Denver, Colorado
NOISE-CON 2013
2013 August 26-28

Buy-Quiet Roadmap: a web-based application supporting procurement of low-noise equipment in the context of a hearing conservation program

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ABSTRACT

The ***Buy-Quiet Process Roadmap*** is a web-based application for executing the identification and selection of low-noise-emission equipment. Based on industry best practices contributed by more than twenty organizations, the ***Roadmap*** was developed by NASA to meet the diverse needs of its 15 field centers. The ***Roadmap*** is a publicly available resource that may be easily adapted by other government, military and industrial organizations. Users are guided through a stepwise process that includes project planning, researching the marketplace, selecting an achievable noise emission criterion, and developing a specification document, and includes customizable forms and worksheets that facilitate decision-making and documentation. The ***Roadmap*** also incorporates guidelines for identifying the appropriate government procurement strategy for each purchase, based on an assessment of the purchase-specific long term financial and noise exposure risk. The heart of the ***Roadmap*** is a "cost of noise" calculation that evaluates the relative cost of long-term noise exposure for products that differ in both noise emission and price.

1. INTRODUCTION

The process of researching, identifying, specifying, and selecting low-noise-emission equipment may be formalized and proceduralized to support a consistent and uniform implementation of a corporate Buy-Quiet Program across large and diverse populations of users within an organization. Many large and multi-site organizations may benefit from a standardized yet flexible and customizable tool that accommodates site-specific variations in technical (e.g., noise-producing) operations, culture, management structure, administrative procedures, and procurement policies. In early 2009, NASA contracted with Nelson Acoustics to help develop a Buy-Quiet "Roadmap." This collaborative project was undertaken in response to mounting field center requests for specific guidance on how to accomplish the procurement of low-noise equipment in accordance with Buy-Quiet requirements that had been added to the Agency's hearing conservation policy in 2006[1].

After an initial release and period of evaluation, the resulting beta version of the ***NASA Buy-Quiet Process Roadmap*** was dramatically restructured and rebuilt as part of a larger website overhaul to incorporate user feedback and better reflect federal procurement regulations and NASA procurement policies. The ***Roadmap*** is a tool for the requestor or end user who is responsible for developing technical requirements in preparation for procurement. The ***Roadmap*** encompasses the requirements development and leads the user through the development of a

specification document, where appropriate. Requestors are encouraged to work with a Contracting Officer or procurement organization to execute the procurement once the technical requirements have been developed.

In early 2012, NASA announced the new ***EARLab*** Auditory Demonstration Laboratory website (http:// http://buyquietroadmap.com), which is now hosted as a public service by Nelson Acoustics and maintained by the site's developer, Gelfand Design. Residing within the site is the ***Buy-Quiet Process Roadmap*** (http://buyquietroadmap.com/buy-quiet-purchasing/buy-quiet-process-roadmap/), a self-contained online system that guides the entire "low-noise" procurement process in a stepwise fashion − from project planning through field verification of equipment noise emissions − and produces formal documentation of key analyses, associated decisions, and the resulting management approvals.

The ***Roadmap*** is intended to be employed in the context of an occupational hearing conservation program and, thus, is focused on equipment expected to generate noise emissions relevant to hearing conservation (80 dBA and greater). The primary reason for the limited applicability is that the embedded analysis for quantifying the "cost of noise" (which allows the direct comparison of products with differing noise emission and purchase price) is based on the long-term costs of exposure to hazardous noise (http://buyquietroadmap.com/buy-quiet-purchasing/advocacy/the-cost-of-noise/)[2]. The mechanism for quantifying effects of non-hazardous noise (e.g., speech intelligibility, annoyance, work environment comfort, etc.) to allow such a comparison for office equipment and other nominally non-hazardous noise-producing equipment would be markedly different. Although the effects of exposure to non-hazardous noise are outside the boundaries of the ***Roadmap's*** analyses, a check for potential community noise issues is employed for equipment expected to be sited outdoors.

2. ROADMAP GUIDES LOW-NOISE PROCUREMENT PROCESS

The ***Roadmap*** is nested within the ***EARLab*** site's Buy-Quiet Purchasing section (http://buyquietroadmap.com/buy-quiet-purchasing/), which includes background information and other resources of general applicability to the development and promotion of Buy-Quiet programs, including reference documents, analyses, and PowerPoint presentations that may be adapted for use in program advocacy efforts.

The ***Roadmap*** is organized and visually presented to be easily accessible to a broad end user population by allowing the user to choose between following sequentially numbered steps from start to finish or (after gaining familiarity with the process and accumulating some historical product noise emission data), interacting directly with selected sections of interest or downloading specific worksheets and forms as needed. The ***Roadmap*** was constructed such that a vertical navigation menu is always visible in the left-hand sidebar. The numbered steps and their subparts are always in view, thus allowing the user freedom to move among steps or to follow the numbered process from start to finish. The center panel of each page contains detailed instructions for a particular step in the process, with links to step-specific worksheets and forms as well as links to related background reference materials, online databases, and other sources of information. The entire list of forms and worksheets is also included at the bottom of the left-hand sidebar navigation menu for easy access. ***Roadmap*** tutorial presentations are linked from the left-hand sidebar navigation menu, just below the forms and worksheets section.

