Ultimate Sound Pressure Level Decibel Table , COPYWRITE WILLIAM HAMBY 2004 Decibel's (db) are units of ratio's and in this table are expressed in atmospheric decibels and in this table are REPRESENTATIVE OF THE OBJECT (N), and not neccesarily what the listener or sound level meter experiences (P). (N) = NORMALIZED TOTAL AIR POWER ENERGY LEVEL SOUND PLUS ANY WIND, WATTS OR JOULES PER SECOND. THESE LEVELS HAVE BEEN CONVERTED (P) = ACTUAL PEAK PRESSURE METER READINGS i.e. A FORCE PER UNIT AREA (NP) = NORMALIZED PRESSURE USED IN EXPLOSIVE MEASUREMENTS, BLAST WIND IS NOT INCLUDED (Q) = BLAST WIND DYNAMIC PRESSURE CREATED BY THE PEAK SHOCK FRONT OVERPRESSURE (P) REF. = REFERENCE NUMBER OF DATA SOURCE AND YEAR IN APPENDIX BELOW DECIBEL LEVEL (N = NORMALIZED) (P = ACTUAL PRESSURE) (NP = BOMB PRESSURE) CAUSE OR EFFECT -30 (N) ONE HUMAN TALKING 20 MILES AWAY (60 DB / METER AT A DISTANCE OF 20 MILES)-REF.1.2003 -4 TO +4 (N) THE TICKING OF AN ORDINARY WRISTWATCH AT 1 METER -REF.1 2003 0 (N) BEGINNING OF HEARING, A MOSQUITO 10 FEET AWAY, THE EAR DRUM MOVES LESS -REF.1.1990 THAN 1 / 100 THE LENGTH OF AN AIR MOLECULE (N) 3.5 (P) 1E-10 METERS OF MERCURY = 0.000000001 METERS OF MERCURY 10 (P) ABSOLUTE SILENCE, ATT-BELL LABORATORY " QUIET ROOM " 13 (P) ORDINARY LIGHT BULB HUM 15 (N) A PIN DROP FROM A HIEGHT OF 1 CENTIMETER AT A DISTANCE OF 1 METER -REF.1.2003 30 (P) TOTALLY QUIET NIGHTIME IN DESERT-IMPOSSIBLE ANYWHERE NEAR CITY 35 (P) ANECHOIC HEARING TEST ROOM -REF.1. 1998 40 A WHISPER, A NORMAL CONVERSATION IS 60 DB, NORMAL SOUND 70 DB -REF.1.1983 73.98(P) = 1 uBAR = 1 microbar pressure 85 BEGINNING OF HEARING DAMAGE, EARPLUGS SHOULD BE WORN 93.98(P) = 1 PASCAL PRESSURE 100 NORMAL AVERAGE CAR OR HOUSE STEREO AT MAXIMUM VOLUME -REF.1.1982 107-104 (P) THE BEGINNING OF PAIN AT THE MOST SENSITIVE FREQUENCY OF 2750 HERTZ -REF.1.1982 109 ONE SOUND WATT RADIATING AS A PERFECT SPHERE, 4 PI SQUARE METERS -REF.1. 1986 110 A CAR STEREO WITH TWO 6 X 9" SPEAKERS AND 100 WATTS -REF.1.1982 113.81(P) = 1 MILLIMETER WATER 114-107 A VERY LARGE, POWERFUL PORTABLE RADIO REF.1.1982 116 HUMAN BODY BEGINS TO PERCIEVE VIBRATION IN THE LOW FREQUENCIES -REF.1.1986 117-123 HOME STEREO SYSTEM, A VERY LOUD AND POWERFUL 200-2000 WATTS -REF.1.1983 120.24(P) ONE PURE SOUND WATT FLOWING THROUGH 1 SQUARE METER, YOUR ELECTRIC AMPLIFIER MAY BE 3000 WATTS.ALSO A TESTIMONY TO HEARING SENSITIVITY -REF.1.1986 120-130 FRONT ROW AT A ROCK CONCERT- UP TO 200 REFRIGERATOR SIZE SPEAKERS AND 50000-300000 WATTS OF CLEAN, FULL FREQUENCY SOUND -REF.1.1981 125 DRUM SET-ONLY AT THE MOMENT OF STRIKING, CONTINOUS LEVEL 115 126-130 TYPICAL PROFESSIONAL D.J. SYSTEM -REF.1.1984 127 HUMAN TINNITUS (RINGING IN THE EARS) BEGINS -REF.1.1984 127.48 = 1 pound per square foot 128 (P)HUMAN, LOUDEST SCREAM MEASURED AT A DISTANCE OF 8 FEET 2 INCHES

