LUMBER MILL NOISE AND ITS CONTROL

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The high level of interest in woodworking plant noise control is, of course, due to Federal regulation under the Occupational Safety and Health Act. However, it has been of concern for decades, with research papers on saw and planerhead noise appearing in the 1950's and earlier. The first known planer enclosure in California was operating by 1959. This focus on saw and planerhead noise served a very useful purpose but one result has been that industry personnel tend to underrate other noise sources. Woodworking plant noise is the result of many pieces of equipment.

The underlying reasons for the high noise levels in sawmills and planermills are easily recognized. Saw tooth speeds normally approach 120 miles per hour, and they are supported by blades which have large surface areas in a state of continuous, sometimes resonant, vibration. Individual machines are frequently connected to motors of several hundred horsepower. Raw material processed is large, when considered on a tonnage basis, even in a small plant and it is regularly accelerated and decelerated. Often overlooked is the noise producing power of escaping compressed air.

Recognizing that there is a problem is only the first step toward solution. To be effective in controlling noise, efforts must be based on an understanding of it as a physical phenomenon and on a realistic set of priorities that consider not simply the existing noise level but also the number of workers exposed and the cost of achieving control. Also required is an understanding of the regulations as they apply to worker noise exposure.

Sound

In general terms, sound is measured in decibels (dB) and this refers to the sound pressure level (SPL). The SPL of the smallest audible sound is such a small fraction of the SPL of commonly occurring sounds that the only reasonable way of measuring them in similar units is to use a logarithmic scale. The practical importance of this is that the amount of energy represented by one decibel increases as the decibel level increases. This means that noise levels cannot be added or subtracted in a simple fashion. Table 1 gives an example of combining multiple sources.

A second important characteristic of sound is that it decreases in intensity with distance from the source. This decrease is 6 dB for each doubling of the distance in a free field. The existence of structures, etc., changes the rate of decrease but not the principal involved.

Another basic characteristic of sound in this discussion is its tone. The tone is dependent on the frequency distribution of the sound. Data in this paper are presented in octave bands. The upper limit of the octave band is the frequency that is twice that of the lower limit and the band is identified by the middle frequency. In measurement, sound outside the specified band is filtered out by the meter circuitry.

The fourth consideration is that the human ear does not respond uniformly to all frequencies. Consequently, regulations and measurements that are elated to worker exposure are made on a weighted scale called the A scale and SPL's identified as dBA.

Table 1

No. of identical noise sources at 90 dB	Resulting SPL
1	90 dB
2	93 dB
4	96 dB
8	99 dB
10	100 dB

Noise Exposure Regulations

The present standard is quite simple in most respects. It sets forth a table of noise exposure limits which are not to be exceeded. It specifies that where noise levels are above 90 dBA corrective measures must be taken. It states that where corrective action is required, engineering controls must be instituted if feasible. Where these are not feasible, administrative controls are the next choice. Administrative controls are usually defined as shifting workers into and out of noisy areas in a fashion that assures that permissible exposure is not exceeded. Personal protective devices such as ear plugs and muffs are considered as temporary expedients. The regulations also require a hearing conservation program for workers exposed to more than 90 dBA. Permissible exposure times are given in Table 2.

Table 2

Permissible noise exposures

Duration per day hours	Sound level dBA
8	90
6	92
4	95
3	97
2	100
1 1/2	102
1	105
3/4	107
1/2	110
1/4	115

