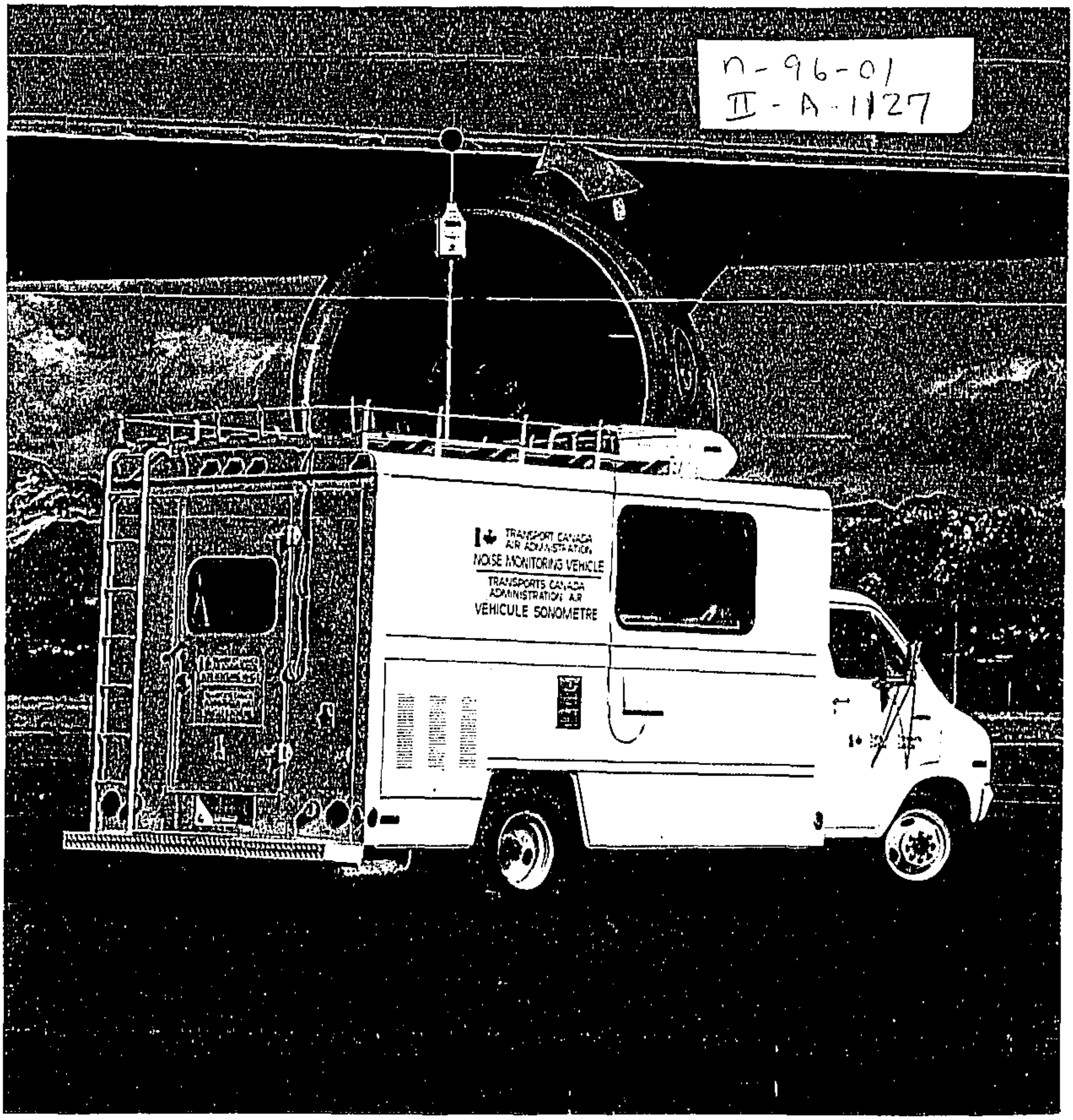
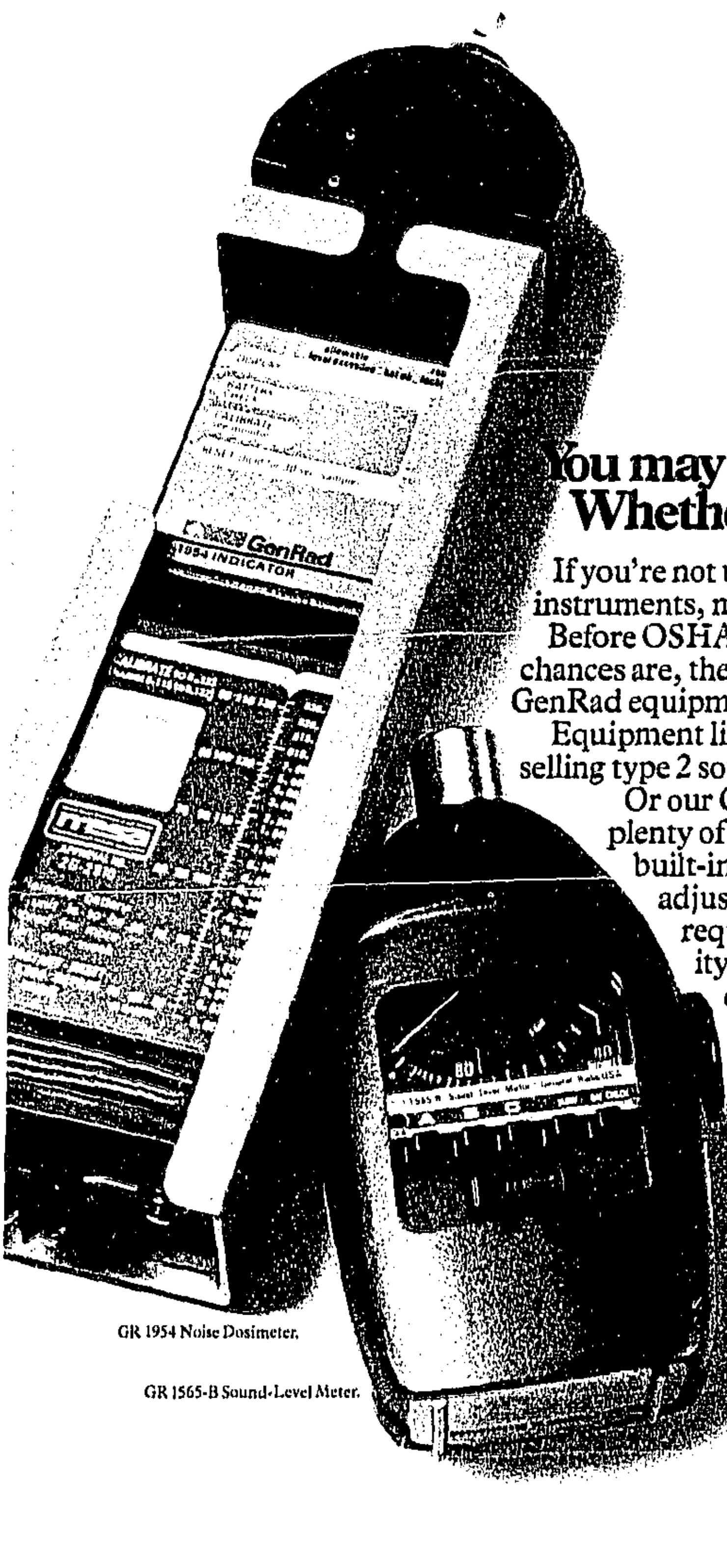
Quiet Communities Act
Noise and Air Pollution
State Noise Regulations