http://www.makeitlouder.com/Decibel%20Level%20Chart.txt

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128 HUMAN HEAD HAIR BEGINS TO DETECT VIBRATION -REF.1.1983 128 HUMAN CAN BEGIN TO DETECT VERY SLOW "BLAST WIND" OF 0.124 METERS/SECOND -REF.1.1983 130 (N)MARCHING BAND-OVERALL LEVEL AT A DISTANCE, 100-200 MEMBERS -REF.1.1996 132 EARDRUM "FLEX" TOTALLY NOTICEABLE -REF.1.1982 132.4(P) = 1 SOUND WATT MAXIMUM IN A SMALL SEALED BOX BELOW HYDRODYNAMIC CRITICAL LOW FREOUENCY 133 (N)GUNSHOT- EAR LEVEL, MAY VARY GREATLY TO SIZE AND TYPE OF GUN, DURATION CONVERTED TO ONE SECOND, PEAK LEVEL MAY REACH 140-160 (P) 133.98 (P) = 1 MILLIBAR PRESSURE 135-122 (P) "VERY LOUD" CAR STEREO, ONLY BASS LEVEL, HIGHS RARELY ABOVE 115(P) -REF.1.1983 135-130(N) LARGE TRAIN HORN -REF.1.1985 135 HUMAN, A SLIGHT COOLING EFFECT BEGINS TO BE NOTICED, FROM AIR EXPANSION -REF.1.1983 136.498(P) = 1 TORR PRESSURE = 1 MILLIMETER MERCURY 137 HUMAN BODY VIBRATION IS STRONG -REF.1.1983 137-140 HUMAN EAR ALL FREOUENCIES ARE PAINFUL -REF.1.1983 140 EXTREMELY DAMAGING TO HEARING NO MATTER HOW SHORT THE TIME EXPOSURE 140 BLAST WIND = U = (PARTICLE VELOCITY) IS 0.49 METERS PER SECOND OR ABOUT 1 MPH 140 HUMAN THROAT AND VOCAL CORD VIBRATION BEGINS -REF.1.1983 141 HUMAN BODY BEGINS TO FEEL NASUEA AFTER A FEW MINUTES -REF.1.1983 141.918(P) = 1 INCH OF WATER PRESSURE 142 HUMAN BODY CHESTPOUNDING IS INTENCE -REF.1.1983 142 (P) INSIDE A CAR WITH TWO PRO 18 INCH WOOFERS AND 300 WATTS EACH -REF.1.1983 143 HUMAN BODY FEELS AS IF SOMEONE JUST FOOTBALL TACKLED YOUR CHEST -REF.1.1983 144 HUMAN NOSE ITCHES -REF.1.1983 145 HUMAN VISION BEGINS TO VIBRATE MAKING IT SLIGHTLY BLURRY, 1-3 DEGREES -REF.1.1983 145-136 (P)"COMPETITION" CAR STEREO, SIXTEEN 12 OR EIGHT 15, OR FOUR 18 SPEAKERS -REF.1.1983 146.1(P) AIR PARTICLE VELOCITY(WIND) IS 1 METER PER SECOND OR ABOUT 2 MILES PER HOUR 147 (N)FORMULA 1 RACE CAR, 700 HORSEPOWER, CHESTPOUNDING AND SUCTION FORCE ON CALM OUIET MORNINGS CAN CLEARLY BE HEARD 6 MILES AWAY.-REF.1.1991 148 HUMAN VIBRATION VERY UNCOMFORTABLE AND SLIGHTLY PAINFUL -REF.1.1986 149 HUMAN LUNGS AND BREATHING BEGINS VIBRATING TO THE SOUND -REF.1.1986 150 (N)ROCK CONCERT "THE WHO" TWO 10 STORY STACKS = 144 DOUBLE REFRIDGERATOR SIZED SPEAKERS, ACTUAL LEVEL REACHED 120 DB AT A DISTANCE OF 32 METERS FOR THIS NORMALIZED READING OF 150 DB.CONTINOUS LEVEL 114-118db (P) AT 32 METERS -REF.1.1982 150 ROCK CONCERT SPEAKER AT 1600 WATTS ON THE ACTUAL VIBRATING SURFACE -REF.1.1991 150 HUMAN SENSATION OF BEING COMPRESSED AS IF UNDERWATER IS OVERWHELMING -REF.1.1983 150 HUMAN SOUND EXPERIMENTS DOWN TO 1 TO 2 HERTZ - REF.13. 152 HUMAN VIBRATION IS PAINUL AND ALSO FELT IN ALL JOINTS -REF.1.1983 153 HUMAN THROAT IS VIBRATING SO HARD IT IS ALMOST IMPOSSIBLE TO SWALLOW -REF.1.1983 154 TOY BALLOON POPPING, DEPENDS ON TYPE AND HOW LARGE AND HARD TO INFLATE -REF.1.1986 155 HUMAN BODY COMPRESSION AND EXPANSION TO VIBRATION IS TO THE "CORE" -REF.1.1983 155 HUMAN COOLING EFFECT IS HIGH, AS A GUESS 10 TO 25 DEGREES FARENHEIT? -REF.1.1983 156 (P)IN A MINI-VAN WITH TWENTY 12" WOOFERS AND 19,000 WATTS OF AMPLIFIER POWER. EACH SPEAKERS IS DISPLACING (PUMPING BACK AND FORTH) 0.75 INCHES IF LONG HAIR WOMEN SIT IN IT, HER HAIR WILL FLY OUT OF WINDOW WITH BASS WINDSHIELD WIPERS FLY OFF VEHICLE 1/2 TO 2 INCHES, DOOR AND FRONT WINDSHIELD FLEXION MAY BE UP TO +-2 INCHES OR 4 INCHES PEAK TO PEAK EVEN WITH EARPLUGS (-30 DB) AND HEADMUFFS (-24 DB) = -54 DB IT'S STILL LOUD -REF.1.1997 156.498(P) = 1 CENTIMETER MERCURY = 0.01 METERS MERCURY

