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A Survey of Management Opinions of Noise in the Pulp and Paper Industry

Carola Trittin

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A SURVEY OF MANAGEMENT OPINIONS OF NOISE
IN THE PULP AND PAPER INDUSTRY

by
Carola Trittin

A
Thesis
submitted to the faculty
of
Western Michigan University

In partial fulfillment of the prerequisites for the degree

of
Master of Arts

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A SURVEY OF MANAGEMENT OPINIONS OF NOISE IN THE PULP AND PAPER INDUSTRY

INTRODUCTION

The pulp and paper industry is the fifth largest in the United States, dollar-wise, and is also the third fastest growing industry in the United States (1). There are between 375,000 and 400,000 people employed directly in the pulp and paper mills in the United States and Canada. A nation-wide survey on the importance of noise in this industry is needed to help clarify the effects, if any, that noise has upon its employees.

By definition, noise is non-harmonious sound. When the subject of noise is mentioned, many suggestions are given on places where such a study should be made. Noise is potentially annoying to anyone who can hear, but the annoyance might be greater in some people (6) than in others. Industrial noise is a relatively recent problem brought about largely by the development of machines, the speeding up of these machines (3), and the noises resulting from this speedup.

BACKGROUND

The nation-wide attention to the noise problem must be attributed to the increasing number of claims for compensation awards on the grounds of deafness incurred while working in noisy surroundings (7). Statutory regulations for deafness compensation schedules vary from state to state, but the nation-wide scope of the problem as presented (5) shows that 24 of the states, and the District of Columbia, in the United States have compensation laws for loss of hearing, in which temporary disability is allowed in addition to allowance for permanent partial disability. The Federal Employees Compensation Act and the Longshoremen and Harbor Workers' Act also provide the same type of compensation. Thirteen more states allow compensation for temporary disability in addition to permanent partial disability with certain limitations as to period of disability. The remaining eleven states in the United States deduct temporary disability from the allowance for permanent partial disability. The Federal Employees Compensation Act allows up to \$24,000.00 for partial disability in both ears.

One reason why there have not been more claims is the legal differentiation between temporary and permanent deafness. In order to establish permanent deafness the worker must have been away from the noisy environment for a minimum of six months (7).

McCormick (8) states that "there are two primary types of deafness: one is called 'nerve' deafness and most frequently is caused by a condition of the nerve cells of the inner ear that reduces sensitivity. The other is 'conduction' deafness and is caused by some condition of the outer or middle ear that affects the transmission of sound waves to the inner earNormal deterioration of hearing through aging is usually the nerve type, and continuous exposure to high noise levels also typically results in nerve deafness. Once nerve degeneration has occurred, it can rarely be corrected. Conduction deafness is only partial, never complete, since air-borne sound waves strike the skull and may be transmitted to the inner ear by conduction through the bone. It may be caused by different conditionsHearing aids are more frequently useful in this type of deafness than in nerve deafness." Sabine (7) states that "there is a wealth of reliable data from medical sources in support of the statement that sustained exposure to noise is a contributing factor in impaired hearing, chronic fatigue that lowers bodily resistance, neurasthenia, increased blood pressure and decreased working and mental efficiency and that noise should rightfully be classified as an occupational hazard along with gases, fumes, dust, toxic liquids and bacteria." Therefore, a potential hazard to hearing ability is present even though compensation statis-

tics do not indicate trouble with loss of hearing in the pulp and paper industry.

Proceedings of the Third Annual National Noise Abatement Symposium (10) and of the Fourth Annual Noise Abatement Symposium (9) present papers on industrial noise measurement, the methods of reducing the noise of industrial machines, the use of accoustical materials in the control of industrial noise, the effects of noise upon the behavior of people, safety standards for industrial noise, the relation of noise exposure to hearing loss, recent noise hazard legislation and its implications, and combating the effects of noise. The titles alone of these papers indicate the interest in noise and its abatement.

Up to this point the subject of noise has referred to industry in general. In the pulp and paper industry, much work has been done and many references are to be found in the trade journals of the industry.

