Real-Time Video Monitoring of Noise in Agriculture

By *Alice L. Greife, Ph.D.*
National Institute for Occupational Safety and Health

MR. SESTITO: Our next speaker is Alice Greife. Alice is an industrial hygienist toxicologist, and she also leads our hazard surveillance program in the surveillance branch. Alice is going to be sharing with you a presentation entitled, "Real-Time Video Monitoring of Noise in Agriculture." Alice.

DR. GREIFE: As John said, I am going to give you a discussion this morning about real-time video assessment of noise in an agricultural setting. I would like to give some credit to Herb Venable, Mike Gressel, and Randy Tubbs, who collected the data and participated in analysis of development of the videotape.

The purpose of our activity was to pilot test the application of a video monitoring technique for the assessment of exposure to noise in an agricultural work place. There has been a great deal of research of noise in an industrial setting, but looking at tasks and the assignment of specific noise values is a rather new approach in agriculture.

There have been several reports of noise as a hazard in agriculture. Gregg, in 1972, did a review of active patients of an otolaryngologist and found that approximately 6 percent of those patients were being seen and treated for noise induced hearing loss.

Sullivan, in 1981, did an analysis of several studies and suggested that between 6 percent and 18 percent of agricultural workers, at sometime during their working lifetime, suffered a handicapping noise induced hearing loss.

Plakke, in 1990, did a prevalence study of farmers and their spouses, and the spouses were those who were indirectly exposed to noise, that they observed operations, or were near the operations, but did not directly participate, in that they did not operate the machinery. Plakke found that, as expected, the farmers had a noise induced hearing loss which was greater than the control group, but their spouses unexpectedly also had a noise induced hearing loss, which was greater in comparison to a control group of spouses of individuals who were not farmers.

Broste, in 1989, observed that children frequently are in and around noisy agricultural settings as well as in participating in situations which reduce noise. Broste suggested that the noise induced hearing loss, which we are seeing in adults, may have some foundation or be initiated in these early childhood exposures.

There are many difficulties in evaluating noise in agricultural settings. There are numerous sources of noise. For example, there are mechanical sources such as tractors, combines, power tools. There are also non-mechanical sources such as hogs, pigs and chickens. There are different types of noises. There are continuous noises, impact noises, as well as a variety of exposure conditions. For example, there is a very great seasonality in exposure to noise. A farmer may be exposed to noise in a tractor without

a cab for 18 to 24 hours at a stretch during harvesting; but in the middle of the season, in the summer, he may only be exposed for a few hours.

Sometimes farmers are insulated from noise exposure such as on combines which have cabs, or directly exposed to noise on tractors which do not. So there is a great deal of variability in the exposure conditions.

We elected to employ a video monitoring technique which would make a video and audio record of the noise, coupled with a monitoring system. In this acquisition system we had a video camera which could record on a video tape the work task that was being performed, and make an audio record of the exposure. The monitor we employed was a sound level meter which was attached to a data logger, which could continuously record and store the data. Those were then downloaded into a personal computer which was fitted with the specific graphics board. A computer program for producing a video overlay of a vertical bar indicating the sound level, and then the computer is also equipped with a variety of different software which can manipulate the noise data further such as SAS or SPSS or Lotus.

This is the backpack which was fitted with the sound level meter and the data logger. It is lightweight in construction and is worn on the farmer's back. Placement of equipment such as this is very important. It is up high enough so that when he sits on the tractor or on a mower, does not impede his work. Because it is behind him, he has free use of his hands. You do not want to impede the farmer's work activity, and you certainly do not want to endanger him at what he is going to do.

Here is an illustration of the backpack being placed on the farmer. As you can see, it is lightweight. It wraps around his shoulders and his waist, and will not interfere with the use of his hands or his legs.

We investigated three different noise operations. The first was mowing with the tractor. As you can see the backpack on the farmer's back and he proceeds in his normal activities. The second operation is in the construction of a grain bin. In this particular activity, shown here, you can see the use of a power rachet. The third operation was of a grain dryer, more specifically in the area of the rear exhaust.