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158 HUMAN BODY VIBRATION IS VIOLENT, NAUSEA BECOMES MORE INTENCE -REF.1.1983 158 (P)INSIDE A ROCK CONCERT SPEAKER BOX REFRIDGERATOR SIZE AT MAX. 5000 WATTS -REF.1.1983 160 (P)FLASHLIGHTS EXHIBIT ELECTROMAGNETIC PULSING-EMP (DIMMING DURING SOUND) -REF.1.1983 162 U.S. FESTIVAL ROCK CONCERT 1983. 10 SEPARATE STACKS, AMPS = 400,000 WATTS (N) -REF.1.1983,-REF.3. 163-153 (N) N.H.R.A. DRAGSTERS- 5000 TO 7000 HORSEPOWER, LIQUID NITROGLYCERIN FUEL, EARTHSHAKING AT 50 FEET, HUMANS FIND IT HARD TO SEE, AND BREATHE 140db(P) -REF.1.1987 163 (P)GLASSBREAKING LEVEL, MINIMUM, IT IS VERY HARD TO BREAK GLASS WINDOWS. MANY STORIES COME FROM BREAKING GLASS BUT IT IS HIGHLY VARIABLE: IT IS EASIER TO BREAK IF THE WINDOW ALREADY HAS A CRACK, IS VERY LARGE OR OLD AND BRITTLE AND NOT CAR SAFETY GLASS WHICH CAN FLEX MASSIVELY BEFORE BREAKING. AN OPERA SINGER AT 110 DB MAY BREAK A WINEGLASS BUT IT IS AN EXAMPLE OF FREQUENCY RESONANCE, AND NOT HIGH SOUND DB LEVEL -REF.1.1987 163 (N)OCEAN WHALE REFERENCE 2 EXP-5 NEWTONS PER SQUARE METER 164 (P)INTERNAL SOUND PRESSURE OF A LARGE JET AIRPLANE TURBINE MOTOR -REF.1.1993 164.568(P) = 1 INCH MERCURY PRESSURE 165-145 (NP) THE COMMON TYPE OF FIREWORKS AT PROFESSIONAL PYROTECHNIC SHOWS -REF.1.1988 165 (N)JET AIRPLANE, BOEING 727-15,000 LBS OF THRUST, DEPENDS ON THE TAKEOFF -REF.1.1982 165(P) MOTOR DRIVEN PISTON HEADPHONES -REF.16. 166 AIR PARTICLE VELOCITY IS 10 METERS PER SECOND OR ABOUT 20 MILES PER HOUR 170.75 PRESSURE (P) = 1 P.S.I. = 1 POUND PER SQUARE INCH MOST SOUND READINGS HIGHER THAN THIS REFER TO P.S.I. INSTEAD OF DB. BUILDINGS AND HOUSES HAVE APPROXIMATELY A 50 % CHANCE OF SURVIVAL REF.2. 171-150 (P)WORLDS LOUDEST CAR STEREOS, UP TO 80 SPEAKERS, 32 CAR BATTERYS, 100,000 WATTS, 125-138 (N) 171(P) acoustic air pressure generator -ref.12 172 (N) 727, 737, 747, 757, 767 CRUSING AT 6 MILES HIGH MACH 0.84, AT THE GROUND (SEA LEVEL) LOSES AN ADDITIONAL 6 DB BECAUSE AIR DENCITY IS ONLY HALF SEA LEVEL AT A HIEGHT OF 6 MILES 172 FOG IS CREATED, DEPENDING ON THE TEMPERATURE, DEW POINT AND HUMIDITY 173-164 (P)BASS INJECTION TESTS, EXPIERIMENTAL ELECTROMAGNETIC TYPE SPEAKERS -REF.1.1987 173(P) = hydraulic, whole body dynamic pressure chamber, at 8 hertz -ref.11. 174 AIR BEGINS TO HEAT UP DUE TO COMPRESSION, MOST SHOCK WAVES ARE VERY HOT 174(P) LOUDSPEAKER COUPLED MANOMETER HEADPHONES DOWN TO 1 HERTZ -REF.15. 175 (N) QUARTER DYNAMITE STICK, VERY CLOSE PRESSURE MAY EXCEED 210 db (P) 175.8(P) 1 TON T.N.T. AT 250 FEET 177 (P) = 2 P.S.I., DAMAGE TO STRUCTURES ARE SIGNIFICANT, 30% SURVIVAL -REF.2. 180 (P) 1 POUND T.N.T. AT 15 FEET -REF.4. 180 (P) = 3 P.S.I., DAMAGE TO STRUCTURES IS CATASTROPHIC, WHEN A SHOCK -REF.2. WAVE HITS A STRUCTURE ITS MOMENTUM AND PRESSURE MORE THAN DOUBLES, ESPECIALLY AT HIGHER DB LEVELS, DYNAMIC WIND IS ABOUT 103 MILE / HOUR AND CAUSES A LARGE PORTION OF DAMAGE, 15 % OBJECT SURVIVAL -REF.2. 180 (P) = MOTOR DRIVE COUPLED MANOMETER STATIC PRESSURE, 165 DB(P) UP TO 50 HERTZ, -REF.14. 182 (P) 1 TON T.N.T AT 150 FEET, EXACTLY 182.2 DB -REF.4. 183 (P) = 6 P.S.I. TOTAL DESTRUCTION OF ALL STRUCTURES, PARTICLE VELOCITY (BLAST WIND) IS 180 MILES PER HOUR. 0.9 MILES FROM HIROSHIMA ATOMIC BOMB AND 3.3 MILES FROM 1MEGATON NUCLEAR BOMB, LESS 0.1 % OBJECT SURVIVAL -REF.2. 185.75 (NP) 0.375 POUNDS OF T.N.T. RIECHTER -1.5

