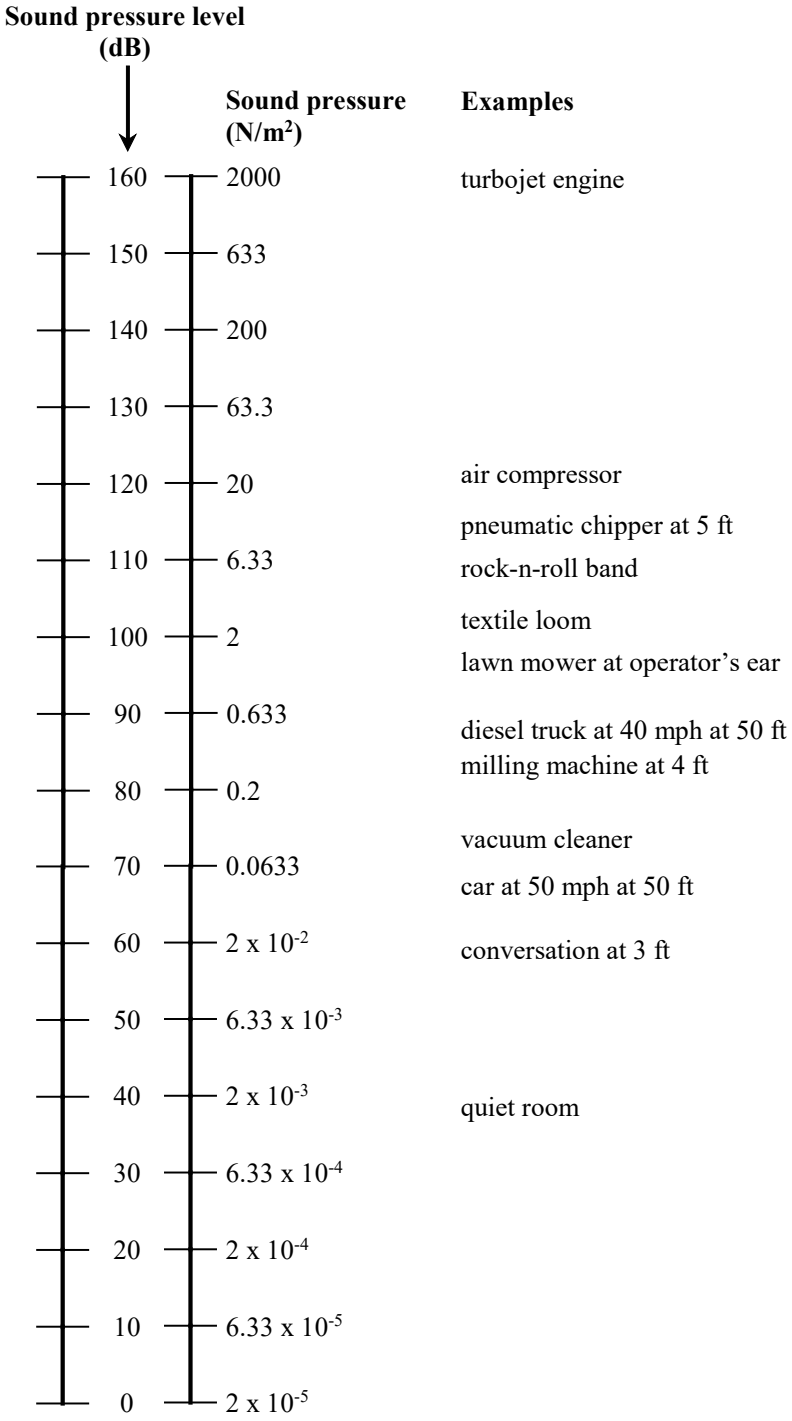

Figure 3.29 (corrected) Relationship between sound pressure, sound pressure level, and sound power, and some common sources of noise (adapted from US NIOSH, 1973).

