

NOISE CONTROL IN THE AUTOMOTIVE INDUSTRY: SOME PRACTICAL EXPERIENCE

Mohan Barman, M.A.Sc., P.Eng.

Vibron Limited
Mississauga, Ontario

ABSTRACT

The General Motors Transmission Plant in Windsor, Ontario is presently undergoing a large-scale expansion program. This program has included a commitment by management to meet all appropriate sound and vibration criteria related to in-plant, office and environmental acoustics. The consequence of this decision is that substantial expenditures will be allocated for noise and vibration control. The following paper presents some aspects of a noise and vibration control program generated to ensure adequate control of cost and performance of the acoustical materials and hardware being considered. Also discussed are methods developed to deal with the practical problems of meeting acoustical design targets in a major industrial plant and results obtained to date.

Both to meet noise regulations and to reduce hearing loss, 85 dBA was selected as the maximum in-plant noise goal. A better working environment with enhanced productivity was considered an offshoot of the design goal.

The noise control design of a new plant is best carried out from a proposed layout and equipment list. In this case, the GM plant expansion has evolved as corporate decisions and targets have changed, so noise control methodology had to be flexible. To start with, some general acoustic treatments of the plant at construction were considered.

A typical example is the separation of noisy areas from quiet areas using barrier walls. For precise cost-benefit analysis, computer assisted noise maps, with or without acoustic treatment, were originally proposed. However, for the want of definitive layout and equipment lists, the acoustic treatment of walls and ceilings were decided on the basis of past experience, subjective judgement and knowledge of the type of equipment slated for the plant areas of concern.

The main thrust of the plant noise control is, however, built around the machine tools and other equipment to be purchased for this plant. In theory, the procedure is clear cut: the owner

writes a noise specification for the equipment and the vendor complies. In practice, a host of problems are encountered. For example, the owner may not have an enforceable noise specification and may not have a mechanism to enforce it. The vendor, on the other hand, may not take the specification seriously or may not know how to meet the specification.

Based on past experience, it was decided to meet the problem head on and make the best use of the noise specification. A more active role was decided on to help the supplier meet the requirements of the noise specification such that problems would not be encountered near delivery deadline time.

The role was considered to be noise Quality Assurance (QA), similar to an engineer's role in building construction, as an owner's representative. To carry out this role successfully, three ingredients were necessary:

- (a) First, an enforceable noise specification that is clear in intent and covers most possibilities. This is true of the GM specification which generally calls for 80 dBA when measurement is taken according to NMTBA or other standards.
- (b) A good certification and acceptance scheme built into the contracts and the purchase order is equally important. Vibron has worked with QA schemes where monitoring was the only role, since the contracts were based on performance after installation. It needed co-operation from the supplier for the QA to be effective. The co-operation was not forthcoming in some instances, and the equipment failed to meet noise specification after installation, creating an additional difficulty for the equipment purchaser.
- (c) Third, it also requires a good deal of perseverance and a firm commitment on the part of the purchaser.

All three ingredients were present in the GM example and a QA procedure was established as follows:

- (i) Contact bidder and suppliers
- (ii) Obtain noise output data of identical or similar machines during actual operation--either from the supplier or from independent measurements
- (iii) If the machine does not or is not likely to meet noise specifications, a noise control program is insisted upon. One or more meetings may be arranged with the manufacturer to review in detail all the noise control measures that are possible
- (iv) The manufacturer is advised to hire outside experts if necessary. In extreme cases, the supplier may be offered the help of GM and Vibron

- (v) An internal policy is instituted at the GM Windsor Transmission Plant, whereby no machine is accepted without noise QA approval

The QA procedure above produced two immediate benefits:

- (a) It was possible to persuade a number of apprehensive manufacturers that they were capable technically, to meet GM noise specification.
- (b) A closer scrutiny was made of the noise control hardware of a number of bidders and a considerable cost saving was pointed out.

One machine tool builder had used expensive in-house labour to erect sheet metal enclosures but the large number of doors in the enclosure had no seals whatsoever. The manufacturer was steered to a local sheet metal contractor proficient in similar work, with both saving in cost and increase in the effectiveness of the enclosure.

Another machine tool builder was insistent that 80 dBA was impossible. When a meeting was arranged and all the noise producing mechanisms were discussed in detail, the manufacturer agreed that solutions suggested are feasible. They hired an outside consultant to treat the noise sources and have indicated the likelihood of meeting GM specification.

It has been quite customary to find machine tool builders preparing enclosure designs with little knowledge of good noise control practices. One finds absorptive materials covered with heavy plastic lining, doors with no seals and enclosures attached rigidly to vibrating surfaces. It is equally common to find large, untreated openings at the wrong kind of places. At the other extreme, one manufacturer offered a 20 dB enclosure at enormous cost, to solve a 3 dB problem.

One other common and persistent problem has been the efforts made by the machine tool builders to avoid taking responsibility for machining noise. The GM noise specification is very specific about this, and has gone as far as to simulate a loading method for the presses for noise certification.

It has often been said that noise control at the source has been sorely missing in the industrial workplace. This is one way in which we have found that the manufacturers can be made to look at noise control of the equipment that they provide.

In the past, even the most well-intentioned plans for noise control for new plants were severely hampered by equipment manufacturers' failure to include noise control as one of their priority features. GM plans for a noise control program have managed to overcome some of these difficulties and with supporting professional expertise, encourage manufacturers to comply with noise control specifications, resulting in a more desirable workplace environment.

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Since the concentration of workers around this equipment is also high, it is essential that workers be protected from hearing loss due to noise exposure. The post office decided on the most stringent levels of 70 dBA in manual sorting areas, which affects the majority of workers, 75 dBA in other areas and 80 dBA as the absolute maximum anywhere. After initial planning and projected noise maps, it became clear that only by working with the process equipment suppliers was it possible to meet the goals. The term noise QA (quality assurance) was invented and tests were devised for prototype equipment. Noise control features were recommended to the equipment manufacturers and incorporated in the prototype testing in successive stages.

The final stage of commissioning of process equipment is taking place at present. While most process equipment meets the noise QA standards, some production versions require fine-tuning in the field.

VIBRON LIMITED
1720 Meyerside Drive
Mississauga, Ontario
L5T 1A3

(416) 677-4922