186.1(P) 1 POUND T.N.T AT DISTANCE OF 10 FEET -REF.4. 187 (P) 1 TON T.N.T. AT 100 FEET, EXACTLY 186.8 DB -REF.4. 190.60 (NP) RIECHTER SCALE 0 (ZERO) EARTHQUAKE 190.60 (NP) 2.0000 POUNDS T.N.T. 191 (N)BOMB-VERY SMALL 1 LB. OR GRENADE, VERY CLOSE PRESSURE MAY EXCEED 210 db (P) 193.806(P) = 1 KILOGRAM PER SQUARE CENTIMETER 193.979(P) = 1 BAR PRESSURE = 14.504 POUNDS PER SQUARE INCH = 14.504 P.S.I. 194.09(P) = 1 (ONE) AIR ATMOSPHERE = 14.6962 POUNDS PER SQUARE INCH = 14.6962 P.S.I.= 1 ATM SOUND WAVES DISTORT AND ARE NOW DEFINED AS SHOCK WAVES AND THEY BEGIN TO FOLLOW SHOCK WAVE BEHAVIOR. PARTICLE VELOCITY (BLAST WIND) = 590 FEET / SECOND = 180 METERS PER SECOND = 402 MILES PER HOUR. -REF.2. 194.1(P)EXACTLY, 1 POUND T.N.T. AT 6 FEET -REF.4. 195-190 (P) HUMAN EARDRUMS RUPTURE 50 % OF TIME -REF.2. 195.2(P) 1 TON T.N.T. AT 60 FEET -REF.4. 200.59 (NP) 63.24 POUNDS OF T.N.T., RIECHTER SCALE 1 202-198 (P) HUMAN DEATH FROM SOUND (SHOCK) WAVE ALONE. DEATH FROM: SCHRAPNEL AT ANY LEVEL ABOVE 165 DB IS LIKELY AND BEING THROWN (10 FEET PER SECOND) ABOVE 180 DB -REF.2. 205.29(NP) 320 POUNDS OF T.N.T. RIECHTER 1.5 207 (N)BOMB, SMALL SIZED 250 POUNDS, 14 FOOT WIDE CRATER, NEARBY MAY EXCEED 238 db (P) -REF.2. 207.46 (P) = 68.48 P.S.I.= (Q), CRITICAL PRESSURE, THE SHOCK WAVE PRESSURE(P) AND DYNAMIC (BLAST WIND) PRESSURE(Q) ARE EQUAL, LOUDER THAN THIS DYNAMIC PRESSURE(Q) WILL ALWAYS BE MORE THAN SHOCK PRESSURE(P). BLAST WIND (PARTICLE VELOCITY = U) IS 1697 FEET PER SECOND = 518 METERS SECOND = 1157 MILES PER HOUR. 400 FEET FROM A 1000 TON T.N.T EXPLOSION -REF.2. 209 (N)BOMB, MEDIUM 500 POUNDS, 18 FOOT WIDE CRATER NEARBY MAY EXCEED 240 db (P) -REF.2.4. 210 N.A.S.A. 400,000 ACOUSTIC WATTS EXPIERIMENTAL NOISEMAKER 48 FEET ACROSS OF CONCRETE AND STEEL 210.6 (NP) EARTHQUAKE REICHTER SCALE 2.0 210.6 (NP) 1 TON OF T.N.T. and a 23.40 foot crater 212 (N) SONIC BOOM AVERAGE FROM JET -REF.5. 213 (N) SONIC BOOM GENERATES APPROXIMATELY 1.2 GIGAWATTS OR 1.6 MILLION HORSEPOWER -REF.1.2002 213 (N) BOMB 1 TON TNT, 23 FOOT WIDE CRATER OR 175.8 db (P) AT 250 FEET. 213.44 EXACT -REF.1.2.4. 214.09(P) = 10 atmospheres, DB(Q) BLAST WIND = 217.439 DB(Q) 215 SPACE SHUTTLE LAUNCH EXHAUST, APPROXIMATELY 3 MILES PER SECOND 215 (N)THUNDER, THE LARGEST POSITIVE GIANTS. ORDINARY THUNDER 165-180 DB.LIGHTNING STRIKE ON OCEAN SURFACE 234db (P) AT 2exp-5 NEWTONS PER SQUARE METER 215 (N) BATTLESHIP NEW JERSEY FIRING ALL 9 SIXTEEN INCH GUNS 216 (P) INSIDE A NORMAL CAR ENGINE CYLINDER WITH A 9 TO 1 COMPRESSION RATIO 216.0 (NP)+-0.3 DB 6.5 TONS OF T.N.T. EXACT EXTREMELY ACCURATE HIGH TECH MEASUREMENTS -REF. 8 217.439(Q) = DYNAMIC PRESSURE BLAST WIND FROM A 10 ATMOSPHERE OVERPRESSURE 218.2(NP)sonic boom F-16. at 100 feet high = 3.92 lbs.per square foot = 139.6db, +78.6db = 8536.5 meters high -REF.1.10. 2002 220 ?(N)BOMB, LARGEST USED IN WWII, WIEGHING 11 TONS AND 25 FEET LONG -REF.1.3. 2001 220 (N)SATURN 5 ROCKETSHIP, MELTS CONCRETE AND BURNS GRASS ONE MILE AWAY REACHED A VELOCITY OF 5 MILES PER SECOND AND MOON ON JULY 20, 1969 220 ?(N)SPACE SHUTTLE LANDING SONIC BOOM WITH VELOCITY OF MACH 20 -REF.1. 1998 225 (P) INSIDE A NORMAL DIESEL MOTOR SEMI-TRUCK CYLINDER 25 TO 1 COMPRESSION 226.59 (NP) TRAIN EXPLOSION 2004 FEB 19 09:37AM NEYSHABUR, IRAN, runaway train,