A survey of noise sources and noise levels was conducted in the mills of the Kimberly-Clark Corporation (3). It was found that a noise of high frequency is more dangerous to the ear than a noise of the same intensity at a lower frequency. The noise of compressed air appeared to be very annoying. This noise was found to be at the high frequency end of the noise spectrum. The annoyance was minimized by enlarging the nozzles and reducing the air pressure.

Additional noise sources (3) in the paper mill which are annoying as well as possibly harmful are chippers, motors, refiners, drum barkers, saws, vacuum pumps and suction rolls. Various methods of reducing the effect of these noises have been made, such as mufflers on the equipment, ear-protector devices and silencers on the suction boxes. Some of these methods have caused operating difficulties and must be modified.

At a Canadian mill, a reduction of 22 decibels in intensity was obtained when serrated sealing strips were used for reducing the howl produced by suction rolls (13). In another study made by an accoustical material manufacturer at a paper mill, it was found that the effects of noise in terms of fatigue and inefficiency had been underestimated. Quieting machine noises increased production capacity 9 per cent. Intermittent noises were worse than continuous noises. Noise meter tests showed that at 10 decibels intensity, no noise was heard, at 35 - 65 decibels ordinary speech could be heard, 90 decibels was the borderline of efficiency, and 130 decibels was painful to the ear (11).

A large pulp and paper manufacturing company has been working on the noise problem, and has started to reduce noises by using an Abbott and Kraus silencer on suction-transfer equipment, and by having new suction rolls made with a specially drilled hole pattern. They also use a

movable booth with double wood, accoustically treated walls for use near noisy spots (2).

A handbook has been issued by the American Academy of Ophthalmology and Otolaryngology Subcommittee on Noise in Industry of the Committee on Conservation of Hearing. They state in this handbook that the effects of noise on hearing depend on individual susceptibility, length of exposure to noise, the characteristics of the noise, and the noise intensity. The probability of damage within a short time is very high for noises of 120 - 130 decibels or more, ultimately for 100 - 120 decibels, and certain noises at 90 - 100 decibels in highly susceptible people. High noise levels may cause permanent impairment of hearing by damage to the inner ear. There is no way to repair this damage. Early losses are not noticed, but can be detected by audiometric evaluation. Most losses of hearing occur from sounds at 3000 - 6000 cycles per second (6).

The problem of noise has become increasingly more important in industry in general (8) as the machine replaced manual labor. Industrial noise problems have developed with the advent of increased speeds (3) in machinery. This results in louder and more irritating noises. Continued exposure to loud noise can cause deafness. Impairment of hearing due to excessive noise is considered a compensable occupational disease. A direct survey of the pulp and paper

industry was required to determine if management considers noise to be a real problem in this industry.

EXPERIMENTAL PROCEDURE

A survey of the pulp and paper industry was conducted by means of a questionnaire sent to all of the pulp and paper companies in the United States and Canada. A total of 607 were mailed. This number represented 1358 individual plants, since many of the 607 companies contacted have more than one mill. A copy of the questionnaire used is found in Appendix I. A copy of the covering letter sent to the Industrial Relations Departments of these companies is found in Appendix II.

Of the 607 questionnaires sent, 330 were returned. This is a 54.4 per cent return and represents over one-half of the mills in the United States and Canada. Of the 330, twelve were returned unanswered for various reasons. The returns were signed in the majority of cases. When titles were given, these included presidents, vice-presidents, directors of industrial relations, personnel managers, plant nurses, plant doctors, and plant engineers.

A careful examination of the signed returned questionnaires does not indicate what the opinions of those who did not return the questionnaire might have been, but one would not expect their opinions to deviate very much from the opinions of those who returned the questionnaire.

RESULTS OF SURVEY

On Question No. 1 "Do you feel you receive complaints from your employees about noises: more than in other industries, the same as in other industries, or less than in other industries," 4.4 per cent of the opinions given indicated that pulp and paper mills received more complaints about noises than did other industries, 33.0 per cent regarded their complaints about as numerous as those in other industries, and 62.6 per cent were of the opinion that they had fewer complaints about noises than did other industries.