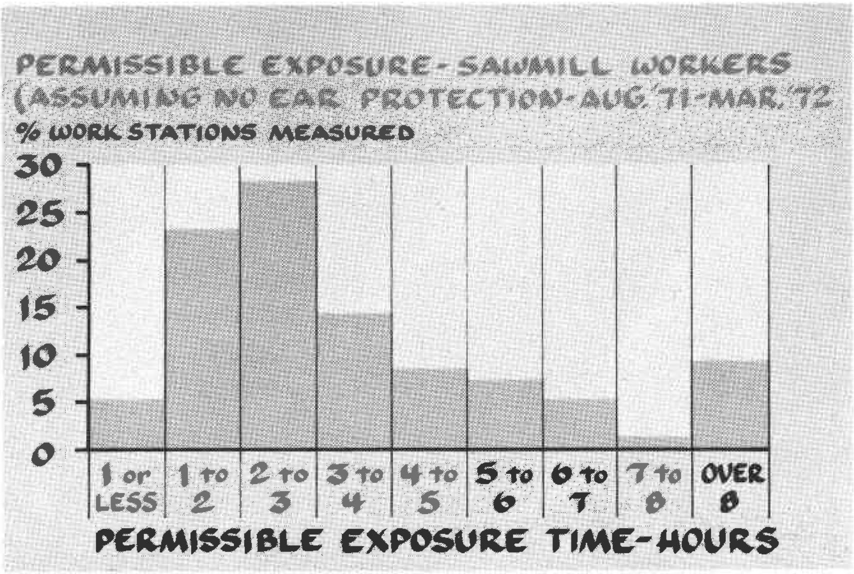


Figure 1. Sawmill noise exposure.

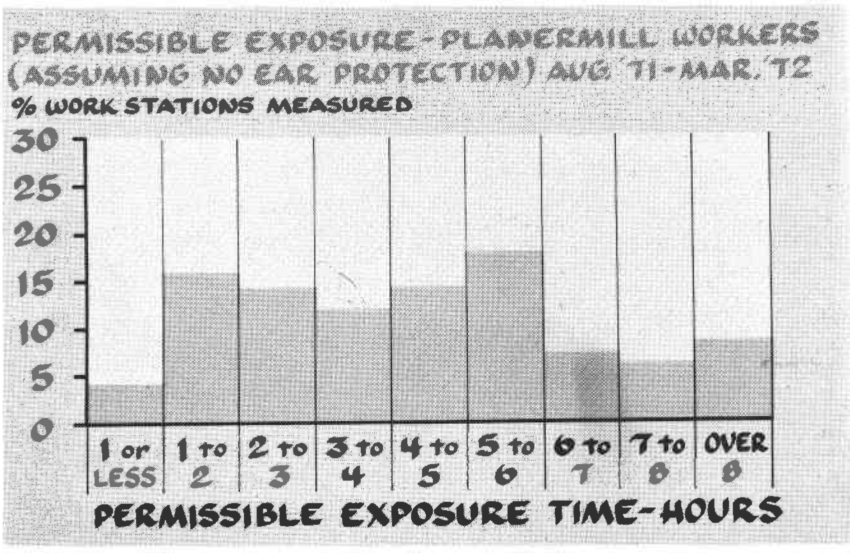


Figure 2. Planermill noise exposure.