possible terrorism, shattered windows at 15 km., crater is 500 feet diameter and 50 feet deep, magnitude 3.6 riechter, at several miles "the entire area shook", heard at to 251.195 tons of t.n.t., 51 car train = 17 cars sulpher, 6 cars 75 km, equal gasoline, 7 cars ammonium nitrate fertilizer (a.n.f.o.), 10 cars cotton wool, 3 left involved, 8 miscellaneous loads at station not 228.1 (P)EXACTLY. 1 POUND OF T.N.T. AT A DISTANCE OF 1 FOOT -REF.4. 229 (N) SEAFLOOR VOLCANIC ERUPTION, REFERENCE 2 EXP-5 NEWTONS PER SQUARE METER 230.59 (NP) EARTHQUAKE RIECHTER 4.0 230.59 (NP) 1000 TONS OF T.N.T. 232 (N)LARGE NON-NUCLEAR EXPLOSION, 500 TONS, 1917 DESTRUCTION OF GERMAN WWI TUNNELS IN MESSINES RIDGE BELGIUM, HEARD OR FELT IN LONDON (N) -REF.1.,-REF.3. 234.09(P) = 100 ATMOSPHERES, BLAST WIND = 241.46 DB(Q) 235 (P) 1 TON T.N.T. AT 10 FEET, EXACTLY 235.3 DB -REF.4. (N)TORNADO AVERAGE, 5100 TONS OF T.N.T. -REF.1. 2004 ? 235.19 (NP) EARTHQUAKE RIECHTER 5.0 235.19 (NP) 31624 TONS OF T.N.T. 240 (N)ONE KILOTON OF T.N.T EXPLOSIVE, 233 FOOT WIDE CRATER 29 FEET DEEP,10 P.S.I. AT 1000 FEET (P), 230 DB AT 10000 FT(N) -REF.2. 240?(N)TORNADO, FUJITSU 5, ENERGY GUESS BASED ON 300 MILE PER HOUR WIND, 1 MILE WIDE -REF.1.1997 241.46 (Q) = blast wind pressure from a 100 atm overpressure 243 (N)LARGEST NON-NUCLEAR EXPLOSION EVER, 1947 DESTRUCTION OF NAZI U-BOAT PENS USED 7100 TONS OF EXPLOSIVE -REF.1. -REF.3. 247 (P) BOMB INSIDE SHOCK WAVE MAXIMUM LIMIT PRESSURE OF T.N.T. EXPLOSIVE -REF.2.4 248 (N)ATOMIC BOMB-HIROSHIMA AND NAGASAKI JAPAN AUG. 6, 9, 1945.TRAGICALLY KILLED 300,000 PEAPLE. TOTALLY DISINTEGRATED 16 SQUARE MILES, CRACKED DISTANT CONCRETE WALLS 12" THICK, EQUAL TO 20,000 TONS OF T.N.T., WIND WAS AROUND 300 MILES PER HOUR, DESTROYED WALLS 28" THICK AT 1 MILE.POWER TO MAKE A CRATER 633 FEET WIDE AND 80 FEET DEEP -REF.1.2. 254.09 (P) = 1000 atmospheres overpressure, dynamic pressure = 261.721 db(Q) 255 (N) 600 KILOTONS GROUND BURST CRATER IS 2112 FEET WIDE AND 211 FEET DEEP -REF.2. 257 (N)NUCLEAR BOMB, 1 MEGATON (1 MILLION TONS OF T.N.T.) -REF.2. ? (N)NUCLEAR BOMB "OAK" 8.9 MEGATON, ENEWETAK, JUNE 29 1958, 5740 FEET WIDE 204 DEEP CRATER 261.721 (Q) = dynamic blast wind pressure generated from a 1000 atmosphere overpressure 274.09 (P) = 10000 atmospheres overpressure, dynamic pressure = 282.042 db(Q) 278 (N)NUCLEAR BOMB, "BRAVO" TEST 15 MEGATONS, 1954, BIKINI ATOLL, MARSHALL ISLANDS REF.2. (N)METEOR HITTING EARTH, "ARIZONA CRATER" SPEED WAS 44 MILES PER SECOND ? AND ABOUT THE SIZE OF A HOUSE AND MADE A CRATER ONE MILE IN DIAMETER 20 MT Τ.Ν.Τ. (N)NUCLEAR BOMB, 20 MEGATONS, SURFACE BURST CRATER IS 7392 FEET WIDE AND 792 FEET ? DEEP 282 (N)NUCLEAR BOMB, 57 MEGATONS HYDROGEN LARGEST EVER DETONATED, 1961 SHOCK WAVES CIRCLED THE EARTH 3 TIMES, FIRST ORBIT TOOK 36 HR 27 MIN. -REF.2. 282.042 db(Q) = dynamic wind pressure from a 10000 atm overpressure source 286 (N)MT. SAINT HELENS VOLCANO ERUPTION-BABY VOLCANO, BLEW DOWN TREES 16 MILES AWAY. COULD BE SEEN FROM OUTER SPACE ON THE SPACE SHUTTLE BLEW OUT SOME WINDOWS IN SEATTLE-TACOMA 200 MILES AWAY, 163 db (P) -REF.20. 294.09 (P) = 100000 atmosphere overpressure, dynamic pressure = 302.0488 db(Q) 296 (N)EARTHQUAKE 8.6 RIECHTER SCALE- GROUND MOVED UP AND DOWN 13 FEET. -REF.1.3. 1988 300 (N)HURRICANE - AVERAGE, EXTREME ENERGY IS "DILUTED" BY COVERING 500,000 SQUARE MILES. ENERGY = APPROX. 1000 NUCLEAR BOMBS A SECOND.

302?(N) TUNGUSTA SIBERIA METEOR, BLEW DOWN HOUSES 600 MILES AWAY -REF.1.3. 1989 302.0488 db(Q) = dynamic pressure from a 100000 atmospheres overpressure 310 (N)KRAKATOA VOLCANO ERUPTION-1883 A.D., CRACKED ONE FOOT THICK CONCRETE

> AT 300 MILES, CREATED A 3000 FOOT TIDAL WAVE, HEARD 3100 MILES AWAY, SOUND PRESSURE CAUSED BAROMETERS TO FLUCTUATE WILDLY AT 100 MILES INDICATING LEVELS OF AT LEAST 170-190 DB (P) AT THIS DISTANCE OF 100 MILES EVEN WHEN SHOUTING IN SOMEONES EAR, COULD NOT BE HEARD AT 100 MILES CAUSED FOG TO APPEAR AND DISAPPEAR INSTANTLY AT HUNDREDS OF MILES ROCKS WERE THROWN TO A HIEGHT OF 34 MILES. DUST AND DEBRIS FELL CONTINOUSLY FOR

10 DAYS AFTER BLAST. PRODUCED VERY COLORFUL SUNSETS FOR ONE YEAR, EJECTED 4 CUBIC MILES OF

The Earth. Created anti-node of negative pressure at the exact opposite side of the Earth.sound covered 1 / 10 of the worlds surface, shock (sound) waves "echoed" around the Earth 36 times and lasted for about a month! -ref.19.

316 (N)VOLCANO ERUPTION SORANTINI, ITALY,1470 B.C. ALTHOUGH MORE ENERGY THAN KRAKATOA, IT BLEW UP OVER A LONGER PERIOD OF DAYS AND NOT AS VIOLENTLY, HENCE THE INSTANT PEAK PRESSURE IS BELIEVED TO BE LOWER -REF.1.3.

THAN KRAKATOA. 15 CUBIC MILES EJECTED, CREATED TIDAL WAVE 165 FEET

HIGH AT A DISTANCE OF 80 MILES -REF.3.

320 (N)VOLCANO ERUPTION, TAMBORA INDONESIA,1815, EJECTED 36 CUBIC MILES.APPROXIMATELY EQUAL TO

14,000 MEGATON NUCLEAR BOMBS OR A 14 GIGATON BOMB BASED ON EJECTED VOLUME, CHANGE IN MEGATONS TIMES 1.345 EQUALS VOLUME EJECTED CHANGE.IF WAS A NUCLEAR BOMB IT WOULD CREATE A CRATER ABOUT 12.4 MILES WIDE AND 1.33 MILES DEEP.INTERNAL PRESSURE IS BELIEVED TO BE ABOUT 47 MILLION P.S.I. = 347 DB (P) -REF.1.3.