December 1979

sound and vibration





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S)V News

EPA Sets Noise Limit for Garbage Trucks

The U.S. Environmental Protection Agency has announced standards which limit the noise from newly manufactured garbage trucks. The Congress, through the Noise Control Act of 1972, directed EPA to reduce noise from major sources to levels that would protect the public health and welfare. As part of the Agency's continuing actions to reduce environmental noise, EPA Assistant Administrator David G. Hawkins said recently that all truck-mounted solid waste compactor vehicles manufactured after October 1, 1980, will not be allowed to emit a noise level in excess of 79 decibels measured at 7 meters (23 feet). The permissible level is reduced further to 76 decibels for vehicles made after July 1, 1982.

Reduction of the noise of garbage trucks should reduce urban and residential noise levels and the long-term impact on people exposed to the noise, as well as the disruption of speech communication and sleep. EPA estimates that this regulation will result in a 74 percent decrease in the extent and magnitude of the adverse effects from refuse vehicle noise by 1991.

"In addition to giving relief to the approximately 19 million people in this country who are adversely affected by high levels of noise from refuse compaction," Hawkins said, "the new regulation will bring the extra benefit of saving fuel. The reason for this is that a principal method for reducing the noise of the vehicle during compaction operations is to reduce the speed of the engine running the compactor. This will result in less fuel usage. When all the refuse collection vehicles meet the noise standard, the operators will be saving, every year, about two million gallons of gasoline, and over a million gallons of diesel oil."

Some garbage trucks now on the road have noise levels greater than 90 decibels, more than twice as loud as the standard EPA is imposing. "Nevertheless, the technology is available to make a refuse vehicle even quieter than EPA's proposed standard. Some of the new refuse collection vehicles in New York and San Francisco right now are achieving a 74 decibel level," Hawkins said.

This regulation does not require refuse haulers to replace their fleets with quieter vehicles. "EPA, Hawkins said, "is leaving to state and local authorities the problem of regulating the noise of clanking cans and shouting personnel during collection operations." This element of the garbage collection noise problem has been solved in a number of city neighborhoods by the substitution of plastic cans and bags for steel garbage cans. In commercial collections, the larger containers that are more durable than a home container have been quieted through use of non-metal covers. In such cases, EPA recommends that local authorities require that noise reducing materials, such as rubber or plastic, be applied to the steel containers.

EPA estimates that the list price of new refuse vehicles should not go up more than ten percent to cover the cost of added noise reducing technology in the vehicle. Those increased costs, passed on to the consumer, could result in an increase in collection costs of about one-half percent, by EPA estimate. For example, a family paying refuse collection costs of $100 a year would pay an additional 50 cents per year.

Truck manufacturers are free to use any technology they like to meet the new standard. In general, however, they will be quieting the three principal sources of noise: the engine, the power takeoff and the compactor mechanism.

Most garbage trucks use the same engine that powers the truck as the source of power to drive the compactor. Slowing down the engine's speed during compacting will be one way to reduce the noise. This can be done without increasing compaction time by increasing the capacity of the hydraulic pump which powers the compaction mechanism.

The second source of noise, the power takeoff, is used to transfer the engine's power to this same hydraulic pump. Technology is available to make quieter power takeoff units than most now in use.

A third way of reducing noise is to cushion the parts of the compactor that meet during operation of the mechanism.

The new regulation was published in the *Federal Register* of October 1, 1979.

Community Noise Control

Douglas M. Costle, Administrator of the Environmental Protection Agency, recently announced 22 noise control grants to 16 local governments and six other organizations totalling $696,193. "Strong local noise control programs are essential to the success of the national noise control effort," said Costle.

The communities receiving awards to establish or strengthen a local noise control program are: Teaneck, New Jersey; Brookline/Newton, Massachusetts; Stamford, Connecticut; York, Pennsylvania; Kingsport, Tennessee; Mentor, Ohio; Boise, Idaho; National City, California; Thornton, Colorado; St. Louis County, Missouri; Norman, Oklahoma; and Akron, Ohio.

Ten of the awards were for demonstration projects designed to test and develop the best available techniques for local noise control.

"Four of these awards will provide information and practical experience on new ideas for noise control in cities, as part of the Urban Noise Initiatives program announced by President Carter in his August 2, 1979 Environmental Message," said Costle.

The organizations, States and communities receiving demonstration awards are: State of New Jersey; State of Oregon; City of Chicago; City of Des Moines, Iowa; City of New Orleans; City of Portland, Oregon; Delaware Valley Regional Planning Commission; Massachusetts Port Authority; National Association of Neighborhoods; and National Institute of Governmental Purchasing.

These financial awards represent a major step in the implementation of the Quiet Communities Act of 1978.

Motorcycle Noise Guide

Effective control of excessive noise from motorcycle-related sources is in the best interest of the motorcycle industry and the public alike. For noise control efforts to be effective, they must reflect comprehension of the principles of acoustics; the unique nature of motorcycle noise measurement and reduction; and the technological, economic, and enforcement aspects of noise control. "Motorcycle Sound & Noise" has been published by the Motorcycle Industry Council and is available by contacting: Motorcycle Industry Council, Inc., 4100 Birch St., Suite 101, Newport Beach, CA 92660.

Gale Names VP

Mike Blanck has joined the Gale Corporation of North Brunswick, NJ, as Vice President – Marketing. He will be responsible for all aspects of sales and marketing for the Gale line of HVAC and Industrial Silencing Systems.

Mr. Blanck comes to Gale from Electrical Testing Laboratories where he was a vice president managing the Acoustical Testing and Consulting Division. Before that he was General Manager of Kodaras Acoustical Laboratories prior to its merger with E.T.L.

Gale is a manufacturer specializing in HVAC and Industrial light gauge noise control products, including panels and silencing systems.

S)V News

New Turbofan Engine

The second of two experimental turbofan engines designed to demonstrate a technology of quieter operation and cleaner exhaust for future general aviation aircraft has been delivered to NASA for performance and acoustical testing.

The engine was developed and initially tested by AVCO Lycoming Division of AVCO Corp., Stratford, CT under direction of aeronautical engineers at NASA's Lewis Research Center, Cleveland.

The first engine in the program, known as QCGAT, for quiet, clean, general aviation turbofan, was delivered to Lewis last winter by its designer/builder Garrett AiResearch Manufacturing Co., Phoenix, AR.

