CASE HISTORY 27: BRAIDING MACHINE
(OSHA Noise Problem)

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Problem Description

Braiding machines are used in the textile industry to combine several filaments of material into a single braided strand. The braiding process is accomplished mechanically by having many individual material "carriers" move simultaneously around the periphery of a table in such a fashion that the carriers criss-cross each other as they move. The material strands, fed from the carriers, are thus formed into a braid. The whole process is similar to the interweaving of ribbons on a Maypole. In this situation, however, considerable noise is generated by the gearing and the impacts associated with the carriers as they constantly change direction. Typically, many braiding machines are assembled in multiple rows and operate simultaneously, tended by operators who make sure the machines are functioning properly.

For the project involved in this case history, I.D.E. Processes Corporation, Noise Control Division, was called in to help a manufacturer of medical sutures bring worker noise exposures of his braider operators down to an equivalent of 85 dBA or less when a bank of machines was operated. Because of funding limitations, I.D.E. was asked to work on a prototype installation that would be evaluated after normal working hours, when the treated equipment could be run independently of other untreated machines in the area.

Problem Analysis

In this problem, the client specifically asked for an enclosure control to be installed after other equipment modifications had been tried and rejected, including replacing metal components with their nylon equivalents. Sound levels were measured at aisle positions, 2/3 m in front of the untreated equipment, first, with just the bank of machines to be enclosed running and, second, with all equipment turned off. The sound level was 101 dBA (with peak frequencies 2000 to 4000 Hz) with the bank of 26 braiders running and 57 dBA maximum with the machines turned off, indicating that the problem noise originated at the braiding machines.

The enclosure design had to provide a minimum of 16 dB of noise reduction on a dBA scale, to achieve 85 dBA guaranteed. In addition to the acoustical requirements, the client specified that the control would have to be robust and sanitary (a medical

product was involved) and could not cause any significant worker inconvenience.

Control Description

The custom-designed I.D.E. enclosure constructed for this problem is shown in Figures 6.27.1 and 6.27.2. From the photographs, it is easy to see that the operators retain good visibility of their machines. Several aspects are not revealed by the pictures: The windows slide on roller bearing, making worker accessibility relatively easy and fast. Panels on the bottom of the enclosure also slide. All windows and the bottom panels are removable for maintenance. Gravity ventilation sufficient for these machines is furnished via the silenced vent openings visible below the bottom panels. The outer skin of the enclosure panels is made of corrosion-resistant steel. The inner skin of the panels is of perforated sheet metal that covers an acoustical fill material, thereby making the inner surface acoustically absorbent and thereby minimizing any build-up of sound inside the enclosure. A layer of woven glass fiber fabric protects the inner fill from working out of the perforated sheet metal.

Result

Sound levels at the aisle positions have been reduced by 18 dB to 83 dBA when only the treated bank of machines is running. It should be noted that the achieved noise reduction is not a characteristic reduction of I.D.E. acoustic panels but rather an overall reduction of the entire system, consisting of approximately 50% glazed area of the total enclosure surface. The gravity ventilation is acoustically treated and compatible with the enclosure attenuation.

Operators are exposed to higher sound levels only for short periods of time, when opening one of the windows to work on a particular machine. Under these circumstances, the machine being worked on is typically shut off, and the worker is exposed to noise coming from more distant machines. Measurements taken at the enclosure at a position occupied by an operator tending a machine, while the other 25 machines are running, confirmed that such an exposure would contribute only a small fraction to his overall noise exposure — the sound level was 92 dBA under these conditions.

Since the enclosure, when installed in an existing plant, reduces aisle clearance between adjacent rows of equipment, some braiding equipment users may find it necessary to move their equipment in order to accommodate the 10- to 20-cm loss of clearance caused by the treatment. New plant layouts, of course, can accommodate required walkway clearances.

Figure 6.27.1. Braider enclosure.

Figure 6.27.2. Braider enclosure, another view.