After collection of the data with a video camera which is, to remind you, a video as well as an audio record of the noise, the sound level meter collects the actual noise levels. The two are integrated using a specially designed computer program written by Mike Gressel with NIOSH, in which the video image has a vertical bar which is overlaid onto the video tape itself, which rises or falls in response to the sound level. So as you see a work task, you hear the sound rise on the audio portion of the video tape. You see a vertical bar rise as well.

There are very interesting results based on this technique. First of all, the highest level we have recorded in a mowing operation was 90.5 dBA. In advance of the data collection, the industrial hygienist estimated that the highest level that would be collected would be, first of all, greater than this, and secondly, there would be a great deal of variability in sound intensity. In listening to

the tractor, in listening to the mower bar being engaged and disengaged, and the tractor gears being engaged and disengaged, there appears to be a great deal of variability in the noise level. Indeed, we found that there was not. The maximum noise level was 90.5 dBA, the average was 85.1 dBA, so very small a variability that there was no one single task that could be isolated using the technique that was responsible for the noise.

In looking at the grain bin dryer, the highest level that was recorded was 97.7 dBA, with an average level of 80 dBA and a range of 60 to 97.7 dBA. By analyzing the video tape and the vertical overlay, we found that this very high exposure level was associated with the use of a hand held power ratchet. So in this case we were able to isolate a specific source of noise, and would be able to, perhaps, have an intervention strategy in place.

The grain dryer had the highest overall level of 105.7, dBA. We were able to determine that when the farmer walks behind the grain dryer near the exhaust, was this high level of exposure occurred. The mean of the exposures was 96.3 dBA on his other operations, but this very high exposure level, using this technique, was isolated to his work around the exhaust.

There were several problems that we encountered in collecting this data. The first one was the response time of the noise level meter. There was a perception on the part of the industrial hygienist hearing the noise fluctuate faster than the sound level meter would record the sound. This could be solved by simply having a sound level meter which has a faster response time. There are instruments on the market which do give a faster response time than the instrument that we used.

The second is placement of the microphone to record the audio signal to be combined with the video input. We used the microphone that was on the video camera itself. By using a remote microphone which would be attached to the farmer, one would have a much more representative sound associated with the video tape, and that would also greatly enhance its usefulness as an educational tool, by clearly being able to hear the sound, as the farmer does, as it increases and decreases.

The third problem we had was with the data logger itself. The data loggers will average several data points in order to give one value for the recording time. We selected a rather long recording time, and because of the capacity that the data logger had to store the data point, the peak levels that were recorded were actually an average of several data points. The solution would be either to use a data logger, which has a greater capacity, or simply select a data collection time that was smaller. But all of these problems are problems with equipment which can be solved.

NIOSH has developed a training course on how to use its video monitoring technique. This technique could also be an effective tool to educate farmers and farm families from workers. It documents exactly what are the sources of noise; what they do that causes an overexposure to noise. It can be used in design and validation of prevention strategies to other reduced noise, to change

the farmer's work habits, to encourage them to wear hearing protective equipment. It could also be used by manufacturers of the equipment to show them what operation of equipment causes an increase in overexposure to noise. This information could then be used in engineering and modifications.

We found that this video monitoring technique can be used to assess noise in the work place; that it can be used to isolate specific tasks or operations having excess noise exposure. It can also be used to identify potential or possible intervention strategies.

Broste indicated that exposure of children to noise may lead to increased hearing loss in the adult farmer. By starting early in education programs promoting the use of hearing protection, loss of hearing in the adult farmer may be lessened. Using this technique to point out how one can help themselves, how work practices can be modified, procedures can be changed or controlled, may be useful in reducing hearing loss in the future. Thank you. ■

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Publications Dissemination, DSDTT
National Institute for Occupational Safety and Health
4676 Columbia Parkway
Cincinnati, OH 45226-1998
Fax (513) 533-8573

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