

## NOISE LEVELS IN MISSOURI VOCATIONAL AGRICULTURE SHOPS

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The recent expansion of interest in vocational education has caused an increase in the enrollment in vocational agriculture programs in the secondary school systems. To meet the needs of these added students, larger and better planned facilities are being equipped with larger and more sophisticated equipment to help facilitate the learning process. The use of new and more sophisticated equipment has created potential problems in the shop environment. Concern about the health and safety of students and teachers has led to interest in the school shop environment.

Poorly designed or maintained facilities have been found to affect the health of students and teachers, as well as to have a negative influence on student learning. Key (1976) reported that the effectiveness of a program can be influenced by poor facilities. Wall and Jessee (1971) conducted a study to evaluate occupational health hazards in agricultural education laboratories in Virginia. They indicated that noise levels in selected laboratories were in excess of permissible levels established by federal standards. Hicks (1974) investigated the existing noise conditions within selected Utah industrial education woodworking laboratories to determine whether noise conditions exceeded the standards set by the Occupational Safety and Health Administration (OSHA). The study revealed that five of 12 metal instructors were exposed to noise levels which violated OSHA standards. Clarke (1974) studied noise generated by the radial arm saw to determine the influence of noise reduction on the effectiveness of verbal communication between the student and the teacher. He found that the understanding of speech by the students was greatly influenced by various degrees of noise. Jewell (1977) asked students to complete a learning exercise at two noise levels. He found significant differences in reading comprehension and in mean learning time used. Students working in the higher noise environment of 110 dB(A) did not perform as well as students working in the quieter environment of 55 dB(A).

In the review of related literature, noise was described as any undesirable or unwanted sound. Several variables were identified in the studies reviewed relating to excessive levels of noise. There was a great deal of information available concerning the environmental quality of industrial settings, the effect on

laboratory animals and human health. On the other hand, much less research was identified which described or recommended a course of action dealing with noise levels in the vocational agriculture shop.

### *Purpose of the Study*

The primary purpose of the study was to provide data about noise levels as a potential health hazard for students and instructors involved in vocational agriculture shop operations in Missouri.

Specifically, the study was designed to answer the following questions:

1. What was the level of noise pollution in vocational agriculture shops?
2. Did the level of noise pollution in vocational agriculture shops exceed the standards established by OSHA?

### *Population and Design*

The population involved in the study consisted of 36 schools in central Missouri offering a course titled, "agricultural construction." The sample for this study consisted of 10 randomly selected high schools in central Missouri offering a course in agricultural construction during the 1977 fall semester.

This study was descriptive in nature, providing data about selected noise levels present in each shop. The areas of potential noise problems were determined by comparing the threshold level values found in the study to the specified maximum standards established by OSHA.

### *Procedures*

The data for the study were collected in a 14-day period during the fall semester of 1977. Data from each school were collected during a 1-day period. Noise level readings were taken from three locations in the shop when the grinder and the radial arm saw were on, but not in operation, and also during the operation of each machine. Readings to determine peak noise levels were taken from two locations. The readings were taken with the radial arm saw and the right angle grinder in operation and while five students were chipping on welds. Noise measurements were made by using a General Radio Company octave band analyzer, Model 615 A S equalization analyzer system, and a Radio Shack noise meter with a unidirectional microphone.

## OSHA Standards

The OSHA standards for noise levels are given in Table 1.

Table 1

### OSHA STANDARDS ON NOISE LEVELS IN DECIBELS dB(A)\*

Duration Per Day Hours	Sound Levels dB(A)	Duration Per Day Hours	Sound Levels dB(A)
16	80	1	100
8	85	1/2	105
4	90	1/4	110
2	95	1/8	115

\*U. S. Department of Labor, 1976:99.

The OSHA threshold limit values for noise were stated in terms of sound pressure levels and duration of exposure. The American Conference for Governmental Industrial Hygienists (1976) reported that the medical profession has defined hearing impairment as an average hearing threshold shift in excess of 25 dB(A) at 500, 1000 and 2000 Hz. The limits which are given were established to prevent a hearing loss in excess of these levels. These values apply to the total duration of exposure for a work period, whether the exposure was continuous or a number of short-term exposures.

OSHA standards were used to provide data in checking the findings of the study to determine if there were areas which exceeded the standards.

### *Findings and Conclusions*

The following findings and conclusions were formulated as a result of the data collected for this study.

#### *Noise from the Grinders and Saws*

The readings from the grinder, as reported in Table 2, exceeded the standard for noise levels of 100 dB(A) for 60 minutes in nine schools; five of these exceeded the standard of 105 dB(A) for 30 minutes and one school exceeded the standard of 110 dB(A)

for 15 minutes when the readings were taken on the work table during the operation of the grinder.