On Question No. 2 "What equipment causes the most complaints from workers," the following equipment was regarded most likely to be noisy:

<u>Equipment</u>	<u>Percentage opinions naming equipment</u>	<u>Equipment</u>	<u>Percentage opinions naming equipment</u>
Refiners	26.7	Corrugators	1.0
Suction rolls	19.6	Turbines	1.0
Chippers	11.0	Generators	1.6
Pumps	8.8	Steam	1.9
Saws	3.8	Compressed air	2.2
Cutters	4.1	Bag machines	1.0
Gears	2.5	Coal equipment	0.6
Machine shop	1.3	Cookers	0.6
Barkers	2.2	Screens	1.6
Rewinders	1.3	Miscellaneous	4.7

On Question No. 3 "During the past five years, have you had to pay injury compensation to individuals who have claimed loss of hearing due to noisy equipment," there was only one answer in the affirmative. All others were marked negative. This is the only question that was answered on all the returned questionnaires!

On Question No. 4 "If the answer to question No. 3 is 'yes', what percentage of the people employed by you have received compensation for hearing loss, calculated on the total number of employees in your company, and the total number of injury compensations in your company," the only company that answered "yes" to Question No. 3 did not answer Question No. 4.

On Question No. 5 "In your opinion, are the effects of noise on your employees primarily psychological, primarily physiological, or a combination of the two effects," 18.6 per cent were of the opinion that the effects of noise were psychological, 8.5 per cent were of the opinion that the effects of noise were physiological, and 34.3 per cent regarded the effects of noise as a combination of psychological and physiological effects. 38.6 per cent did not express opinions on the effects of noise.

On Question No. 6 "To minimize noises in your company, have you used soundproofing materials in building construction, used accoustical materials for isolating noisy

machines, and made provisions to reduce echoes," 21.4 per cent used soundproofing materials in construction, 24.6 per cent isolated noisy machines, 18.6 per cent made efforts to reduce echoes, and 56.0 per cent reported no effort to reduce noise.

On Question No. 7 "Is it your practice to measure the hearing of prospective employees, employees who complain of noises, or employees who have requested hearing ability measurements," 36.9 per cent measured hearing of prospective employees, 9.1 per cent measured hearing of employees who complained of noises, 12.3 per cent measured hearing of employees upon request, and 54.1 per cent reported no testing program.

DISCUSSION OF RESULTS

In studying the results of this survey, one must recognize that the questions answered reflect the opinions of the person giving the answers. The amount of experience and definite information behind the answers probably varied considerably.

The opinions in answer to Question No. 1 divided the pulp and paper industry into three groups, (A) those who stated that they received more noise complaints than other industries, (B) those who stated that they received about the same number of complaints, and (C) those who stated that they received fewer noise complaints. There were 14 replies in Group A, 105 replies in Group B, and 199 replies in Group C.

The low number in Group A and the high number in Group C indicated that noise was not judged a serious problem in the pulp and paper industry. This conclusion is supported since only one compensable case of hearing loss was reported (Question No. 3) during the last five years.

The opinions of key personnel in the pulp and paper industry were sought (Question No. 5) by asking them whether they considered the effects of noise to be primarily psychological, primarily physiological, or a combination of the two. Their opinions are shown in Table I.

TABLE I

(Numerical values show percentages within each group)

	Group A	Group B	Group C	Total Survey
Psychological	21.4	26.0	14.6	18.6
Physiological	28.8	7.7	7.0	8.5
Combination	35.7	48.6	26.6	34.3
No answer	14.1	17.7	51.8	38.6

It should be pointed out from the above table that the effects of noises were regarded as physiological to any appreciable extent only by those who stated that they had more noise than have other industries. Over 50 per cent of Group C did not answer this question. The highest percentage of opinions favoring noises as having primarily psychological effects is found in Group B.

The survey on the types of equipment which produce the most complaints by workers because of noise is the most concrete information obtained. In answering this question, the pulp and paper mill personnel merely had to record complaints on noises which they have had from their workers regarding various types of equipment.