Preliminary results from the newly arrived AVCO engine indicate flyover noise level reduction of at least 14 dB as compared to the quietest business jet now in service, said G. Keith Sievers, project manager at Lewis. "This lower level of noise," he said, "would produce a noise 'footprint' on the ground of less than one-tenth that produced by the quietest business jet now flying."

Noise reductions were achieved in the AVCO engine through improved acoustical design of internal engine parts – including use of sound-absorbing materials to muffle fan, compressor and turbine noise – and reduced engine exhaust velocity.

Test results from the AiResearch engine showed flyover noise reduction of approximately 10 dB and exhaust emission reductions compared to current engines of 54 percent and 76 percent for carbon monoxide and unburned hydrocarbons, respectively. Emissions from the AVCO engine are even lower.

Overall objective of the NASA project is to demonstrate adaptability of large turbofan engine technology to smaller general aviation turbofan engines. Specific goals are to achieve major decreases in noise and exhaust emissions while maintaining or reducing fuel consumption as compared with present day general aviation turbofans.

"Test results to date for both engines have clearly demonstrated that noise need not be a major constraint on the future growth of turbofan-powered aircraft in general aviation," Sievers said.

NANCO Names Officials

Three new directors will be chosen by members of the National Association of Noise Control Officials (NANCO) in a mail election now underway. They will take office January 1, 1980. The seven noise control officials nominated for the three positions include: Dr. Paul Herman, City of Portland, Oregon; John S. Moore, State of Illinois; Miles B. Orton, City of Albuquerque, New Mexico; David E. Saunders, State of Washington; Samuel Stempler, New York City; John W. Swing, State of California; Dr. William J. Webster, State of New York.

NANCO directors are chosen for three-year terms, with three board positions rotating each year. Directors who will continue in office are President-elect James V. Adams of Boulder, Colorado; James E. Dukes, San Diego; and Al Perez, Minnesota, whose terms run through 1981; and Edward J. DiPolvere of New Jersey, John Hector of Oregon, and Richard B. Ranck Jr., Salt Lake City, serving through 1980.

The directors, at their first meeting in 1980, will elect those among them who will serve as president-elect, Secretary, Treasurer of the Association.

NANCO is completing its first full year of work and the current officers and directors all are charter members of the Association, which was incorporated in 1978. The association was founded to establish and maintain a forum through which personnel of State and local agencies charged with the administration of laws regulating environmental noise, and others interested in the control of noise pollution could unite. NANCO'S office is in Fort Walton Beach, Florida.

Ear and Hearing Journal

The Journal of the American Auditory Society will change its name, editor, editorial thrust, and format beginning January 1st, 1980. The new journal, named *Ear and Hearing*, will now be edited by Ross J. Roeser, Ph.D., Chief of Audiology, Callier Center for Communication Disorders/UTD, Dallas, TX.

Ear and Hearing is designed principally for the practicing clinician/physician/educator who is dealing with the assessment, diagnosis, and management of auditory disorders. As such the journal will be of primary interest to audiologists, otologists, educators of the hearing impaired, and those involved in the design and manufacturing of hearing aids. The overall goal of the journal is in direct harmony with the aims of the American Auditory Society: to increase knowledge of human hearing, to promote conservation of hearing, and to foster habilitation and rehabilitation of the hearing impaired. The journal will translate current research data into clinical concepts.

The new journal will be published bimonthly (6 issues per year). Members of the American Auditory Society will receive the publication as part of their annual dues, but subscriptions may also be purchased directly from the publisher, Williams and Wilkins Company (428 E. Preston Street, Baltimore, MD 21202).

Featured in the new publication will be up to date submitted manuscripts on clinically relevant topics, as well as regular sections that will be edited by well known scholars. The list of Section Editors includes AAS members: Phillip A. Bellefleur, Ph.D., Henry M. Carder, M.D., J. Donald Harris, Ph.D., Robert W. Keith, Ph.D., Todd Porter, M.A., F. Blair Simmons, M.D., John C. Sinclair, Ph.D., and W. Dix Ward, Ph.D.

Papers are now being accepted for Volume I. Authors with manuscripts are invited to send four copies to: Ross J. Roeser, Ph.D., Editor, *Ear and Hearing*, 1966 Inwood Road, Dallas, TX 75235.

Kistler Opens New Plant

Kistler Instrument Corporation, affiliate of the international organization, Kistler Instrumente AG, headquartered in Winterthur, Switzerland, has been re-established on the American scene as a complete and self-contained manufacturing facility, it was announced by Ronald F. Lochocki, vice president, marketing and administration. The new plant offices are located at 75 John Glenn Drive, Amherst, NY.

Mr. Lochocki points out that the original Kistler Instrument Corporation, establihed in 1953 and most recently located in Clarence, NY, had been sold in 1970 to Sundstrand Data Control of Redmond, WA. Since 1972, until Kistler's present re-establishment in the U.S.A., the Swiss-made piezoelectric instruments of Kistler Instrumente AG have been distributed and serviced through its American service and stocking subsidiary, Kristal Instrument Corporation, Grand Island, NY, explained Mr. Lochocki, adding that Kristal was absorbed and concluded by Kistler when its original dynamic instrument lines were re-acquired from Sundstrand earlier this year.

The new plant is reported to be already in full production of the complete instrument line formerly manufactured by Kistler of Clarence and later by Sundstrand Data Control: quartz transducers for pressure, force and acceleration; as well as a complete line of associated electronics. In addition, it is noted, Kistler U.S.A. will continue to provide from stock and with full service, high temperature transducers, piezoresistive transducers, multi-component force transducers, dynamometers, and platforms, manufactured by the company's Swiss affiliate.

sound and vibration

THE NOISE AND VIBRATION CONTROL MAGAZINE

Noise and Vibration Control • Dynamic Measurement Instrumentation Hearing Conservation • Dynamic Environmental Testing Architectural Acoustics

DECEMBER 1979 **VOLUME 13/NUMBER 12**

Editorial

Features

Departments

Cover

Transport Canada's noise monitoring vehicle at Vancouver International Airport. The vehicle is used to monitor environmental noise around the airport and at other locations (see "Transport Canada's Noise Monitoring Vehicle," page 6). *(Photo courtesy of Transport Canada, Vancouver, British Columbia.)*

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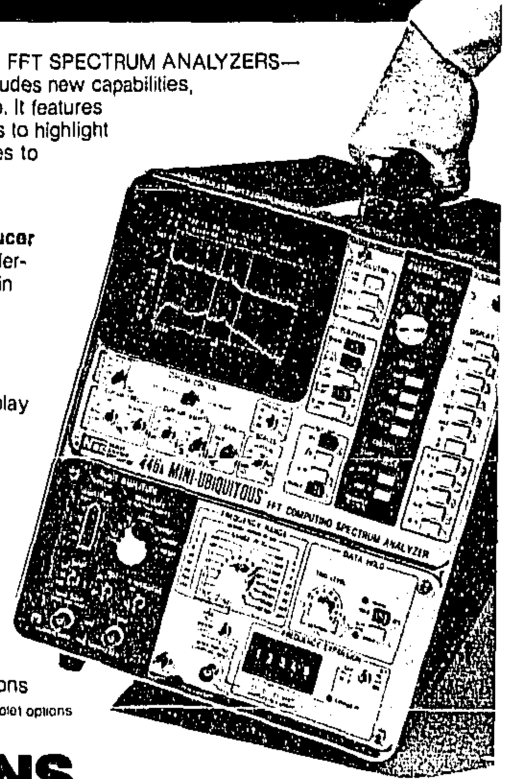