Table 3.5 ACGIH and OSHA noise limit standards for the workplace (from Internet websites and US Office of the Federal Register, 1988).

sound intensity (dBA)	ACGIH exposure time (hr)	OSHA exposure time (hr)
80	24	32
82	16	24.3
85	8	16
88	4	10.6
90	-	8
91	2	7
92	-	6
94	1	4.6
95	-	4
97	0.5	3
100	0.25	2
102	-	1.5
105	-	1
110	-	0.5
115	-	0.25 or less

Table 3.6 **Metabolic rate $\dot{M}$ as a function of physical activity for a 70 kg adult man** (abstracted from ASHRAE, 1997). [Basal row added by J. Cimbala.]

activity	$\dot{M}$ = metabolic rate (W)	$\dot{M}$ = metabolic rate (kcal/hr)
sleeping	72	62
basal (lying down, not asleep)	**84**	**72.2**
seated, quiet	108	93
standing, relaxed	126	108
walking about the office	180	155
seated, heavy limb movement	234	201
flying a combat aircraft	252	217
walking on level surface at 1.2 m/s	270	232
housecleaning	284	244
driving a heavy vehicle	333	286
calisthenics/exercise	369	317
heavy machine work	423	364
handling 50-kg bags	423	364
playing tennis	432	372
playing basketball	657	565
heavy exercise	900	774

Table 3.8 Heat stress index (adapted from ASHRAE, 1997). (from H&C textbook)

HSI (%)	consequence of 8-hr exposure
< 0	Indicates varying degrees of stress due to hypothermia.
0	No thermal strain.
10-30	Mild to moderate heat stress. Manual dexterity and mental alertness may suffer but there is little impairment to perform heavy work.
40-60	Severe heat stress. Health may be threatened unless physically fit. This condition should be avoided by people with cardiovascular or respiratory impairment or chronic dermatitis.
70-90	Very severe heat stress. Only specially selected people are capable of sustaining these conditions for 8 hrs. Special care must be taken to replace water and salt.
100	Maximum heat stress. Only acclimated, physically fit young people can withstand this for 8-hrs.
>100	Indicates varying degrees of stress due to hyperthermia.

Table 3.9 Comparison of the three odor thresholds for some common petrochemicals (abstracted from Hellman and Small, 1974).

chemical	odor quality	detection (PPM)	50% recognition (PPM)	100% recognition (PPM)
acetone	sweet, fruity	20.0	32.5	140
acrylic acid	rancid, sweet	0.094	1.04	1.04
amyl alcohol	sweet	0.12	1.0	1.0
n-butanol	rancid, sweet	0.30	1.0	2.0
2-butanol	sweet	0.12	0.41	0.56
butyl acetate	sweet, ester	0.006	0.037	0.037
n-butyl chloride	pungent	8.82	13.3	16.7
n-butyl ether	fruity, sweet	0.07	0.24	0.47
carbitol acetate	sweet	0.026	0.157	0.263
cyclohexanone	sweet, sharp	0.12	0.12	0.24
diacetone alcohol	sweet	0.28	1.1	1.7
diethylamine	musty, fishy, amine	0.02	0.06	0.06
ethyl acetate	sweet, ester	6.3	13.2	13.2
ethyl acrylate	sour, pungent	0.0002	0.00030	0.00036
ethylene	olefinic	260	400	700
ethylene oxide	sweet, olefinic	260	500	500
1-hexanol	sweet, alcohol	0.01	0.09	0.09
isobutanol	sweet, musty	0.68	1.80	2.05
isobutyl acetate	sweet, ester	0.35	0.50	0.50
methanol	sour, sharp	4.26	53.3	53.3
methyl amyl acetate	sweet, ester	< 0.07	0.23	0.40
methyl amyl alcohol	sweet, alcohol	0.33	0.52	0.52
2-methyl butanol	sour, sharp	0.04	0.23	0.23
methyl ethyl ketone	sweet, sharp	2.0	5.5	6.0
n-propanol	sweet, alcohol	< 0.03	0.08	0.13
propylene	aromatic	22.5	67.6	67.6
styrene	sharp, sweet	0.05	0.15	0.15
toluene	sour, burnt	0.17	1.74	1.74
vinyl acetate	sour, sharp	0.12	0.40	0.55
xylene (o-xylene)	sweet	0.08	0.27	0.27

Table 3.10 Comparison of odor recognition threshold and OSHA PEL for various chemicals (maximum value of odor threshold to two significant digits, abstracted from Appendix A.20). (from Heinsohn-Cimbala textbook)

material	odor recognition threshold (PPM)	PEL (PPM)
n-butyl acetate	20.	150
n-butyl mercaptan	9.0×10^{-4}	10
carbon monoxide	no odor	50
ethylene oxide	780	1
hydrogen cyanide	4.5	10
methyl alcohol	20,000	200
methyl bromide	1,000	5
methyl formate	2,800	100
methyl methacrylate	0.34	100
methylene chloride	620	25
nickel carbonyl	30.	0.001
triethylamine	0.27	25
xylidene	0.0049	5