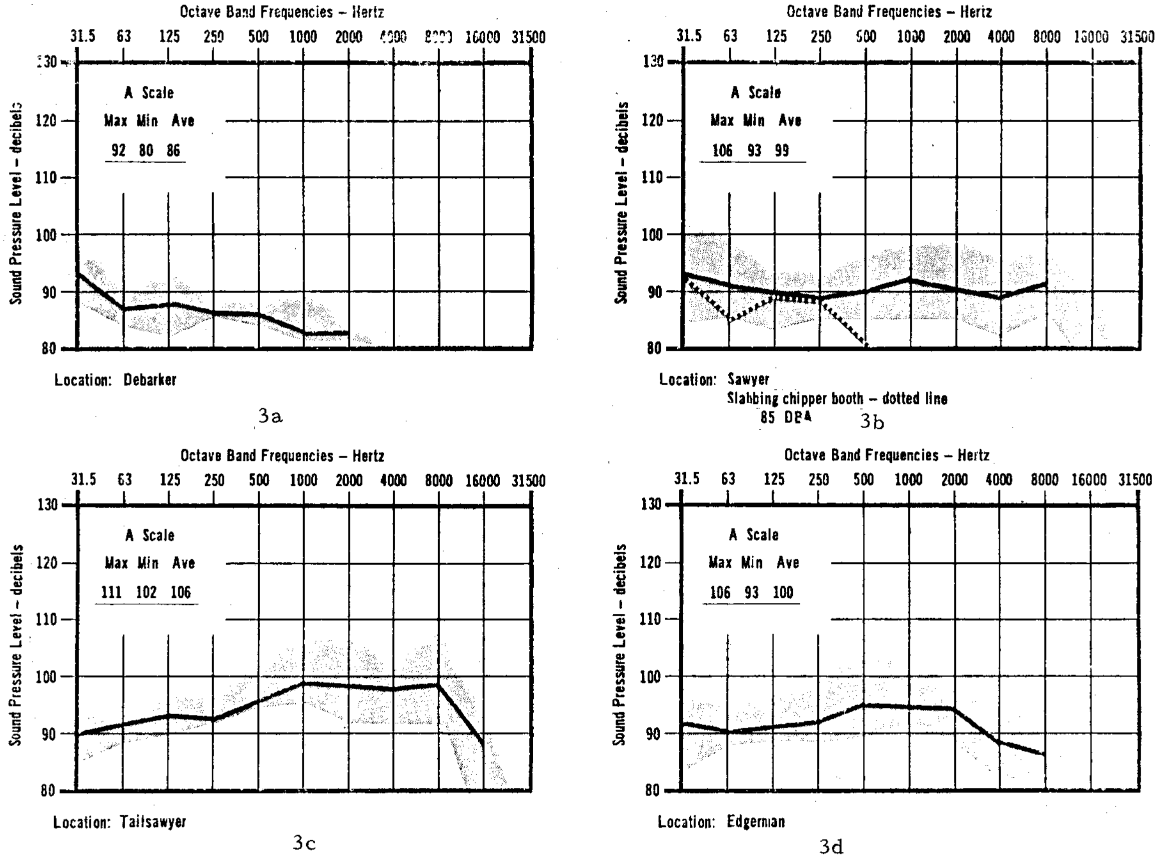
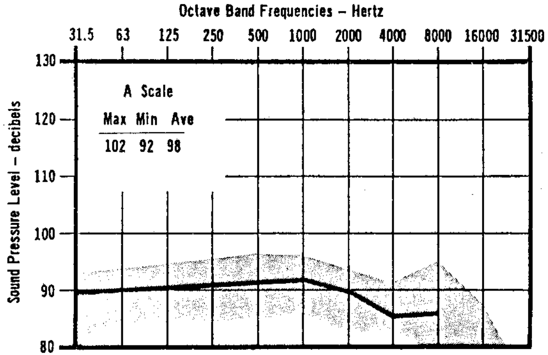
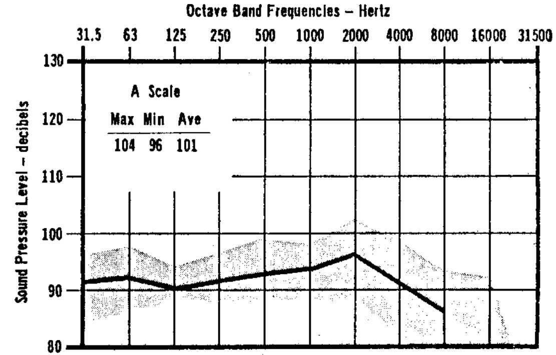


Figure 3a-d. Noise levels in California sawmill work locations. The range of A-scale decibel levels is given in the upper left. Width of the shaded area indicates the range in levels for each octave band. The solid black line indicates the average.



