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KERALA STATE POLLUTION CONTROL BOARD
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STANDARD OPERATING PROCEDURE
NOISE LEVEL MONITORING OF INDUSTRIES & SUBSEQUENT ACTION TO BE TAKEN

1. Sound monitoring results are to be expressed as $L_{eq}(A)$, L_{max} and L_{min}. Leq for a given interval is that sound pressure level (sound level) which can replace the fluctuating sound pressure levels during that particular interval by a constant pressure level, which, over that particular time interval, expands the same amount of energy, as is expanded by the fluctuating levels over the same time.
2. Frequency of noise is very important as far as the human ears are considered. For example, if two sound sources A & B generates equal sound levels of 60 dB and if the frequency of A is higher than that of B, then the sound produced by source A may be more objectionable (more louder) to the human ear than that from B. Hence filtering circuits (A,B & C) are used. For measurements, A type weighting network is used which severely filters very low frequencies so that such low frequencies do not interfere with the measurement.
3. For environmental noise level monitoring only Type 1 or Class 1 Integrating Sound Level Meter with free-field microphone which meets accuracy as per IEC 804 (BS 6698) Grade-1 or ANSI Type-1 or equivalent IEC 61672-1(2002-5) Class-1 shall be used for the measurement. This is because Type 2 or Class 2 Sound Level Meters are not capable of accurately measuring sound levels in the higher frequency ranges.

4. Both ambient noise level and that from the source may be taken for equal durations at all measurement points to identify the difference and quantify the noise from the source.
5. Start the measurement when the source starts the noise and end when the source stops the noise. However, for practical purposes, for constant noise from source like operation of DG sets, a total monitoring time of 30 minutes may be sufficient. For industrial units, a minimum monitoring period of 4 hours may be done and extended if required, to cover all the noise generating activities in the process. In many cases, high noise generating activities extend for a short duration only and may repeat after some time. This factor may be taken into account while taking measurement.
6. The L_{max} (maximum value) gives a measure of the maximum sound pressure level experienced at the measurement points. The maximum and minimum sound may be reported along with L_{eq}. However there exists standards for L_{eq} only.
7. All sound level monitoring equipments first convert sound pressure into its root mean square values using r.m.s circuit. Addition or subtraction of sound levels can be done using the following equation:

   $L_p = 20\log_{10} (P_{rms}/20\mu Pa)$, where L_p is the sound pressure level in decibel under A weighting, P_{rms} is the corresponding r.m.s(root mean square) sound pressure level and 20 μPa (micro pascal) is the pressure of the faintest sound that can be heard by a normal healthy individual. Decibel values cannot be added or subtracted directly. Hence the decibel values are converted to the r.m.s values and then the squares of r.m.s values added or subtracted and square root calculated. Then the resultant r.m.s value can be converted to corresponding decibel value using the equation cited.

   a) For adding two sounds:

      If there are two sound sources generating 50 dB(A) each, then in order to add the sound the corresponding rms values have to be determined.

50 dB = 20 $\log_{10}$ (P_{rms}/20)

Therefore (P_{rms}/20) = Antilog (50/20) = 316.277 or P_{rms}=6324.55 μPa

Therefore 50 dB + 50 dB = (6324.55^2 +6324.55^2)$^{1/2}$

= 8944.26 μPa (as r.m.s)substituting in the original equation:

Net sound Level = 20 $\log_{10}$ (8944.26/20) = 53dB(A). Thus adding two 50dB sound gives 53dB.

b) For finding the sound from the industrial source alone, first the ambient sound has to be measured and then the (ambient + industrial) noise levels for duration as explained earlier has to be measured.

If the L_{eq}ambient sound is 45dB(A) and if L_{eq} (ambient + Industry) sound is53dB(A):

r.m.s of 53dB(A):

53 dB = 20 $\log_{10}$ (P_{rms}/20) P_{rms}/20= Antilog(53/20) = 446.68

Prms for 53dB(A) = 446.68 x 20 = 8933.6 μPa.

r.m.s of 45 dB(A) :

(P_{rms}/20) = Antilog (45/20) = 177.8

$P_{rms}$for 45 dB(A)= 177.8 x 20 = 3556.6 μPa

Therefore $P_{rms}$for industrial source = (8933.6^2-3556.6^2)$^{1/2}$ =8195.11 μPa. Therefore sound level of the industry = 20 $\log_{10}$ (8195.11/20) =52.25 dB(A).

8. **Alternatively, instead of using the above equations table 1 & 2 attached as Annexure can be used for computing adding/subtracting noise levels.** For example, in case mentioned above (case 7.a) for adding 50 dB + 50dB, the difference is calculated first, ie,50-50=0. From table 2, the correction for difference 0 is 3dB. This correction has to be added to the higher of the two values, which is 50 in this case. Hence, the added sound is 50 +3= 53dB(A).

   In case 7.b above, the ambient + industry noise is 53 and the ambient noise is 45dB. Hence, the difference is 53-45= 8. From Table 1, the correction for

difference 8 is 0.75.This correction has to be subtracted from the total noise, ie, 53. Hence the noise due to the industry alone is 53-0.75= 52.25dB (A).