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Editorial

The Filtering Down Process

The filtering down process is a concept typically identified with housing supply and demand. However, it has applicability to the acoustical community. This theory suggests that housing stock is available to the market as a function of economic demand. Generally the higher income groups benefit first from new housing stock on the open market. Over time, this housing "filters down" to lower and lower economic groups. Ultimately, a house reaches the end of its productivity cycle and is removed from the inventory or is recycled vis-a-vis preservation, restoration or rehabilitation.

This filtering down process has major implications for products we produce and use in terms of noise generation and impact. In this regard, there are two components to examine, the product itself and the user.

Product. Most products at the initial point of sale are at their optimal condition. In this state, they should be in excellent repair. From a noise perspective, the item has been subject to a manufacturing product emission standard, existing law, or hopefully engineered to minimize noise. With time, the product will age and maintenance will be required to insure efficiency, and as part of filtering down ownership will change. Depending upon the product's age, use, condition and level of maintenance, the possibility of noise emission will increase. Typically a product will ultimately reside in the hands of those less able to afford to maintain and operate it properly.

Such a product cycle has occurred frequently. For example, in many countries certain earlier generation aircraft that were often noise producers are sold to less "developed countries." This filtering down process can result in exporting potential noise generators, no longer acceptable in the U.S., to third world countries. Therefore, levels of noise unacceptable in country A are not terminated with the introduction of quieter aircraft but are rather transferred to country B. A product does not have to be exported to generate an impact. Many pieces of transportation and construction equipment ultimately are in the hands of those that do not or cannot maintain standards of product efficiency. Consequently, even though their economic life cycle is not complete, the noise level does increase.

Receiver. Historically, most transportation related projects follow the path of least resistance. Whether it be an airport, highway, etc., it has been common to impact those residences generally of lower economic status. As the filter down process has demonstrated, those most impacted by housing condition are least able to afford alternative housing. This population segment (e.g. low income and elderly) is land locked. These people have been less interested in environmental issues in general. Other issues have priority (e.g. housing, employment, human services) and environmental advocacy is not in their lexicon.

As environmentalists we need to understand the filtering down process in order that we are sensitive to the needs of all groups. We can assist in insuring that environmental noise does not place an undue burden on any social or economic group.

Clifford R. Bragdon
Contributing Editor

S)V Observer

Transport Canada's Noise Monitoring Vehicle

A noise monitoring vehicle is being used by Transport Canada, Vancouver, British Columbia, to monitor environmental noise around Vancouver International Airport and other locations within their Pacific Region (see front cover).

The noise monitoring program has been designed to monitor aviation-related noise in the communities surrounding Federally-operated airports. Before steps can be taken to reduce the impact of aviation-related noise, present noise levels associated with the various aviation activities must be measured.

A number of noise monitoring projects have been set up to gather basic noise data required for further action. They include:

1. Continually updating the noise data collected and analyzed in 1973-74, and again in 1978, for the Vancouver International Airport Planning Committee.
2. Monitoring nighttime noise levels caused by authorized flights.
3. Monitoring noise levels around the clock to establish baseline data for assessing the effectiveness of current and future noise abatement and mitigation procedures.
4. Monitoring final approach and take-off noise levels to check for proper implementation of noise abatement procedures.
5. Monitoring day and night engine run-up noise levels.

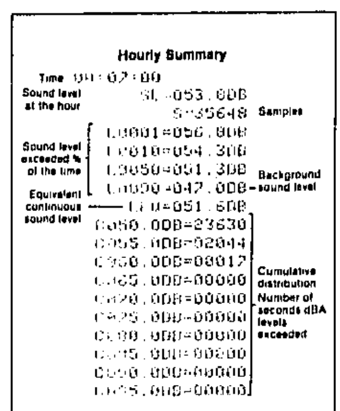
In addition when time and availability of staff and equipment permit, the noise monitoring program may conduct before and after assessments of noise levels in a building which has been acoustically treated or has used other measures to reduce indoor noise levels caused by outside aviation related activities.

The Transport Canada noise monitoring vehicle is a specially-equipped 12 foot van. It is outfitted with electronic noise monitoring instrumentation, and is also equipped to provide accommodation for the operator for lengthy periods.

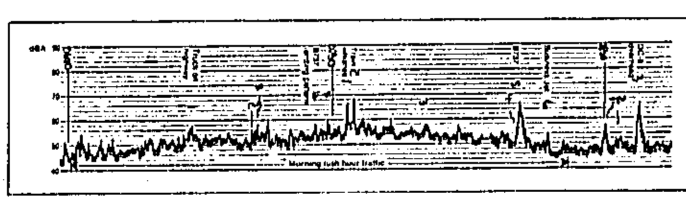
The vehicle is powered by several sources including a self-contained, gas powered generator and auxiliary batteries permitting operation for periods of 24 hours or more. The vehicle can also utilize a 110 volt household outlet, thus providing continuous operation.

The output of roof-top, or tripod-mounted outdoor microphone system is fed to analysis instrumentation located inside the vehicle. A noise level analyzer and mini computer samples the input signals at a rate of 36,000 times per hour. The analyzer provides a direct read out in digital form of the sound levels. It can perform on-the-spot statistical analysis of data recorded during the past hour. The sound level data are then displayed on a strip chart recorder which gives a permanent, continuous recording of the sound level variations. Once per hour the analyzer feeds all the data in its memory to a digital printer which provides a permanent record of the statistical analysis for the preceding hour. The information provided includes: L_{eq}, length of time various sound levels are exceeded, and levels exceeded for a given percentage of time.

Air and ground communications can be monitored to correlate all air traffic instructions and actual operations of individual aircraft with the sound levels recorded by the instrumentation. The communications equipment can also be used to assist in identifying particular aircraft or to obtain information on their actual position or height. S)V



Typical statistical summary of measured environmental noise data.



Typical graphical record of environmental noise from 0600 to 0800 hours.

Our Authors

The article "EPA's Implementation of the Quiet Communities Act of 1978" was coauthored by John M. Ropes and Donna Williamson of the U.S. Environmental Protection Agency, Washington, D.C.

Mr. Ropes is the Director of the State and Local Programs Division of the Office of Noise Abatement and Control. He formerly was Assistant Director of the Office of Federal Activities, USEPA; Administrative Assistant to Governor Harold E. Hughes of Iowa; and a member and Chairman of the Iowa State Commerce Commission. In his current capacity, Mr. Ropes is responsible for the development and expansion of State and local noise control programs, public education activities, noise control demonstration programs, and airport noise control planning projects. He received his B.A. and M.S. degrees from Drake University, Des Moines, IA.