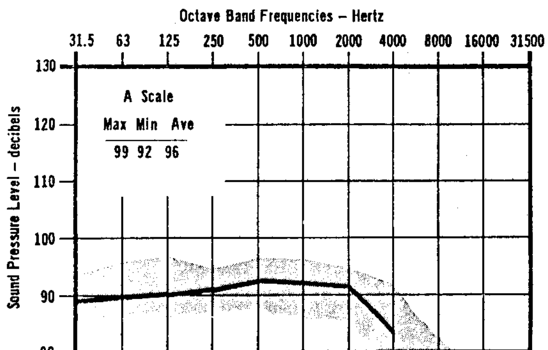
Location: Resawyer

3e



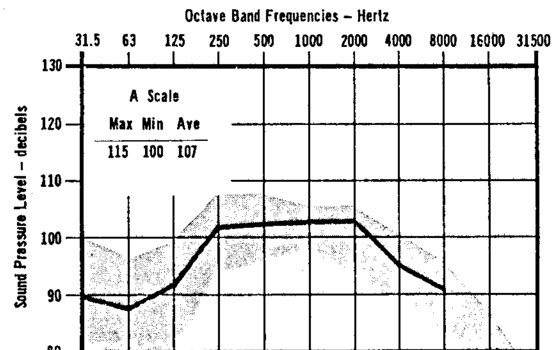
Location: Trimmerman

3f



Location: Sawmill Grader

3g



Location: Chipper Tender

3h

Figure 3e-h. Noise levels in California sawmill work locations. The range of A-scale decibel levels is given in the upper left. Width of the shaded area indicates the range in levels for each octave band. The solid black line indicates the average.

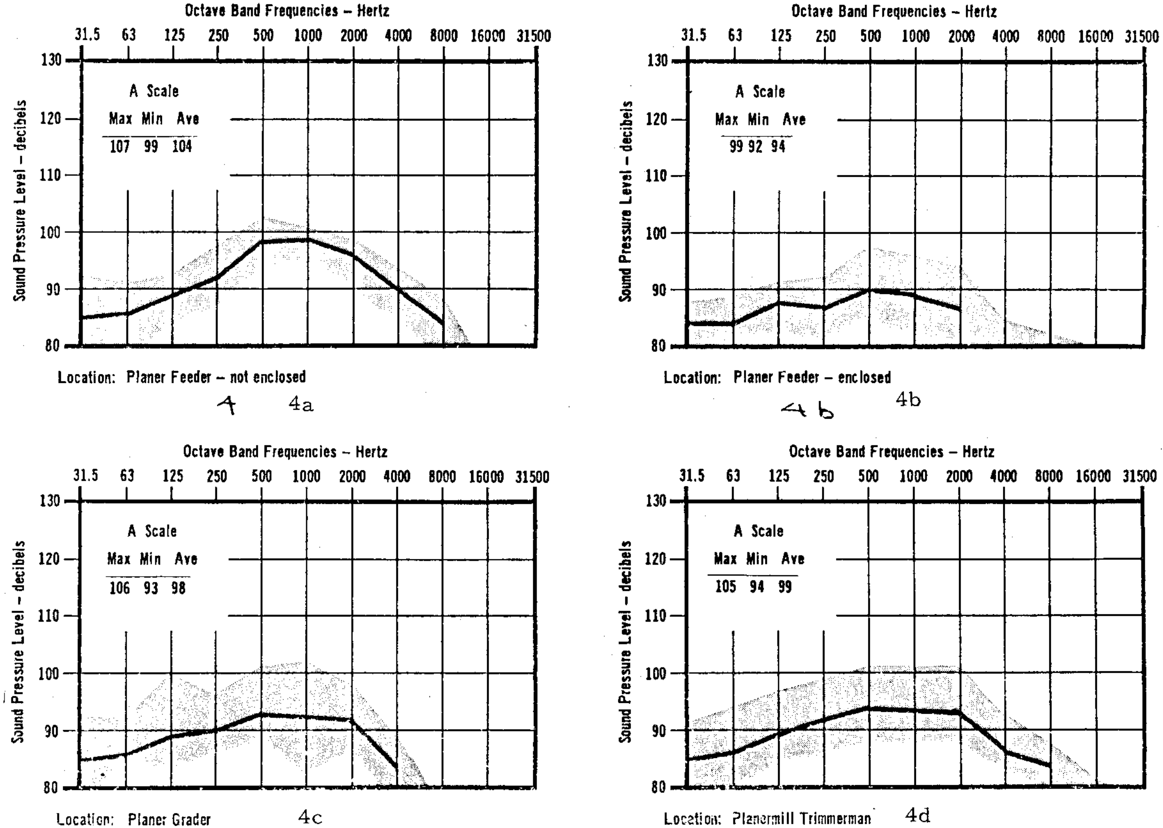
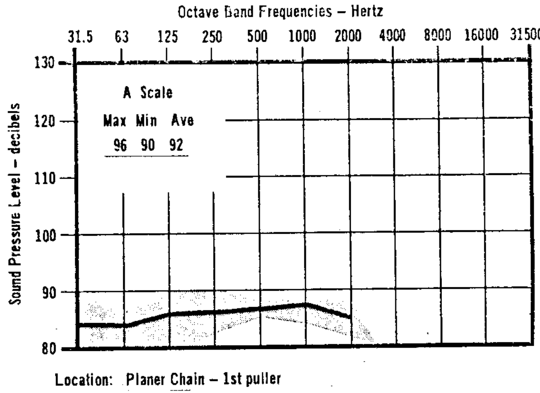


