., & Mannarino, A. J. (2016). Noise exposure assessment among groundskeepers in a university setting: A pilot study. *J Occup Environ Hyg*, 13, 193-202.

Berger, E. H., Neitzel, R., & Kladden, C. (2016). *Noise navigator sound level database with over 1700 measurement values*. Retrieved from MI: Ann Arbor:

Binnington, J. D., McCombe, A. W., & Harris, M. (1993). Warning signal detection and the acoustic environment of the motorcyclist. *Br J Audiol*, 27(6), 415-422.

Bragdon, C. R. (1971). *Noise pollution, the unquiet crisis*. Phila.: PA University Pennsylvania Press.

Bray, D. E. (1974). Noise environments in public transportation *Sound Vibration*, 6, 28-20.

British Meat Processing Association (2014). *Health & Safety Guidance Notes for the Meat Industry*

British Meat Processors Assn (2014). *Health & Safety Guidance Notes for the Meat Industry*

Broadwater, K. R., & Brueck, S. E. (2014). *Health hazard evaluation report: Evaluation of a surgical staff's noise exposures during total knee replacement surgeries*. https://www.cdc.gov/niosh/hhe/reports/pdfs/2014-0154-3275.pdf

Bruno, P. S., Marcos, Q. R., Amanda, C., & Paulo, Z. H. (2013). Annoyance evaluation and the effect of noise on the health of bus drivers. *Noise Health*, 15(66), 301-306. doi:10.4103/1463-1741.116561

Burgess, M., & Lai, J. (1999). *Noise Management for the Building Industry: Current Practices and Strategies for Improvement ; Condensed Report*.

Campbell, R. A. (1972). A survey of noise levels on board pleasure boats. *Sound Vibration*, 6, 28-29.

Casali, J. G., Lee, S. E., & Robinson, G. S. (1998). *Evaluation of the FHWA hearing requirements for truck drivers*. Paper presented at the Proc National Hearing Conserv, Alberquerque, New Mexico.

Chasin, M. (1996). *Musicians and the prevention of hearing loss*. San Diego: Singular Publishing Group.

Clark, W. W. (1991). Noise exposure from leisure activities: a review. *J Acoust Soc Am*, 90(1), 175-181.

Clark, W. W., & Bohne, B. A. (1984). The effects of noise on hearing and the ear. *Med Times*.

Davies, A. C., Fortnum, H. M., Coles, R. B. A., Haggard, M. P., & Lutman, M. E. (1985). *Damage to hearing arising from leisure noise: A review of the literature*.

Davies, W. J., Moorhouse, A. T., & Oldfield, R. (2005). *Noise from pubs and clubs*.

Depczynski, J., Franklin, R. C., Challinor, K., & Williams, W. (2002). *Farm noise hazards*.

Dobie, R. A. (1993). *Medical-Legal Evaluation of Hearing Loss*. NY: New York: Van Nostrand Reinhold.

Dobie, R. A. (2015). *Medical-Legal Evaluation of Hearing Loss* (3rd ed.): Plural Publishing.

Dutta, A., Mala, K., & Acharya, S. R. (2013). Sound levels in conservative dentistry and endodontics clinic. *Journal of conservative dentistry : JCD*, 16(2), 121-125. doi:10.4103/0972-0707.108188

EASHW. (2005). *Noise in figures*. . Retrieved from

Eaton, S. (2000). *Construction Noise, Project Number 7.11-99284*. Retrieved from Vancouver, British Columbia:

EPA. (1974). *Information on levels of environmental noise requisite to protect public health and welfare with an adequate margin of safety EPA/550-9-74-004*.

EPD, H. K. (1989). *A practical guide for the reduction of noise from construction works*.

Flamme, G. A., Wong, A., Liebe, K., & Lynd, J. (2009). Estimates of auditory risk from outdoor impulse noise. II: Civilian firearms. *Noise Health*, 11(45), 231-242. doi:10.4103/1463-1741.56217

Folprechtova, A., & Miksovska, O. (1978). The acoustic conditions in a symphony orchestra. *Pracov Lek*, 28, 1-2.

Gerges, S., Sehrndt, G., & Parthey, W. *Noise sources. In Occupational exposure to noise - evaluation, prevention & control. WHO Special Report S64*

Green, D. R., & Anthony, T. R. (2015). Occupational Noise Exposure of Employees at Locally-Owned Restaurants in a College Town. *J Occup Environ Hyg*, 12(7), 489-499. doi:10.1080/15459624.2015.1018517

Greenspan, C. A., Moure-Eraso, R., Wegman, D. H., & Oliver, L. C. (1995). Occupational Hygiene Characterization of a Highway Construction Project: A Pilot Study. *Applied Occupational and Environmental Hygiene, 10*(1), 50-58. doi:10.1080/104732 2X.1995.10387611

Gupta, D., & Vishwakarma, S. K. (1989). Toy weapons and firecrackers: A source of hearing loss. *The Laryngoscope, 99*(3), 330-334. doi:10.1288/00005537-198903000-00018

Harling, C. C. (1987). Noise hazard for crews of light aircraft. *Aviation Medicine Quarterly*, 93-99.