APPENDIX:

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As a ATMOSPHERE:
        Speed of sound = 343 meters per second
        Air density = 1.18 kilograms per cubic meter
        Air temperature = 20 degrees celcius
        Barometric pressure = 1013. 25 millibars
        Humidity = 10 to 90 %
As a PRESSURE force:
        P = PRESSURE OR SHOCK OVERPRESSURE
        0 db = 2 * 10 E-5 n / m * E +2 = 0.00002 newtons per square meter = 6.76 * 10
E-6 ounces /square foot
        6 db = 2 times the pressure
        DB CHANGE = 20 * LOGBASE10 (PRESSURE CHANGE)
As a POWER flow:
        0 db = 10 * E-12 W / m * E +2 = 0.000,000,000,001 Watts per square meter
        DB CHANGE = 10 * LOGBASE10 (POWER CHANGE)
        3.01 \text{ db} = 2 \text{ times the power}
        10 db = 10 times more power
        20 db = 100 times the power
        30 db = 1000 times the power
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As a DISTANCE:
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0 db = 0 db / m = a reference distance of one meter
        6 db = half the distance closer
        DB CHANGE = 20 * LOGBASE10 (DISTANCE CHANGE)
        ( it may have actually been measured or scientifically converted to an
imaginary particle point source( like the size of a pinhead ), i.e. any object which
                  be absolutely measured with a sound level meter to a correct level
could not
( an accurate reading is taken when a given decibel level is lowered by 6 db when
your distance from the object doubles, or conversely when the db reading increases by 6
 db when distance is decreased by half)
As an AREA:
        0 db = 0 db / m * E +2 = a reference area of one square meter
        3 db = double the area is twice the power
        DB CHANGE = 10 * LOGBASE10 (AREA CHANGE)
        Many objects such as hurricanes and volcano's are very large their area
conversion yields extremely high db levels, luckily for humans high energy usually
means high
                   area, except in the case explosives.
As a VELOCITY = U:
        U = 0 db = 4.9414 * 10 E-8 m * s * E-1 = 4.9414 * 10 E-8 meters per second =
0.000000494 meter / second
        6 db = 2 times the velocity
        blast wind VELOCITY = U = (5*OVERPRESSURE/7*ATM) * (C/SQUARE ROOT
(1+6*OVERPRESSURE/7ATM))
        blast wind PRESSURE = Q = 2.5 * OVERPRESSURE SQUARED/(7*ATM + OVERPRESSURE)
        DB CHANGE = 20 * LOGBASE10 (VELOCITY CHANGE)
        but it becomes non-linear and inaccurate progressively above about 170
db.Although the speed of sound is 343 meters per second, a sound wave generates a
certain actual
                      particle velocity. This is the molecular velocity of air
particles. Usually these
                                 velocities are extremely slow, after all molecules
are very, very small. However for extremely loud sounds these velocities can become
very high 10 TO 2000 meters per second, and are called "blast winds" which generate
"dynamic pressure"(Q). These blast winds also consume a large percentage of the TOTAL
acoustic output. The louder the sound, as in bomb explosions these blast winds produce
a significant portion of the damage. Also, when a dynamic WIND wave(Q) hits a
structure its momentum reflects and increases from at least twice the pressure to 4.4
times at 70 p.s.i. or even more the louder the shock wave. Interestingly, typical
shock waves are very, very thin, about 2 molecules thick which is equal to 0.000000002
inches, even when pressure is very high:180-200 db.
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As an EXPLOSIVE BOMB:

all formulas are log base 10

There is: db(N) = distance normalized air TOTAL ENERGY sound pressure plus wind to a theoretical distance of 1 meter, db(P) = PEAK shock front OVERPRESSURE at a certain location, db(NP) = distance normalized PEAK shock front OVERPRESSURE to a theoretical distance of 1 meter pressure, db(Q) = peak DYNAMIC pressure i.e. blast WIND after shock wave pressure front passes by at a certain location, db(PR) = reflected shock overpressure is the momentum force a wall feels when hit by a shock

http://www.makeitlouder.com/Decibel%20Level%20Chart.txt

overpressure

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1 TON T.N.T.(trinitrotoulene explosive) = 210.6 db (NP), 23.40 foot crater
        6.5 tons T.N.T.= 216.0 db(NP)+-0.3DB (NP = normalized PEAK SHOCK OVERPRESSURE
not including blast wind Q pressure which usually is much higher), and a 43.68 foot
crater.
        1 MEGATON T.N.T= 250.6db (NP)
        W = WIEGHT OF T.N.T. = YIELD
        CHANGE IN DB(P) = 6.67 * LOG (change in wieght of explosive) peak SHOCK
OVERPRESSURE only, does not include blast wind DYNAMIC pressure = db(Q), i.e. db(P)
less than 207.46
        CHANGE IN DB(P) = 20 * LOG (change in CRATER width)
        CHANGE IN CRATER WIDTH = (change in explosive WIEGHT) raised to the power of
0.3333
        CHANGE IN DB(P) = -20 * LOG (change in DISTANCE to the power of 3)
        W = WIEGHT OF T.N.T. = YIELD
        (DISTANCE FROM BOMB1/DISTANCE FROM BOMB2) = (W1/W2) TO THE POWER OF 0.33333
        D1 = D2 * W TO THE 0.33333 POWER
        DB(NP) = 210.6 + 6.67 * LOG (TONS T.N.T.)
        BLAST WIND VELOCITY = U = OVERPRESSURE/((AIR DENCITY = 1.18) * C), BELOW 175 db
(P)
        BLAST WIND VELOCITY = U = (5*OVERPRESSURE/7*ATM) * (C/SQUARE ROOT
(1+6*OVERPRESSURE/7ATM))
        MACH NUMBER = M = U/C = SQUARE ROOT(1+(6*OVERPRESSURE/7*ATM))
        OVERPRESSURE = (SHOCK ATM) - (ATM) = ATM (7*(M SQUARED - 1)/6)
        BLAST WIND PRESSURE = 1/2 (AIR DENCITY) * U * U
        BLAST WIND PRESSURE = Q = 2.5 * OVERPRESSURE SQUARED/(7*ATM + OVERPRESSURE)
        Q under 194 db(P) APPROXIMATES to Q = (atm squared)/2.801
        Q between 194 db(P) to 234 db(P) must be CALCULATED from formula
        Q between 234 db(P) to 240 db(P) approximates to Q = 2.30 * overpressure
        Q between 240 db(P) to 250 db(P) approximates to Q = 2.40 * overpressure
        Q between 250 db(P) to 260 db(P) approximates to Q = 2.49 * overpressure
        Q over 260 db(P) IS BASICALLY Q maximum, Q = 2.5 * overpressure
        db(Q) maximum = db(P) + 7.9588 db
        db(PR) REFLECTED SHOCK OVERPRESSURE = 2 * OVERPRESSURE + 2.4 * Q =
        = 2 * OVERPRESSURE(7*ATM + 4*OVERPRESSURE/7*ATM + OVERPRESSURE) =
        overpressure units may be newton /square meter or ATM for quicker, simpler
results
        At very close range so db(P) is more than 207.46, varies +-3.0 db:
        DB(P,1 \text{ ton t.n.t.}) = 265 - 20 * LOG (meters DISTANCE to the power of 3)
        DB(P) = 265 + 6.67 * LOG (TONS OF T.N.T.) - 20 * LOG (meters DISTANCE to the
power of 3)
        1 foot crater width = 0.156 pounds of T.N.T., 10 foot crater= 156 pounds, 100
foot crater = 78 TONS, 633 foot crater = 20 KILOTONS, 1000 foot crater = 78 KILOTONS,
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2112 foot crater = 600 KILOTONS, 7392 foot crater = 20 MEGATONS