3. OUTLINE OF ROADMAP PROCESS

The ***Roadmap*** is organized into six major process steps, which are accessible from the left-hand sidebar navigation menu. A brief description of the major features of each step follows:

A. Plan Your Procurement

This section provides general guidance for project planning and is especially applicable to equipment purchases that are accomplished in the context of larger design, renovation, and noise control projects. The intent of the section is to help the end user develop and articulate functional, operational, and general noise-related requirements for the equipment to be purchased and to identify situations that would benefit substantially from expert noise control expertise.

B. Research Available Products

Guidance is provided to help the user research the availability of products that meet the functional requirements documented in Step A. Links to online product noise databases and other sources of information are provided. The intent of the section is, ideally, to help the user identify a number of suitable candidate products for which measured noise emission data are available. In the absence of measured data for the candidate products being considered, the user is encouraged to find data for the general equipment class or type or to estimate noise emissions using published predictive formulas based on equipment characteristics and power ratings.

C. Select Noise Emission Criterion

The user selects the more appropriate of two options for the baseline noise emission criterion for the equipment to be purchased, using the following rationale:

1. If the equipment is included in the European Union's Machinery Directive (http://eur-lex.europa.eu/LexUriServ/site/en/oj/2005/l_344/l_34420051227en00440046.pdf), the predicted noise emission should be calculated according to the formula in this document. These limits are considered to represent the state of the art and take into account the state and availability of technology for controlling noise, particularly at the source. The EU Machinery Directive contains sound power level noise emission limits for a variety of outdoor equipment.
2. For all other equipment, the baseline noise emission criterion is 80 dBA at 1 m and at the operator position. This sound pressure level is often achievable, pushes the state-of-the-art standard, and is broadly compatible with most "best practices" corporate hearing conservation goals.
3. If the results of the research effort in Step B indicate that neither of the above criteria is appropriate to the specific procurement, the selected baseline criterion may need to be adjusted (typically it is raised, although it may also be lowered) to allow the consideration of a suitable number of candidate products. This adjustment may also include a conversion between sound pressure level and sound power level to allow the noise emission to be expressed according in units for which data may be available. The ***Roadmap*** provides worksheets for accomplishing the SPL-to-PWL conversion as well as a Criterion Adjustment Authorization Form that documents management acknowledgement and approval of the adjusted criterion when the user's research − including discussions with potential vendors, surveys of online databases and external specifications, and internet searches − indicates that a higher sound level limit is necessary in order to enable several acceptable proposals to be considered.

D. Determine Procurement Strategy

In this step, the user is led through a decision tree rubric that identifies the simplest allowable procurement strategy that may be used to accomplish the procurement. This step is particular to the federal procurement process and may be bypassed for non-federal purchasing situations. The intent is to allow users to make use of simplified procurement methods (e.g., Government Commercial Purchase Card, GSA Schedule, or "lowest-price technically acceptable") to the

maximum extent possible, based on an assessment of the risk introduced by noise-related factors. For purchases where measured data is available for the specific product, noise-associated risk is low, and simplified methods would be allowed. However, where only data for the *class* of products was available or where the noise emission data did not meet the criterion established in Step C, an elevated degree of risk would be identified. In such cases, the user's answers to the sequential questions in the "Simplest Procurement Strategy" worksheet would lead to the determination that a more formal procurement process was required in order to properly evaluate the long-term cost of the various candidate products. The most complex of the procurement strategies is the "Tradeoff Process," required in cases where measured product-specific data is either unavailable or does not meet the baseline noise emission criterion. The Tradeoff Process option allows the requestor and Contracting Officer to formally quantify the long-term cost of noise exposure of each offeror's product and compare ("trade off") against the quoted purchase cost. The tradeoff process is implemented by including the requirement in the specification and then using the Tradeoff Analysis worksheet to compare offers.

E. Build Specification

A specification template is provided for cases where a formal specification document is required, either by federal procurement policies or as a result of the Simplest Procurement Strategy decision tree in Step D. The template highlights user-input fields for noise emission criterion, applicable noise emission test standard, and a declaration, when applicable, that the government "will employ a tradeoff analysis to evaluate the net long-term cost of the effects of product noise emission along with cost and other submittal information to arrive at a determination of best value."

F. Verify Noise Emission

The ***Roadmap*** provides authorization forms that document the results and disposition of noise emission measurements, both at the shop (before shipment is authorized) and installed in the field (before final payment is made). Depending on the degree of risk associated with the verification results, increasing levels of management approvals are required in order to document a formal acknowledgement of the risk associated with accepting failed, compromised, precluded, or omitted verifications.

5. SUMMARY

The ***Buy-Quiet Process Roadmap*** is a publicly available online tool that proceduralizes the identification and selection of low-noise-emission equipment. Where appropriate, the ***Roadmap*** provides a formalized mechanism for quantitative comparison of the costs of long-term noise associated with candidate products in a manner that is consistent with federal procurement regulations. The Roadmap may be used by non-government entities and is easily customizable to accommodate site-specific requirements.

REFERENCES

1. Beth Cooper, "Development and implementation of policy-compliant site-specific Buy-Quiet programs at NASA," *Proceedings of Inter-noise 2009*, August 23-26, 2009.
2. David A. Nelson, "A Buy-Quiet Program Incorporating Career-Cycle Noise Costs," *Proceedings of Inter-noise 2009*, August 23-26, 2009.