Hassall, J. R., & Zaveri, K. (1979). *Acoustic noise measurements*. Bruel & Kjaer.

Hermanns, I. (1982). Noise problems when welding: Causes, effects and prevention. *Schweisen und Schneiden (English translation), 34*, E44-45.

Hodge, D. C., & McCommons, R. B. (1966). Acoustical hazards of children's "toys". *Journal of the Acoustical Society of America, 40*(4), 911.

Holt, J. J. M. D., Broste, S. K. M. S., & Hansen, D. A. M. S. (1993). Noise Exposure in the Rural Setting. *Laryngoscope, 103*(3), 258-262.

House, J. W. (1975). Effects of helicopter noise on pilots' hearing. *Transactions of the Pacific Coast Oto-Ophthalmological Society annual meeting, 56*, 175-186.

HSE. (2013). Sound solutions for the food and drink industries. Report Health & Safety Executive (UK)

Hughes, S. T., & Koonce, J. (1986). Cabin noise levels in single engine general aviation aircraft. *Proc Human Factors Soc, 30*, 1381-1385.

Hughson, G., Mulholland, R., & Cowie, H. (2002). *Behavioural studies of people's attitudes to wearing hearing protection & how these might be changed. HSE Report 028*

Kardos, C., & Morata, T. C. (2010). Occupational and recreational noise exposures at stock car racing circuits: an exploratory survey of three professional race tracks. *Noise Control Eng, 58*, 54-61.

Kenney, G. D., & Ayer, H. E. (1975). Noise exposure and hearing levels of workers in the sheet metal trade. *Am Ind Hygiene Assoc, 36*, 626-632.

Kerr, M. J., Brosseau, L., & Johnson, C. S. (2002a). Noise levels of selected construction tasks. *American Industrial Hygiene Association Journal, 63*(3), 334-339.

Kerr, M. J., Brosseau, L., & Johnson, C. S. (2002b). Noise levels of selected construction tasks. *AIHA Journal: a Journal for the Science of Occupational & Environmental Health & Safety, 63*(3), 334-339.

Kilmer, R. (1980). Assessment of locomotive crew in-cab occupational noise exposure. US Dept Transport/ Fed Railway Admin.

Kryter, K. D. (1991). Hearing loss from gun and railroad noise - relations with ISO standard 1999. *Journal of the Acoustical Society of America, 90*(6), 3180-3195.

LaBere-Wickey, T. (2011). *Occupational noise exposure in the tree service industry. University Northern Colorado poster*

Levin, J. L. M. D. M., Curry, W. F. I. I. I. M. D. M. S., Shepherd, S. M., Nalbone, J. T. P. C. I. H., & Nonnenmann, M. W. P. C. I. H. (2016). Hearing Loss and Noise Exposure Among Commercial Fishermen in the Gulf Coast. *Journal of Occupational & Environmental Medicine*, *58*(3), 306-313.

Mahn, J., & Pearse, J. R. (2011). The noise emission of sheep shearing systems. *Noise Control engineering*, *27*, 87-93.

Marvel, M. E., Pratt, D. S., Marvel, L. H., Regan, M., & May, J. J. (1991). Occupational hearing loss in New York dairy farmers. *American Journal of Industrial Medicine*, *20*(4), 517-531.

McBride, D., Cowan, E., Utumapu, M., & Wallaart, J. (2010). *Evaluation of occupational workplace noise levels in an enclosed workshop at Kiwirail*. Paper presented at the International Symposium on Sustainability in Acoustics, Auckland NZ.

McBride, D., Cowan, E., Utumapu, M., & Wallaart, J. (2010(a)). *Noise in the shearing industry*. Paper presented at the International Symposium on Sustainability in Acoustics, Auckland NZ.

McBride, D. I. M. B. B. P., Firth, H. M. M. B. C. P., & Herbison, G. P. M. (2003). Noise Exposure and Hearing Loss in Agriculture: A Survey of Farmers and Farm Workers in the Southland Region of New Zealand. *Journal of Occupational & Environmental Medicine*, *45*(12), 1281-1288.

McClymont, L. G., & Simpson, D. C. (1989). Noise levels and exposure patterns to do-it-yourself power tools. *Journal of Laryngology and Otology*, *103*(12), 1140-1141.