Ms. Williamson is an Environmental Protection Specialist in EPA's State and Local Programs Division. On the staff of the Technical Assistance Branch, she has been Project Officer for the National ECHO (Each Community Helps Others) program and participated in the implementation of the Quiet Communities Act grants program. Ms. Williamson was formerly in EPA's Region II Noise Office (New York, New Jersey area), with' the State of Connecticut Office of Noise Control, and the City of Boston Air Pollution and Noise Control Commission.

The article "Correlations Between Noise and Air Pollution" was coauthored by Rufin Makarewicz and Alex E. S. Green of the University of Florida, Gainesville FL.

Makarewicz, at the time this article was authored, was a Visiting Adjunct Professor, Department of Physics and Astronomy, at the University of Florida. He received his Ph.D. from the A. Mickiewicz University in Poznan, Poland, and is the author of two books and over 25 articles. Dr. Makarewicz has returned to the A. Mickiewicz University in his former capacity of Professor of Acoustics.

Green is a Graduate Research Professor of Physics, Nuclear Engineering Sciences, and Director of the Interdisciplinary Center for Aeronomy and (other) Atmospheric Sciences. He was previously Chief of Physics and Space Sciences of General Dynamics, Convair. Green received his Ph.D. from the University of Cincinnati in 1948, his M.S. from Cal Tech in 1941, and his B.S. from CCNY in 1940. He is the author or coauthor of five books or monographs and over 260 scientific articles in the fields of nuclear, atomic, atmospheric, radiation, and environmental physics, and on socio-economics.

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E·A·RLOG

second in a comprehensive series of technical monographs covering topics related to hearing and hearing protection.

Single Number Measures of Hearing Protector Noise Reduction

BY ELLIOTT H. BERGER,
Manager Acoustical Engineering, E·A·R[*] Corporation

In EARLog #1[1] we discussed the threshold shift method of measuring hearing protector attenuation. The results of such a laboratory hearing protector test consist of attenuation and standard deviation values at nine frequencies. Reduction of this data to a single number rating provides a simple and efficient means of choosing hearing protection devices and determining their suitability for particular applications. This EARLog will discuss single number ratings, their accuracy, calculation, and utilization.

The most accurate method of determining an employee's noise exposure under the protector (effective exposure) is to utilize an octave band analysis of the actual sound spectrum to which the employee is exposed, in conjunction with the attenuation and standard deviation data mentioned above. This will be labeled the long method.[2,3] It involves computations similar to those necessary to determine a device's single number rating. The long method noise reduction must be individually calculated for each noise environment, whereas the single number rating provides a noise reduction value that can be supplied by the manufacturer and simply subtracted from the measured A or C-weighted sound level in question.

There have been at least eleven[4] single number rating descriptors proposed since 1970. Johnson[5] and Waugh[6] among others have statistically evaluated the accuracy of these ratings vs. the long method by examining the resulting predictions for large numbers of industrial noise spectra. The data indicate that a good single number rating scheme will provide a successful compromise between under-protecting a minority and over-protecting a majority of wearers in most environments.

The Noise Reduction Rating (NRR)

The Noise Reduction Rating (NRR)[7], a variant of the NIOSH R_c factor[8], is the current EPA proposed single number descriptor. A sample NRR calculation is demonstrated in Table 1. The key point to consider is that the NRR is subtracted from the measured (unprotected) C-weighted sound level to yield an effective A-weighted sound exposure for the employee. The idea of subtracting a noise reduction factor from a C-weighted sound level to find an A-weighted exposure was first proposed by Botsford[9] in 1973. This "C-A concept" is the important common ingredient in all of the successful single number descriptors proposed in recent years.[10,11]

As can be seen in Table 1, the NRR is the difference between the overall C-weighted sound level of a pink (flat by octaves) noise spectrum and the resulting A-weighted noise levels under the protector. The attenuation values used in the calculation are the measured laboratory attenuation values minus two standard deviations. This correction assures that the attenuation values used in the calculation procedure are actually realizable by the majority of employees who conscientiously and correctly wear their protectors. This correction will not account for employee misuse or abuse of the protectors.

TABLE 1 - HOW TO CALCULATE THE NRR

Octave Band Frequency (Hz)	125	250	500	1000	2000	4000	8000
1. Hypothetical noise spectrum OB† sound levels (pink noise) (level assumed is not significant)	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2. C-weighted OB sound levels unprotected ear	99.8	100.0	100.0	100.0	99.8	99.2	97.0
4. A-weighted OB sound levels unprotected ear	83.9	91.4	96.8	100.0	101.2	101.0	98.9
5. E·A·R™ Plug mean attenuation	29.6	31.3	34.1	34.0	35.5	41.4*	39.6**
6. E·A·R™ Plug standard deviations x 2	6.4	6.6	4.2	4.6	5.4	3.9*	4.8**
7. Protected A-weighted OB sound levels [Step 4 − Step 5 + Step 6]	60.7	66.7	66.9	70.6	71.1	63.5	64.1

3. Overall C-weighted sound level 108.0 dBC (logarithmic sum of the seven OB sound levels in step 2)

8. Overall A-weighted sound level under the protector (effective exposure) - - 76.0 dBA (logarithmic sum of the seven OB sound levels in step 7)

9. NRR = Step 3 − Step 8 − 3 dB††
NRR = 108.0 − 76.0 − 3 = **29 dB**

†OB-Octave band.

††This is a correction (safety) factor to protect against over estimating the device's noise reduction because of possible variations in the spectra of actual industrial noises.

*Numerical average of the 3000 Hz and 4000 Hz data.

**Numerical average of the 6000 Hz and 8000 Hz data.

NOTE: The EPA Noise Labeling Requirements for Hearing Protectors have just been issued. All hearing protectors will have to be labeled with a Noise Reduction Rating (NRR). The following discussion deals with the NRR, its meaning and utilization.

ATTENTUATION DATA FOR THREE TYPES OF HEARING PROTECTORS[16] (ANSI S3.19)

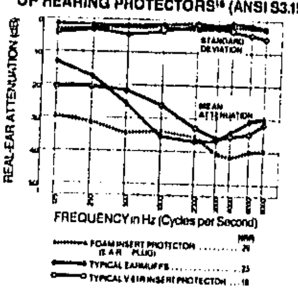

FIGURE 1

In Figure 1, the ANSI S3.19 laboratory data for three protectors are plotted. The associated NRRs are listed at the bottom of the graph. Although the NRR is most correctly computed using ANSI S3.19 (noise band) data, it can be useful to look at the range of NRRs computed from ANSI Z24.22 (pure tone) data since this is available in an existing NIOSH document.[8] The range is approximately 7-31. The NRR = 31 is the value for E-A-R™ Plugs tested according to ANSI Z24.22. That it is higher than the currently reported (ANSI S3.19) E-A-R™ Plug NRR of 29 is due primarily to laboratory testing variability.