+6.0206 DB(P) CHANGE = +8.0017 TIMES MORE EXPLOSIVE WIEGHT +6.67 DB(P) CHANGE = +10.000 TIMES MORE EXPLOSIVE WIEGHT +10.000 DB(P) CHANGE = +31.5682 TIMES MORE EXPLOSIVE WIEGHT

Furthermore, if a noise source is louder than 194.09 db or faster than the speed of sound (MACH NUMBER = 1, approximately 740 miles per hour at sea level) the air no longer behaves as sound but more like shock waves or sonic booms, which for very complicated reasons are hard to estimate. Bomb explosions are tricky to measure or estimate because they get significantly more violent the closer you get (to the power of 3) so sometimes crater size is used to estimate bomb energy with the general formula: the cube root of bomb energy change equals crater size change.Nearby, the shock wave decibel drop can be high as 18.06 db every distance doubling, then fading off to 11 to 9 db loss every doubling, until its just a loud sound (elastic wave) and loses 6.0206 db every doubling, just like sound, but this is very far away, sometimes miles. The (NP = NORMALIZED OVERPRESSURE) is the bomb shock wave pressure that is normalized at the proper distance when the correct 6.0206 db loss every distance doubling starts. The (NP) level is extremely accurate but underates the true energy and destructive power because it does not include the blast wind pressure, any db level than 207.46 db (P) the blast wind pressure (Q) is higher than shock wave overpressure (P) or (NP), this is why this chart uses the (N) rating for bombs, it is a more accurate rating of the destructive energy.

Allthough it is not very clear, SHOCK fronts degenerate into sound waves, with distance.

Therefore measured pressure degenerates initially cubicly then squared, i.e from the

third power to the second power continuosly. The exponents are 3.0000 then 2.99, 2.98, 2.97,..., 2.02, 2.01, so on and finally 2.0000 for pure sound.

As an SPEAKER IN A AIR TIGHT SEALED BOX (ref.1.):

db(H) = HYDRAULIC, HYDRODYNAMIC OR STATIC PRESSURE i.e. CLOSED OR SEALED BOX WHERE THE PRESSURE IS ESSENTIALLY UNIFORM INSIDE THE BOX OR CHAMBER, I.E. INSIDE THE BOX

ADIABATIC IS WHEN THE COMPRESSION IS FAST LIKE SOUND WHICH IS USUALLY AT LEAST 1 HERTZ, i.e. IT IS SO FAST ESSENTIALLLY NO HEAT IS ALLOWED TO ESCAPE OR TRANSFER

ADIABATIC ISENTROPIC EXPONENT IS 1.4 FOR NORMAL AIR WHICH IS RESPONCIBLE FOR THE "WIERD" 28.0 LOG INSTEAD OF THE USUAL 20 LOG, I.E. 20 * 1.4 = 28.0

CHANGE IN DB(H)= -28 LOGBASE10 (CHANGE IN VOLUME BOX).i.e. +8.43DB PER HALFING

CHANGE IN DB(H)= 28 LOGBASE10 (FREQ. HIGH / FREQ. LOW) .i.e. +8.43DB PER

HALFING

CHANGE IN DB = 20 LOGBASE10 (CHANGE IN ELECTRICAL AMPERAGE) CHANGE IN DB = 10 LOGBASE10 (CHANGE IN ELECTRIC POWER INPUT) (H) PRESSURE INSIDE BOX = (101325 NEWTONS/SQUARE METER) * ((VOLUME START-VOLUME FINISH/VOLUME FINISH))TO THE POWER OF 1.4

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DB = 20 LOGBASE10 (PRESSURE / 0.00002) 120.05 DB(P) = 1 ACOUSTIC WATT PER SQUARE METER, OUTSIDE BOX 132.4 DB(H) = 1 ACOUSTIC WATT INSIDE BOX, ONLY BASS BELOW CRITICAL FREQUENCY OR VOLUME 146.1 DB = 404 WATTS/meter square = 404 NEWTONS/meter square 146.1 DB = 1 METER/SECOND AIR PARTICLE OR SPEAKER CONE VELOCITY = U = 1 METER/ SECOND U = 2 * (PI) * (F) * (AMPLITUDE) = (PRESSURE = newton per meters)/(1.18 * C) BL WOOFER = NEWTONS / AMPERES OR TESLA METERS I.E. UNIT FORCE PER UNIT ELECTRIC CURRENT BL(MAX) = SQUARE ROOT (1/ AREA FACE) * SQUARE ROOT (OHMS) * 14.21 NEWTONS / AMPERE N(EFFICIENTCY) = ((BL WOOFER/BL MAX))SQUARED. ABSOLUTE MAX. AT OR BELOW RES. F. LIKE D.C. N * WATTS ELECTRICAL = WATTS ACOUSTIC N = 1.0000 IS JUST THE AIR FORCE ONLY, THE SPEAKER ITSELF HAS ESSENTIALLY "DISAPPEARED" AMPLITUDE=SQUARE ROOT ((ELECTRIC WATTS*N/AIR DENSITY*C*AREA*4*PI*PI*F*F)) AIR DENSITY = 1.18 KILOGRAMS PER CUBIC METER C = SPEED OF SOUND = 343 METERS PER SECOND PI = 3.1415926F = FREOUENCYV = CRITICAL VOLUME FC = CRITICAL FREQUENCY As an EARTHQUAKE: M = energy moment: LOGBASE10 (ERG) = 11.8 + 1.5 * M

M = 2.45? + 0.73? * LOGBASE10 (TONS OF T.N.T. YIELD) -REF.7.