McCombe, A. W., Binnington, J. A., & Nash, D. (1994). Wind noise and motorcycle crash helmets. *J Low Freq Noise Vibr*, *13*, 49-57.

McKinley, R. L., & Nixon, C. W. (1998). Human Auditory Response to an Air Bag Inflation Noise: Has it Been 30 Years? . *Acoust Soc Am*, *104*.

McMillan, P. M., & Kileny, P. R. (1994). Hearing loss from a bicycle horn. *Journal of the American Academy of Audiology*, *5*(1), 7-9.

Meat & Livestock Australia: Noise control for abattoirs Report M.338E (1995)

Milz, S. A., Wilkins 3rd, J. R., Ames, A. L., & Witherspoon, M. K. (2008). Occupational noise exposures among three farm families in northwest Ohio. *Journal of agromedicine*, *13*(3), 165-174.

Mirbod, S. M., Inaba, R., Yoshida, H., Nigata, C., Komura, Y., & Iwata, H. (1992). Noise exposure level while operating electronic arcade games as a leisure time activity. *Industrial Health*, *30*(2), 65-76.

Murphy, P. (1980). *The wearing of hearing protection - You and your avoidable noise induced hearing loss.*

Neitze, l. R., ., & Seixas, N. (2004). *Final report on noise and use of hearing protection in construction. Department of Environmental and Occupational Health Sciences, University of Washington*. . Retrieved from **http://depts.washington.edu/occnoise/reports.html**

Neitzel, R., & Yost, M. (2002). Task-based assessment of occupational vibration and noise exposures in forestry workers. *AIHA Journal: a Journal for the Science of Occupational & Environmental Health & Safety*, 63(5), 617-627.

Noise, F. I. C. o. (1992). *Federal Agency Review of Selected Airport Noise Analysis Issues Report*.

NHW Canada Noise Hazard and Control. Env Health Directorate, Health Protection Branch, National Health and Welfare, Canada (1979)

NIOSH (undated) National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention Work-Related Hearing Loss website: **https://www.cdc.gov/niosh/pubs/workplace_date_desc_nopubnumbers.html**

NIOSH General Estimates of Work-Related Noises. National Inst for Occup Safety and Health, Publication OHHS(NIOSH) 2001-141, Cincinnati, OH. (2001)

NIOSH Health Hazard Evaluations: Noise & hearing loss 1986-1997. CDC Report (1998)

NPC (undated) Noise Pollution Clearinghouse website: **http://www.nonoise.org/**

NZ Dawes: Noise survey results from DoH, originally provided to I Stewart, personal communication (various dates)

NZ DoH: Summary of noise surveys Department of Health Report, Wellington NZ (1986)

NZ DoL Noise levels created by common construction tools. New Zealand: Worksafe New Zealand; Factsheet originally published 2002

NZ-Sherwen. 1996 noise survey results from Bay of Plenty.

NZ-Timber-Mill. 2016 noise survey results, courtesy of T Matthews.

O'Neil, J. (1986). Workshop noise: are machines damaging your hearing? . *Fine Woodworking*, 62-65.

Odess, J. S. M. D. (1972). Acoustic trauma of sportsman hunter due to gun firing. *Laryngoscope*, *82*(11), 1971-1989.

Olishifski, J. B., & Harford, E. R. (1975). *Industrial Noise and Hearing Conservation*, National Safety Council, Chicago, IL.

Orchik, D., & Wark, D. J. (1995). Hearing hazards of toy cellular phones and walkie talkies. *Clin Paed*, *34*, 278-280.

Orchik, D. J., Schmaier, D. R., & Shea Jr, J. J. (1987). Sensorineural hearing loss in cordless telephone injury. *Otolaryngology - Head and Neck Surgery*, 96(1), 30-33.

Ozcan, H. K., & S., N. (2006). In-cabin noise levels during commercial aircraft flights. *Canadian Acoustics*, 34.

Pelton, H. K. (1974). Noise control engineering experience with offshore oil & gas platforms & related refinery & process equipment. *Am Soc Mech Eng, New York, NY*.

Price, G. R. (1983). Relative hazard of weapons impulses. *Journal of the Acoustical Society of America*, 73(2), 556-566.

Price, G. R. P., Kalb, J. T. P., & Garinther, G. R. (1989). Toward a Measure of Auditory Handicap in the Army. *Annals of Otology, Rhinology & Laryngology, 98(5_suppl) Supplement*(1), 42-52.

Qsaibati, M. L., & Ibrahim, O. (2014). Noise levels of dental equipment used in dental college of Damascus University. *Dental Research Journal*, 11(6), 624-630.