Table II shows the frequency of complaints on a percentage basis, on the various types of equipment in each of the three groups and in the total survey.

TABLE II

Equipment	Group A	Group B	Group C	Total survey	Estimated per cent of mills * who use this equipment
Refiners	28.6	35.2	22.1	26.7	68.1
Suction rolls	57.2	32.7	10.0	19.6	68.1
Chippers	28.6	15.4	7.5	11.0	31.9
Pumps	28.6	13.5	5.0	8.8	68.1
Saws	7.1	7.6	1.5	3.8	
Cutters	7.1	5.8	3.1	4.1	
Gears	0.0	6.7	0.5	2.5	
Machine shop	7.1	1.9	0.5	1.3	
Barkers	7.1	1.9	2.0	2.2	
Rewinders	0.0	1.9	1.0	1.3	
Corrugators	0.0	1.0	1.0	1.0	
Turbines	0.0	0.0	1.5	1.0	
Generators	7.1	1.9	1.0	1.6	
Steam	14.3	0.0	2.0	1.9	
Compressed air	0.0	1.9	2.5	2.2	
Bag machines	0.0	1.0	1.0	1.0	
Coal Equipment	0.0	1.0	0.5	0.6	
Cookers	0.0	1.0	0.5	0.6	
Screens	0.0	2.9	1.0	1.6	
Miscellaneous	14.3	7.6	2.5	4.7	

* Based upon the total number of mills in the United States and Canada.

Every piece of equipment listed in the above table is too noisy to permit normal conversation in its immediate proximity. The following pieces of equipment operate continuously: refiners, suction rolls, pumps, gears, certain types of barkers, rewinders, corrugators, turbines, generators, bag machines, and screens. Unless the worker is within a few feet of any of these machines, he can and probably will adapt to the steady noise (8). The remainder of the equipment listed produces noises intermittently which have an adverse effect upon workers. It is very difficult to become accustomed to sharp intermittent noises because of their annoying nature (11).

Table II shows that refiners, suction rolls, chippers, and pumps cause the most complaints on noises. The last column in Table II shows the percentages of the mills in the industry which use these noisemakers. The majority of the mills make paper and use refiners, suction rolls, and pumps as standard equipment, while about one-third of the mills manufacture wood pulp where chippers are used.

The number of complaints, while not shown by this survey, might be reflected by the number of workers who are required to remain near the machine. The complaints are materially reduced because many of the real noisemakers have been isolated (3) so that very few workers need approach them and they are usually mentally prepared for

the noises as they come near the machines.

Of the noises tabulated in Table II, the miscellaneous items included music systems, chemical recovery plants, felt whippers, office machines, slotters, presses, lift trucks on metal ramps, calenders, and exhaust fans.

The percentages of mills which did not answer Question No. 2 were 7.3 in Group A, 20.0 in Group B, and 53.8 in Group C.

One would expect that an industry as progressive (1) as the pulp and paper industry would try to reduce noises because of their adverse effect (11) upon the productivity of its workers. The measures employed by pulp and paper mills to minimize noises are shown in Table III.

TABLE III

(Given in percentages within each group)

Method of re- ducing noises	Group A	Group B	Group C	Total Survey
Soundproofing materials of construction	35.7	29.8	16.1	21.4
Isolate noisy machines	42.8	26.0	22.6	24.6
Reduction of echoes	35.7	23.1	15.2	18.6
No noise abatement program	28.6	49.5	61.3	56.0

The values in Table III show that over one-half of the mills in which the noise problem is not recognized as serious do not have a noise abatement program. Although

Question No. 6 did not encourage the respondent to list other techniques for reducing noises, nine replies indicated the use of ear plugs to reduce echoes.

From the time that Louis Robert made the first paper machine until the present time, engineers have had the task to speed production of paper. This has meant heavier machines with higher torques and impacts. These features naturally develop more noise (3). In addition to the noise abatement derived through the skill of the machine builders, the survey shows that, percentage-wise, over twice as many mills in Group A try to eliminate noise than do so in Group C. As a matter of fact, the mills in Group A do considerably more in all respects to lessen noise than do those in Groups B and C, as shown in Table III.