 $\label{eq:main} M = 6.61 + 0.71 * \mbox{logBase10} (\mbox{ground amplitude displacement fracture hieght in meters peak to peak}) - \mbox{ref.9.1997}$

Or as a rough approximation :

(31.623 to the power of the M = Riechter NUMBER) / 1000 = tons of t.n.t. yield energy

In siesmology there are many different ENERGY and SIESMIC MOMENTS (M) like: MS, MP, ML, MR ect., in general we should use the total energy release yield M siesmic moment in newton * meters represented in ERG, it is usually the highest number listed for a particular earthquake.There are many various formulas and log variations and fractional powers to approximate various earthquakes or frequency spectra. Most all earthquakes are lower in frequency than 1.0 to 0.01 hertz, and in general the higher the moment magnitude (M) the lower the primary spectral frequency and is usually proportional to the 31.6 times energy multiplier, i.e. M = 3 is 1.0 hertz, M = 4 is 0.316 hertz and so on. M = 8 is 0.001 TO 0.0001 hertz, these are very rough approximations and siesmologist try to define the "corner frequency spectra" which means the full amplitude is below the corner, and above the corner it is a lower amplitude, more simply the earth is like a huge inductor coil filter or a low pass filter, in other words the earth likes to play low bass frequencies 0.0001 hertz and not higher bass frequencies above 1.0 hertz.

Lightning=3.2, tornado=4.7, northridge=6.7, mt.st.helens=7.8, chile1960=9.5, hurricane=9.6, theoretical six mile diameter meteor hitting earth=12.7

Almost all sound pressure tables give decibel readings while holding a sound level meter , which for loud sounds is inaccurate because you must be far away because of safety. As an example, most tables state a jet airplane at 136 db , which is correct when you are holding the meter standing there at a distance, but the closest safe distance is approximately 32 meters or 160 feet. However if you were to scientifically convert that level using the fact that sound loses 6 db every doubling of distance , or gains 6 db every halving of distance, you would get 32 meters, 16 meters, 8 meters, 4 meters, 2 meters, and finally 1 meter, so the distance has been "halved" 5 times. 5 times 6 db = 30 db , 136 db + 30 db = 166 db at 1 meter = 166 db / m ,"normalized" (N). Furthermore, the meter is measuring sound FREQUENCY power, but not the true actual THRUST of the jet engine , which is the sound force that is not really a frequency but a "FLOW" of exhaust which is at a very high pressure level.

So on this table all the sounds have been converted to their true decibel level if you could theoretically stand 1 meter away, and not get killed. This is also more logical since everyone still recognizes a jet airplane is a very loud object even though it may be 30 miles away and 6 miles high but a nearby cat meow may appear "louder". This "normalizing" chart converts every object to a theoretical distance of 1 meter. So a jet airplane db level is always higher than a cat meow, regardless of distance to either one . . . obviously.

Another reason for normalizing conversions are that objects that are very large, like earthquakes and hurricanes are confusing. For example, while holding a sound level meter the decibel reading during an earthquake or hurricane may reach 110 db to 160 db (P), although using the power rule to conversions: twice the area = + 3 db, or half the area = -3 db. Converting to a distance of 1 meter equals a hemisphere of 6.28 square meters, yields more correct values of 250 db to 300 db (N).Volcanos or nuclear bombs are difficult because no sound meters could survive them at very close range.

Decibel levels higher than the Space Shuttle and Saturn 5 rocket ship's on this table are not absolutely exact, because most measurements occurred at distances of 1 to 3 miles or greater. Extremely loud sounds decay in db level much more rapidly than normal sounds, and much of the energy is in the form of very low sub-bass infrasonic frequencies, what human beings would call a wind or even barometric weather pressure, but hey you don't have to be a rocket scientist to know you should be at least 3 miles from a rocket ship takeoff.

Also, many loud sounds like gun fire or explosives the peak sound level has an extremely short duration usually 1 millionth to 1 hundredth of a second, so to a human being it may not seem as loud as it actually is, some advanced sound meters have a setting to alter the sound to an automatic duration of 1 second regardless of how short the actual duration was, so for a rough example 160db for 1 hundreth of a second is like 140 db for 1 second, this is also known as the "crest factor", here it is about 10, or the db peak minus the average divided by 2, 160-140=20, THEN 20/2= 10.

REFERENCE APPENDIX: 1.WILLIAM HAMBY, HYPERDYNAMICS, HYPERFORCE, HYPERSOUND GROUP OF COMPANIES 2.UNITED STATES DEPARTMENT OF DEFENCE AND OR ENERGY 3.GUINESS BOOK OF WORLD RECORDS 4.KINNEY, "EXPLOSIVE SHOCKS IN AIR" 5. UNIVERCITY OF SOUTHERN CALIFORNIA, WWW.SUPERSONIC.ORG 6. U.S. ARMY: KEITH KOPER, TERRY WALLACE, ROBERT REINKE, JOHN LEVERETTE 2002 MARCH 7. EARTHQUAKE COMMON KNOWLEDGE WORLDWIDE 8.KOOPER DEPT. OF ARMY 2002 9. MOREY, SCHUSTER UNIVERSITY OF UTAH AT SALT LAKE CITY, NOV 18, 1997 10. N.A.S.A. DREYDEN FLIGHT RESEARCH CENTER 11. AIR FORCE, WRIGHT-PATTERSON AEROSPACE LAB. OHIO, U.S.A., JOHNSON, VON GIERKE 12.JOHNSON, 1973 13.BEKESY, 1936 14.BENOX, VON GIERKE, 1953 15.BEKESY,1960 16.NIXON, 1973 19. KRAKATOA ERUPTION BOOK 20.UNITED STATES GEOLOGICAL SURVEY 1980