Further perspective on the meaning of NRR values can be gained by calculating the maximum theoretical NRR possible. Zwislocki[12] has conducted considerable experimentation to determine bone conduction thresholds, i.e., if the ear were perfectly sealed and covered, how effectively could a device attenuate noise before sound conducted through the skull itself would become audible? Calculations based on this data, assuming a very low standard deviation of 1.5 dB at each frequency, yield an NRR of 45. To the best of our knowledge, the highest NRR ever measured on a production protector was found in a 1978 test of E-A-R™ Plugs. It was 34, or about 5 dB greater than the currently reported (conservative) E-A-R™ Plug attenuation data.

How to Use the NRR

As previously mentioned, the NRR is a dB noise reduction value that must be subtracted from the measured dBC sound level in the workplace. Thus we have:

Effective exposure (dBA) =
noise level (dBC) – NRR

According to existing federal regulations, employee noise exposure must be limited to an equivalent level of 90 dBA for 8 hours. Nevertheless there is ample data to substantiate the fact that levels of 85 dBA will not be innocuous to all people.[13,14] Furthermore it is likely that many employees will not fit hearing protectors as carefully as do laboratory subjects. Therefore we suggest targeting for an 80 dBA effective exposure level. Thus for the protectors illustrated in Figure 1 the values in Table 2 are our suggested maximum workplace noise levels for 8 hour exposures.

TABLE 2 – Suggested maximum 8 hr. equivalent noise levels for 3 protectors.

Protector	Max. noise level
Foam Insert Protector (E-A-R™ Plug)	109 dBC
Typical Earmuffs	103 dBC
Typical V-51R Insert Protector	98 dBC

Royster and Lilley[15] have recently developed new techniques of evaluating the performance of hearing conservation programs. Analysis of their data verifies that V-51Rs are only marginally suitable for noise levels of ~ 96-98 dBA. On the other hand, informal data, personal communications, and ongoing research indicate that the foam insert protectors (E-A-R™ Plugs) are, as laboratory NRR values would suggest, measurably more effective in actual industrial noise environments.

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16. All data in this graph is from one independent U S testing laboratory.

EPA's Implementation of the Quiet Communities Act of 1978

John M. Ropes, and **Donna L. Williamson**, U.S. Environmental Protection Agency, Washington, D.C.

When the Quiet Communities Act of 1978 was passed, the Environmental Protection Agency immediately set to work implementing the provisions of the new legislation. For the first time, States and local governments had an opportunity to obtain financial assistance for demonstration projects in community noise control programs. A review of the implementation of this aspect of the Quiet Communities is discussed.

The Quiet Communities Act of 1978, passed by Congress and signed by President Carter on November 8, 1978, represents a marked departure from environmental legislation enacted in the early 1970's. The Act does not require standard setting or new regulations. Instead, it supports the encouragement, development and strengthening of State and local noise control programs. It has added a new dimension to the work of the Environmental Protection Agency and EPA is delighted.

Background

In early 1978, the U.S. Senate Subcommittee on Resource Protection (of the Senate Committee on Environment and Public Works) held extensive oversight hearings into EPA's noise control program. Acting under the provisions of the Noise Control Act of 1972, the EPA had placed a major emphasis on standard setting and regulatory efforts as mandated by the Act. Many witnesses at the oversight hearings testified that State and local program efforts needed more attention and assistance from EPA – Federal regulations were not enough. In fact, EPA's technical assistance program was based on a few lines in the sixteen-page Noise Control Act. The legislative "direction" was not a strong one:

§14 (2) Provide technical assistance to State and local governments to facilitate their development and enforcement of ambient noise standards, including but not limited to –
- (A) advice on training of noise control personnel and on selection and operation of noise abatement equipment; and
- (B) preparation of model State or local legislation for noise control.*

In addition, Section 14 called for the dissemination of public information and the conduct of noise research.

The Senate Subcommittee, chaired by Senator John Culver, felt that a stronger approach to the development of effective state and local programs was needed. Where such programs exist, the public has received better noise control services than would have been possible through Federal regulations alone. A major side benefit occurs when State and local programs complement Federal activity, resulting in a substantial increase in the effectiveness of EPA's noise regulations.

While EPA's regulatory efforts were moving along, Senator Culver felt that the time was right for Congress to provide a better framework, a clearer direction to EPA in its efforts to encourage and assist States and local governments in assuming a stronger role in noise control. At the oversight hearings in Des Moines, Iowa, Senator Culver said:

"We must recognize that the development of regulations may be necessary to reduce noise pollution and provide for a healthy environment. However, controlling noise is a difficult task that requires a comprehensive, coordinated effort by all segments of society and at all levels of government. Only through such an effort will we finally be able to tackle the worthwhile objective of reducing excessive noise levels.

"Major successes have been made in some communities and States, and this progress must be fully recognized. In the end, perhaps the real job of noise abatement should rest with the State and local governments, with the support and involvement of citizens like you who are here today."

The Quiet Communities Act is the result of testimony received at the oversight hearings and the work of Senator Culver and other members of the Senate Subcommittee on Resource protection. The Act is a series of amendments which include a major expansion of the technical assistance provisions under Section 14.

The New Act

The Quiet Communities Act amendments have added a new vitality to EPA's technical assistance effort. The Act provides for the encouragement and promotion of State and local noise control programs and authorizes a major EPA effort in this area. A few highlights of the Act include:

- ☐ Financial assistance to States, local governments and regional planning agencies to investigate existing noise problems, plan and develop a noise control capacity, purchase initial equipment, evaluate noise control techniques and develop abatement plans.
- ☐ Conduct or finance research on physiological and psychological effects of noise on humans with special emphasis on the non-auditory effects of noise.
- ☐ Administer a nationwide Quiet Communities program including grants, loan of equipment to states and local governments, development of a quality assurance program for equipment and monitoring procedures, study and conduct demonstrations to determine resource and personnel needs of States and local governments, and develop educational and training materials and programs including national and regional workshops.
- ☐ Provide technical assistance to States and local governments to facilitate the development and enforcement of noise control, including direct on-site assistance.
- ☐ Establish regional technical assistance centers through universities and private organizations to assist State and local noise control programs.
- ☐ Provide for maximum use of senior citizens as defined by the Older Americans Act in programs developed under this Act.
- ☐ Assist in the development of abatement plans for areas around major transportation facilities including airports, highways, and railyards.

Also included was an authorization for increased EPA funding for the new programs outlined in the Act. Unfortunately, authorization came too late in the Federal appropriation and budgeting process to allow for additional funds for financial assistance projects. In order to implement the grants program and other aspects of the new Act, EPA's existing budget was reshaped by eliminating some previously planned projects and diverting the monies to grants. A "grants assistance" staff was assembled from within the State and Local Programs Division and the grants program was quickly

*P.L. 92-574, Noise Control Act of 1972

but firmly established. The provisions of the Act gave EPA greater opportunities to implement a healthy technical and financial assistance program; we wasted no time getting it started.