Ramsey, K. L., & Simmons, F. B. (1993). High-powered automobile stereos. *Otolaryngology - Head and Neck Surgery*, 109(1), 108-110.

Ren, K. (1999). *An evaluation of noise exposure in construction electricians. Seattle: University of Washington*

Robertson, A., Howie, R. M., Maclaren, W. M., Dodgson, J., Garland, R., Afacan, A. S., . . . Fisher, P. (1989). Hearing abilities of a group of mineworkers in relation to their age and estimated noise exposures. *Inst Occup Med Report TM/88/18*.

Rose, A. S., Ebert Jr, C. S., Prazma, J., & Pillsbury, I. H. C. (2008). Noise exposure levels in stock car auto racing. *Ear, Nose and Throat Journal*, 87(12), 689-692.

Royster, J. D., Royster, L. H., & Killion, M. C. (1991). Sound exposures and hearing thresholds of symphony orchestra musicians. *Journal of the Acoustical Society of America*, 89(6), 2793-2803.

Royster, L. H., & Royster, J. D. *Preventing and Dealing with Claims for Noise-Induced Hearing Loss and Audibility-Related Litigation. Am Ind Hyg Conf Exp Prof Dev Course 610, Dallas, TX*.

Seixas, N. S., Neitzel, R., Stover, B., Sheppard, L., Feeney, P., Mills, D., & Kujawa, S. (2012). 10-Year prospective study of noise exposure and hearing damage among construction workers. *Occupational & Environmental Medicine*, 69(9), 643-650.

Seshagiri, B. (1998). Occupational noise exposure of operators of heavy trucks. *American Industrial Hygiene Association Journal*, 59(3), 205-213.

Simpson, E. W., & Deshayes, I. L. (1969). Tractors produce ear damaging noise. *J Envir Hlth, 31*, 347-350.

Sinclair, J. D. N., & Haflidson, W. O. (1995). Construction noise in Ontario. *Applied Occupational and Environmental Hygiene*, 10(5), 457-460.

Smagowska, B. (2010). Noise at workplaces in the call center. *Arch Acoust, 35*, 253-264.

Smedje, G., Lunden, M., Gartner, L., Lundgren, H., & Lindgren, T. (2011). Hearing status among aircraft maintenance personnel in a commercial airline company. *Noise Health*, 13(54), 364-370.

Smith, L. K. (1971). Explosive-actuated tools--an impulse noise hazard? *American Industrial Hygiene Association Journal*, 32(5), 346-350.

Staab, W., Lindberg, R., & Rintelmann, W. (nd). *Auditory levels of sport firearms*. Retrieved from *http://hearinghealthmatters.org/journalresearchposters/*

Szczepanski, C., & Weclawik, Z. (1991). Exposure of the crew of a fishing trawler-factory ship to noise. *Bulletin of the Institute of Maritime and Tropical Medicine in Gdynia*, 42(1-4), 67-70.

Taylor, W., Lempert, B., Pelmear, P., Hemstock, I., & Kershaw, J. (1984). Noise levels and hearing thresholds in the drop forging industry. *Journal of the Acoustical Society of America*, 76(3), 807-819.

Thelin, J., Joseph, D., David, W., Baker, D., & Hosokawa, M. (1983). High-frequency hearing loss in male farmers in Missouri. *Pub health Rep*, 98, 268-273.

Thiery, L., & Meyer-Bisch, C. (1988). Hearing loss due to partly impulsive industrial noise exposure at levels between 87 and 90 dB(A). *Journal of the Acoustical Society of America*, 84(2), 651-659.

Utley, W. A., & Miller, L. A. (1985). Occupational noise exposure on construction sites. *Applied Acoustics*, 18(4), 293-303.

US Army (1991). HearNoise Data Listing 11: *US Army Environmental Hygiene Agency Technical Guide 167A*

UW. (2004). Hazard analysis - noise. Report by University of Washington. Cited by the Center for Construction Research & Training: *http://www.cpwrconstructionsolutions.org/heavy_equipment/hazard/1076/operate-transport-equipment-noise.html*.

Westmore, G. A., & Eversden, I. D. (1981). Noise-induced hearing loss and orchestral musicians. *Archives of Otolaryngology*, 107(12), 761-764.

Williams, W., Brumby, S., Calvano, A., Hatherell, T., Mason, H., Mercer-Grant, C., & Hogan, A. (2015). Farmers' work-day noise exposure. *The Australian journal of rural health*, 23(2), 67-73.

WIlliams, W., & Presbury, J. (2003). Observations of noise exposure through the use of headphones by radio announcers. *Noise Health*, 5, 69-73.

Zannin, P. H. T. (2008). Occupational noise in urban buses. *International Journal of Industrial Ergonomics*, 38(2), 232-237.

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