9. As per the Noise Pollution (Regulation & Control) (Amendment Rules),2010 "the peripheral noise level of a privately owned sound system or sound producing instrument shall not, at the boundary of the private place, exceed by more than 5 dB(A) of the ambient standards for the area".
10. While analyzing the results of monitoring, the rule in para 9 have to be followed. However, in some cases, the ambient noise may be high (due to heavy traffic in the adjacent road or other reasons) and may be the main contributor in causing the noise level to exceed the permissible limit by 5dB(A). Hence in such cases, the calculation in para 7 or 8 may be used to calculate the noise level caused by the industry alone. Then take the ambient noise level equal to the permissible limit for that area (even though actually it is not) and add to the noise level of the industry as per the calculation in 7.a and see whether there is an exceedence of permissible level by 5dB(A). However the reason for the high ambient level and measures to bring down the noise level of the area has to be considered.
11. In areas where there is continuous heavy noise (like highways, airport etc), only continuous noise level monitoring with measurement of weather parameters can give sensible results. However, the installation of continuous noise level monitoring with weather sensors is costly and requires additional manpower.
12. The impact of noise can be minimized by providing acoustic enclosures, sound proofing etc. The best possible way is to adopt proper town planning practices like zoning (residential, commercial & industrial area), segregation of residential buildings from commercial/industrial areas. Once correct zoning is implemented, the Board can desist from issuing consents for noise generating units in residential areas. However, as of now, most of the small scale units located in residential areas are incapable of adopting technology to bring down noise levels to permissible limits. Hence distance criteria have

to be revised and implemented for new units (like flour mill, engineering work shop etc) and informed to the industries & other concerned Departments in advance. Proper studies have to be conducted after conducting noise monitoring at various distances in units having complaints.

13. Available literature indicates that there is an approximate reduction of 6dB when the distance is doubled. However, this has to be substantiated by conducting studies at field level.
14. In the case of complaint enquiries on noise pollution caused by industries, noise shall be measured from the outer periphery of the complainant's residence where it is likely to get maximum noise. The monitoring shall also be conducted one metre outside the boundary of the unit. However, considering practical aspects, the minimum monitoring time of one hour may be followed. Ambient noise also shall be measured for the same duration. If there are more complainants, monitoring may be done in at least two most affected residences. Notice may be issued to both the complainant & the occupier of the unit generating noise. Both the parties may be requested to sign the notice. After the monitoring, the print out of the results may be shown to both the complainant & the occupier. They may again sign the notice as proof that they have seen the results. In case they refuse to sign the notice, the matter may be recorded in the notice itself by the inspecting official.
15. The sound levels shall be measured at one metre from the boundary of the unit while checking for compliance to consent conditions/complaint enquiry.
    i. Hand held measurements shall be avoided.
    ii. Always use tripod at 1.2 to 1.5m above ground level.
    iii. Isolate the instrument from strong vibration and shock.
    iv. Calibration shall be done before and after measurement to ensure that the instrument is correctly functioning.
    v. Noise monitoring shall not be done during fog and rain.
    vi. The pause facility on noise measurement equipment shall be used to exclude extraneous noise so that the results recorded are representative.

Report shall be saved and the printout shall be recorded.

16. The same procedure as in para 14 may be followed in the case of complaints pertaining to noise from religious institutions also. In such cases, monitoring may be done one metre outside the boundary of the institution. In case loud speakers are placed outside the premises, monitoring may be done where maximum noise is likely to be experienced.
17. As per the Noise Pollution (Regulation & Control) (Amendment Rules), 2010 "the peripheral noise level at the boundary of the public place where loud speaker or public address system is used shall not exceed 10dB(A) above the ambient noise standards for the area or 75 dB(A), whichever is lower. In case of loud speakers established in roads, monitoring may be done within a horizontal distance of 2m from the source. The results may be forwarded to the District Collector & the concerned Police Department for further action.

MEMBER SECRETARY

Annexure (see para 8)

TABLE 1 NOISE SUBTRACTION

Subtraction of Noise Values in Decibels	
Total Noise Minus Background Noise (dB)	**Correction (dB)**
0 —	∞
0.25	12.5
0.50	9.6
1.0	6.8
1.5	5.4
2.0	4.45
2.5	3.6
3.0	3.0
3.5	2.6
4.0	2.3
4.5	2.0
5.0	1.65
6.0	1.35
7.0	1.0
8.0	0.75
9.0	0.55
10.0	0.45

Procedure :

1. Measure total noise and background noise separately in dB.
2. Subtract background noise dB from total noise dB.
3. Consult table to find correction dB.
4. Subtract correction dB from total noise dB.

TABLE-2 NOISE ADDITION (see para 8)

Addition of Noise Values in Decibels	
Difference Between the Two Values (dB)	**Correction (dB)**
0	3.0
1	2.5
2	2.0
3	2.0
4	1.5
5	1.0
6	1.0
7	1.0
8	0.5
9	0.5
10	0.0

Procedure:

1. Measure the two sources separately in dB.
2. Subtract the smaller from the larger value.
3. Consult table to find correction dB.
4. Add correction to the higher of the two values.