Grants Equal Cooperative Agreements

A decision was made early in the grants process to provide assistance in the form of cooperative agreements rather than grants. The cooperative agreement functions like a grant in all respects except one – EPA is allowed to assist and participate. Grants do not provide for this type of program support. All applicants were aware of the nature of the cooperative agreement and it appeared to be the best and most effective way to proceed. In addition, all EPA grants require the commitment, in dollars or in-kind services, of at least 5% of the total funding request. Informal criteria included a commitment to continue the noise control effort after Federal assistance had ceased.

It was not a surprise to us that many States and communities were in need of financial assistance to fan the sparks of an emerging noise control program or to add a crucial element to a barebones operation. Noise control programs have for years been under-funded and subject to elimination when municipal or State budgets need paring. It was a surprise, however, that so many applied for assistance in such a short time for relatively limited funding. By the deadline of May 15th, EPA had received 108 applications. Twenty States and forty-two communities applied for initial implementation or capacity building assistance. There were twenty applications for Regional Technical Assistance Centers and twenty-six applications for demonstration projects.

The awards were made by the end of August. One Technical Assistance Center (TechCenter) was selected in each Region to serve all States and communities in the Region and to operate under the direction of EPA's Regional Noise Program Chief. Each TechCenter is funded at a level of approximately $90,000 for an eighteen-month period and is intended to expand the capacities of the Regional staff to aid States and communities. Training of local officials and delivery of technical assistance are the prime objectives. The locations of the TechCenters are shown in Figure 1.

Fourteen States, one state League of Cities and one Council of Governments received cooperative agreements. The projects that were funded included the training of local law enforcement officers, the development and implementation of State ECHO** programs, an effort to determine the needs of residents and communities for State-wide noise control services, the expansion of State motor vehicle noise enforcement and the assessment of noise levels within a State. Several new State programs will be developed and fifteen of the grantees will be delivering direct technical assistance to communities within their States. The States receiving awards are shown in Table 1 and the structures of the agreements are shown in Figure 2.

EPA is providing funding to twelve local governments for projects which initiate noise programs or add elements to existing ones. Examples of these include the development of a motor vehicle noise abatement program in Kingsport, Tennessee and policy and strategy development in Boise, Idaho. In Massachusetts, the Town of Brookline and the City of Newton will work on an inter-community program to identify and develop noise control techniques useful to both communities. We expect that the results of the local cooperative agreement projects will be useful in many other communities. A list of these awards is shown in Table 2.

A number of exciting demonstration projects are being funded in 1979. Four awards are going to projects which will further the Urban Initiatives Program announced by President Carter in his August 2, 1979 Environmental Message. These

**ECHO: Each Community Helps Others, a volunteer peer-matching program where an official with noise expertise in one community helps another community experiencing noise problems.

Region 1: *Maine, New Hampshire, Vermont, Massachusetts, Connecticut, Rhode Island*
University of Hartford
College of Engineering
200 Bloomfield Avenue
Hartford, CT 06117

Region 2: *New York, New Jersey, Puerto Rico, Virgin Islands*
Rutgers University
Cook College
P.O. Box 231
New Brunswick, NJ 08902

Region 3: *Pennsylvania, Delaware, Maryland, Virginia, West Virginia, District of Columbia*
University of Maryland
Department of Mechanical Engineering
2119 Engineering Building
College Park, MD 20742

Region 4: *North Carolina, South Carolina, Kentucky, Tennessee Florida, Georgia, Alabama, Mississippi*
North Carolina State University
Mechanical and Aerospace Engineering Department
Center for Acoustical Studies
Box 5801
Raleigh, NC 27650

Region 5: *Ohio, Indiana, Illinois, Wisconsin, Michigan, Minnesota*
Illinois Institute of Technology Research Institute
Engineering Division
10 West 35th Street
Chicago, IL 60616

Region 6: *New Mexico, Texas, Oklahoma, Arkansas, Louisiana*
University of Texas at Dallas
Graduate Program in Environmental Sciences
P.O. Box 688
Mail Station BE 22
Richardson, TX 75080

Region 7: *Iowa, Kansas, Nebraska, Missouri*
University of Iowa
Wendell Johnson Speech and Hearing Center
Iowa City, IA 52242

Region 8: *Montana, North Dakota, South Dakota, Wyoming, Colorado, Utah*
University of Colorado
Department of Aerospace and Engineering Sciences
Boulder, CO 80309

Region 9: *California, Arizona, Nevada, Hawaii, Pacific Trust*
University of California at Berkeley
c/o Campus Research Office
M 11 Wheeler Hall
Berkeley, CA 94720

Region 10: *Washington, Oregon, Alaska, Idaho*
University of Washington
Seattle, WA 98195

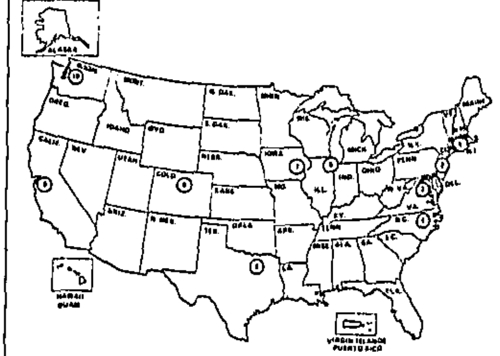

Figure 1. Regional Noise Technical Assistance Centers.

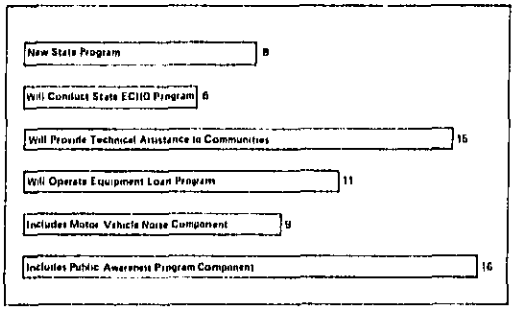

Figure 2. State cooperative agreements: characteristics and components.

include an award to the National Association of Neighborhoods for a "Quiet Neighborhood Self-Help Project" which will build the capacity of individual neighborhoods to address their own noise problems and an award to the National Institute of Governmental Purchasing which will organize a market for quiet products through State and local government "Buy Quiet" procurement practices. These projects have potential application across the United States and we are looking forward to evaluating their progress and results.

Five other demonstration awards were made and include highway noise abatement planning and developing simple but effective motor vehicle noise enforcement techniques in urban areas. In addition, an award was made to the Delaware Valley Regional Planning Commission to determine the severity of the aircraft noise problem around Philadelphia International Airport, to determine alternate solutions to that problem and to present the findings to local community officials and the airport authority. A listing of demonstration projects is included in Table 3.