When one considers the protective measures taken by the pulp and paper mills against possible compensable cases due to the effects of noise and possible negative effects upon production, then it becomes obvious that the pulp and paper industry is interested in the effects of the various unit processes and unit operations upon its employees. The measures taken to protect themselves against litigation and to determine the physiological effects of noise upon the hearing of its employees is shown by the responses to Question No. 7 which are shown in Table IV.

TABLE IV

<u>(Given in percentages within each group)</u>				
	<u>Group A</u>	<u>Group B</u>	<u>Group C</u>	<u>Total Survey</u>
Test prospective employees	50.0	38.5	35.2	36.9
Test employees complaining of noises	28.6	7.7	8.6	9.1
Test employees on request	21.4	13.5	11.0	12.3
No testing program	35.7	52.4	56.3	54.1

These responses indicate that the pulp and paper industry does what is necessary to protect its workers from the effects of noises (Table III) while at the same time it has moved into a testing program to protect itself (Table IV). This points to a very equitable arrangement between employer and employee. In addition to the number of mills which reported testing programs on hearing, many others indicated that they are either contemplating or setting up such testing programs. It is significant to note that almost two-thirds of the mills in Group A have some sort of testing program, while less than half of the reporting mills in Groups B and C have such testing programs. Since these testing programs measure the hearing abilities of many prospective workers, time will give numerical values to the effect of noises on hearing ability if there will be a measurable effect.

CONCLUSIONS

Despite the evidence provided by research on the possible adverse effects of noise in the pulp and paper industry, the results of this survey show that noise is not judged to be a serious problem in the pulp and paper industry. It might be considered a problem which is under adequate control because of the wide acceptance of noise reducing techniques. Many pieces of pulp and paper mill equipment were classified as noisy. The worst offenders were refiners, suction rolls, chippers, and pumps. It appears that the effects of these noises are considered more psychological than physiological, but both effects are present.

One would predict from this survey that noises in the pulp and paper industry do not constitute a serious uncontrolled problem, and that future scientific advances added to the present noise abatement programs will keep the noise factor in the problem areas of the pulp and paper industry under adequate control.

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Appendix I

SURVEY OF NOISE IN THE PULP AND PAPER INDUSTRY

21

1. Do you feel you receive complaints from your employees about noises
☐ more than in other industries
☐ same as in other industries
☐ less than in other industries
2. What equipment causes the most complaints from the workers?
3. During the past five years, have you had to pay injury compensation to individuals who have claimed loss of hearing due to noisy equipment?
☐ yes
☐ no
4. If the answer to question No. 3 is "yes", what percentage of the people employed by you have received compensation for hearing loss, calculated on
☐ the total number of employees in your company
☐ the total number of injury compensations in your company
5. In your opinion, are the effects of noise on your employees
☐ primarily psychological
☐ primarily physiological
☐ a combination of the two effects
6. To minimize noises in your company, have you
☐ used soundproofing materials in building construction
☐ used accoustical materials for isolating noisy machines
☐ made provisions to reduce echoes
7. Is it your practice to measure the hearing of
☐ prospective employees
☐ employees who complain of noises
☐ employees who have requested hearing ability measurements

Please use the reverse side of this sheet for comments.

(Optional: Name _____)

Company _____)

Return questionnaire to
Miss Carola Trittin
Department of Paper Technology
Western Michigan University
Kalamazoo, Michigan

Gentlemen:

Attention Industrial Relations Department

The writer is making a survey of the pulp and paper industry on noise and its effects on workers in the industry.

I am attaching a questionnaire which I hope you will have the time and patience to complete for me. The results of the survey will be made available to all who complete the questionnaire and return it to me.

A stamped self-addressed envelope is attached to the questionnaire for your convenience. A prompt return of answers will aid in the analysis of the survey.

I thank you for your cooperation.

Yours very truly,

(Miss) Carola Trittin
Assistant Professor
Department of Paper Technology
Western Michigan University