Figure 4a-d. Noise levels in California planermill work locations. The range of A-scale decibel levels is given in the upper left. Width of the shaded area indicates the range in levels for each octave band. The solid black line indicates the average.



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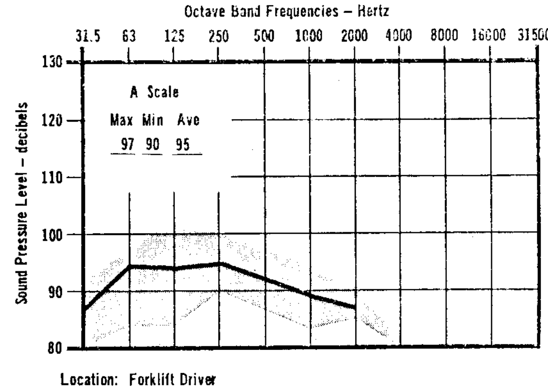

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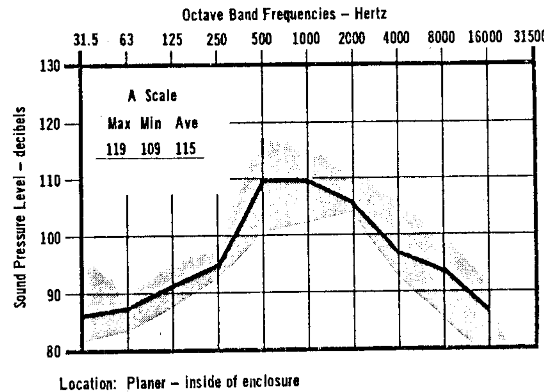

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Figure 4e-g. Noise levels in California planermill work locations. The range of A-scale decibel levels is given in the upper left. Width of the shaded area indicates the range in levels for each octave band. The solid black line indicates the average.

Mill Noise Levels

This paper presents data collected in a series of noise surveys conducted in plants in the California lumber industry during 1971 and 1972. Safety programs in these plants, including noise abatement efforts, ranged from poor to good. The many plants in California with excellent and aggressive programs had little incentive to participate in the surveys and few did so. Consequently, the data do not reflect the better installations but are typical of those where noise control efforts have been limited.

The purpose of presenting this information is to provide firms with a gauge by which to measure their performance relative to the industry as a whole. The data also provide information on the frequency distribution of the noise, so that control measures may be more efficiently designed.

The measurements were made at work stations, with the microphone within one foot of the worker's ear unless otherwise indicated. The first figures provide a measure of the severity of the problem, using the current exposure limits of the Occupational Safety & Health Act. Data for sawmills includes employees from the debarker operator to the mill grader and for planermills, the planer feeder through the first man on the sorting chain.