No school exceeded the standards when the grinder was on but not in operation or when it was in operation and the readings were taken from the other locations in the shop.

The readings from the radial arm saw, as reported in Table 2, exceeded the standard of 100 dB(A) for 60 minutes in all ten schools, five of these exceeded the standard of 105 dB(A) for 30 minutes and three exceeded the standard of 110 dB(A) for 15 minutes when the readings were taken on the work table during the operation of the saw. In addition, one school exceeded the standards of 100 dB(A) for 60 minutes when the saw was on but not in operation when the reading was taken on the work table. No school exceeded the standards when readings were taken at the other locations in the shop when the saw was in operation.

Therefore, it was concluded that there was a potential noise problem for the operator of either the grinder or the radial arm saw if operation was continuous for 15 minutes or longer.

#### *Peak Noise Levels*

Five schools, as reported in Table 3, exceeded the standard of 100 dB(A) for 60 minutes for peak noise levels when the readings were taken in the metal area and one school exceeded this standard in the center of the shop. The other standards were not exceeded. Therefore, it was concluded that during a normal class period, noise was not a problem for others in the work area during typical shop operations.

However, some difficulty was encountered in collecting peak noise levels with a noise meter using a unidirectional microphone. The microphone was randomly aimed between the major pieces of equipment. Evidently, this caused the recorded values for peak noise as reported for some schools in Table 3 to be below those noise level values reported in Table 2 for the right angle grinder and for the radial arm saw. Therefore, the recorded values for peak noise did not show the cumulative effect of added noise which normally would be expected.

#### *Implications and Recommendations*

Based on an analysis of the data collected for this study, it was recommended that students and teachers in the schools studied should be protected against the effects of noise exposure when operating the radial arm saw and the right angle grinder for

Table 2

## SHOP NOISE LEVELS FOR RIGHT ANGLE GRINDERS AND RADIAL ARM SAWS IN DECIBELS dB(A)\*

School	Unoccupied	Center of Shop				On Work Table				Opposite Side of Shop			
		Before Operation		During Operation		Before Operation		During Operation		Before Operation		During Operation	
		Grind.	Saw	Grind.	Saw	Grind.	Saw	Grind.	Saw	Grind.	Saw	Grind.	Saw
1	65	82	72	93	92	100	75	110***	106***	82	70	88	82
2	77	82	82	82	85	92	97	100	103**	75	78	87	83
3	71	88	83	95	99	95	95	103**	112****	82	78	90	93
4	66	80	84	84	97	98	100	107***	102**	76	76	80	82
5	75	86	76	98	82	98	93	101**	101**	82	73	85	79
6	63	85	86	92	94	91	96	101**	104**	83	75	81	88
7	68	83	88	89	100	98	101**	107***	115****	80	85	82	94
8	75	84	72	90	98	90	90	106***	111****	78	72	84	89
9	65	82	74	86	88	91	83	102**	110***	80	71	82	89
10	82	89	85	93	91	94	87	111****	103**	82	78	91	88

\*Readings taken with right angle grinder or the radial arm saw operating continuously for five minutes.

\*\*Exceeds specified OSHA standard of 100 dB(A)/60 minutes.

\*\*\*Exceeds specified OSHA standard of 105 dB(A)/30 minutes.

\*\*\*\*Exceeds specified OSHA standard of 110 dB(A)/15 minutes.

Table 3

## PEAK NOISE LEVELS IN DECIBELS dB(A)\*

Schools	Center of Shop	Metal Area	Opposite Metal Area
1	98	105**	92
2	96	98	90
3	100	101**	100
4	85	92	90
5	98	101**	89
6	96	102**	89
7	92	95	85
8	94	100	91
9	92	100	96
10	101**	102**	98

\*Readings taken with five students chipping welds, the radial arm saw and right angle grinder in operation, and the fans operating continuously for 5 minutes.

\*\*Exceeds specified OSHA standard of 100 dB(A)/60 minutes

a period of 15 minutes or longer. Wearing personalized protection equipment such as ear plugs or muffs to reduce sound levels would provide one method of protection. Teachers in schools in other parts of Missouri or in other states which may have similar noise problems should also consider the use of protective equipment.

The fact that excess noise, as measured by OSHA standards, was identified in this study as well as in selected studies noted in the review of literature would suggest that additional studies of noise levels in vocational agriculture shops should be conducted in other states. In addition, studies to assess the impact of noise levels on the learning and attitudes of students should be conducted to provide additional information about the total learning environment in the shop situation.

#### References

American Conference of Governmental Industrial Hygienists. *Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment*. New York: 1976.

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