Noise Protection and Control

What would be some good guidelines for an in-plant noise control program? Several points should be considered.

Management objectives can range from a goal of complete hearing preservation for all personnel to one of simple compliance with the law. The objectives of the program should be discussed and company goals thoroughly understood by supervisory personnel--their support is essential.

A program can be separated into hearing protection and noise abatement phases. The main justification for the protection phase is that, at present, it is not practical to achieve satisfactory noise levels by noise control engineering at all locations, because of a lack of technology. Measurement of the noise exposure in different positions should be made. A noise survey will give some information indicating those positions that appear to involve the most hazard. An octave or narrower band analysis of the noise will define the noise character and aid in engineering control. However, actual noise exposure in the common situation of flutuating noise levels can only be determined by measurement using noise dosimeters, instruments that integrate exposure over time.

Hearing Protection

People differ in susceptibility to hearing damage. The present exposure criteria represent a compromise between what industry could readily achieve and the level that would give assured protection. Somewhere between five and twenty percent of individuals can be expected to suffer occupationally induced hearing loss when exposed to the currently legal levels for a long time. A program of audiometric testing would detect these susceptible individuals before their hearing loss became serious. Once idenfified, they could be transferred to less noisy jobs or some other change made to give them satisfactory protection. The program would have the added benefit of limiting or even eliminating company liability for hearing losses by establishing the level of hearing acuity for each new employee and giving the information needed to avoid further loss.

Protective devices such as ear plugs and muffs are a vital element in a hearing protection program, given current noise levels in industry. The better ones will provide 20 decibels or more of protection. They are not considered more than an interim solution since their effectiveness is completely dependent upon both proper fitting and regular use and quite frankly, past performance has not been good.

Noise Abatement

Noise exposure can be reduced in several ways: 1) The source may be changed so that it is less noisy; 2) the path that the noise travels to reach the worker may be blocked; 3) the noise energy may be trapped and converted to heat by acoustical absorbents; 4) the worker may be relocated, further from the noise source. There are technical or operational limitations attached to each of these but they should all be considered in any noise reduction effort.

1) While modification of equipment provides the most visible method of source control, maintenance may be the most important place to begin and may yield the best cost/benefit ratio in terms of noise reduction. Shaft misalignment, worn bearings and other play in working parts are major noise sources in woodworking plants. Changes in equipment may be very simple such as muffling the exhaust on air cylinders or the placement of plastic friction plates between metal to metal contacts or, it may involve a major redesign of the machine. The noise of band and most circular saws is an example of noise that can be reduced to only a limited degree with present technology and must be controlled by other techniques.

2) Curtains, screens, and enclosures interrupt the noise travel path. Enclosures may be either around the source or around the hearer. In either case, it is important to make them as "tight" as possible, considering operational limitations. A small opening or leak in the enclosure will cause a major reduction in effectiveness. Partial enclosures including screens and curtains can be expected to give only a few decibels of reduction. They can be very important, however, since many work locations only require a limited improvement. It is important to locate the worker as closely as possible to a screen erected for his benefit to maximize that benefit.

3) Absorption of the acoustic energy - Treatment of the walls and ceiling with acoustical materials is an important way of reducing noise levels in work areas but it will not provide any relief for a worker located near a loud noise source. It is the proper choice for many problems but its potential should not be overestimated. Similarly, baffles of acoustically absorbent material have definite but limited value.

4) Relocation of the worker - Noise in a free field (for example, in the open out of doors) is inversely proportional to the square of the distance to the source. This means that each time the distance is doubled, the noise level falls by six decibels. A worker moved from 3 feet to 12 feet from a noisy machine would theoretically gain twelve

decibels. Inside a building, the gain would probably not reach this maximum but could approach it. This method should be considered wherever the worker does not have to adjust the work or the machine regularly.