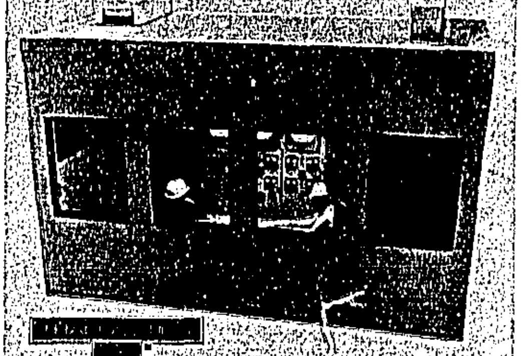

Table 1. State cooperative agreement awards.

1. California	$28,000
2. Colorado	27,990
3. Connecticut	35,644
4. Delaware	25,000
5. Florida	45,080
6. Metropolitan Washington Council of Governments*	42,750
7. League of Minnesota Cities*	38,000
8. Nebraska	26,473
9. New Hampshire	25,000
10. New Jersey	35,109
11. New Mexico	17,000
12. North Dakota	28,008
13. Ohio	27,293
14. Oregon	28,414
15. Utah	25,000
16. Washington	30,000

*These awards include a regional planning agency which covers two States and the District of Columbia and a league of cities which has state-wide functions.

Table 2. Local cooperative agreement awards.

1. Brookline/Newton, MA	$12,000
2. Stamford, CT	12,170
3. Teaneck, NJ	14,250
4. York, PA	9,279
5. Kingsport, TN	9,500
6. Mentor, OH	2,200
7. Akron, OH	12,000
8. Norman, OK	12,000
9. St. Louis County, MO	10,000
10. Thornton, CO	7,600
11. National City, CA	12,000
12. Boise, ID	14,172

Table 3. Demonstration cooperative agreements.

1. New Orleans, LA	$49,774
2. Des Moines, IA	28,297
3. Massachusetts Port Authority	31,610
4. National Association of Neighborhoods	35,474
5. Portland, OR	11,414
6. National Institute of Governmental Purchasing	60,000
7. State of New Jersey	34,440
8. State of Oregon	33,978
9. Chicago, IL	24,035
10. Delaware Valley Regional Planning Commission	130,000

Other Activities

Another program that EPA has developed to implement the Quiet Communities Act is the Urban Noise Counselor Program. The counselors seek to promote community noise control through local self-help programs.

Public education programs, curricula development, "Quiet School" programs and other information and education activities are also designed to give primary emphasis to the development of State and local program capacities and resources.

A New Beginning

Of course, programs we started years ago, the Quiet Communities projects in Allentown, Pennsylvania; Spokane, Washington; and Kansas City, Missouri; National ECHO and others, will continue. We are also developing the LISTEN program to give computer support to communities conducting attitude and acoustic surveys. However, the passage and enactment last Fall of the Quiet Communities Act has opened a new realm of technical assistance to EPA. States and local governments are increasingly concerned about the detrimental effects of noise and are demonstrating that concern. The Quiet Communities Act came at a time of new and exciting movement in the noise control community and provides meaningful support.

Robert Alex Baron, author of *The Tyranny of Noise*, has called the people who work in noise control "pioneers." We agree. It has been a special challenge to work in a field that has yet to excite wide public interest. But we think that the Quiet Communities Act will go a long way to make our "pioneer" days a fond remembrance and lead us to greater achievements.

Correlations Between Noise and Air Pollution

Rufin Makarowicz and **Alex E. S. Green**, University of Florida, Gainesville, Florida

The correlation between noise and carbon monoxide (CO) levels within any urban area is discussed. Both types of pollutants have their source in motor vehicles. After establishing a relation between their temporal values, the dependence of the day-night noise level L_{dn} upon the average day-night CO level, and space average density as one of the macroscopic urban parameters is developed. Finally, a direct relation is established between L_{dn} and an air quality index previously developed.

In a broad sense air pollution may be considered from both chemical and physical (e.g. unwanted sound or noise) points of view. In 15-20 years since noise was first recognized as a serious environmental pollutant, a number of surveys have been conducted in order to assess the magnitude of the problem and to identify the major sources of noise pollution.

Surface transportation, particularly motor vehicles, has been reported as the most evident contributor to environmental noise. On the other hand, a great amount of chemical pollution is emitted by automobiles. These exhausts include unburned hydrocarbons (HC), oxides of nitrogen (NO_x), oxides of sulfur and above all, carbon monoxide (CO). Thus some correlation between noise and air pollution within urban areas might be expected.

"Pulse" of Noise and Air Pollution. Because noise and the above named air pollutants are associated in principle with the same source, their temporal variations should be related to each other.

Average hourly noise levels measured at a few points within Tampa, FL[1,2] were used to determine space average noise levels (expressed in dBA):

$$L_i = 1/N \sum_{j=1}^{N} L^{(j)}(t_i) \text{ for } t_i = 1{:}00 \ldots 11{:}00\text{am} \ldots 11{:}00\text{pm} \quad (1)$$

where $N = 7$ is a number of measuring points. The set of values L_i represents the day-night changes of noise for the entire town (solid line, Figures 1,2).

Taking into account average hourly air pollution levels,[2] by the same procedure (Eq. 1), we get space average air pollution levels I_i (dashed line, Figures 1,2).

Both space average values L_i and I_i do not characterize local levels of pollutants, but describe the quality of environment of the entire region covered by the array of measuring points, i.e. corresponding to the whole town.

It is seen that temporal variations of CO are similar to noise level changes (Figure 1). This is not true for the other pollutants such as HC, NO_x, etc. (Figure 2).

Because Tampa is rather typical of cities with a population of a few hundred thousand, this conclusion seems to be valid for other urban regions of the same character.

Correlation Between Space Average Noise and Air Pollution. The same "pulse" of noise and CO levels (Figure 1) means that the energy associated with space average noise level $10^{0.1L_i}$ should be a linear function of the space average CO level:

$$10^{0.1L_i} = aI_i + b \quad (2)$$

To estimate values a and b we apply linear regression analysis (LRA). Making use of data from Figure 1 we obtain $a = 2.42 \cdot 10^6$ and $b = -2.27 \cdot 10^6$ with the correlation coefficient $r = 0.79$ which indicates that function (2) fits these data very well.

It is seen (Figure 2) that temporal correlation between space average noise levels and space average HC levels do not exist. Indeed, LRA gives in this case $r \sim 0.3$. This fact may be explained by the presence of HC from sources other than automobiles. The same sources are responsible for poor correlations between noise and other chemical pollutants such as NO_x, SO_2, O_3 etc.

Relation Between Average Day-Night Noise and Pollution. Figure 1 shows the variations of noise and CO pollution for 24 hours. To compare changes of the environmental quality "from day to day" it is desirable to use some procedure leading to a "one number description" of both time patterns. To this end let us start from the definition of the equivalent level L_{eq} which is one of the accepted noise indexes:

$$L_{eq} = 10 \log 1/24 \sum_{i=1}^{24} 10^{0.1L_i} \quad (3)$$

where L_i is a space average noise level (Eq. 1) for the i-th hour.

In view of Eqs. (2,3) with the numerical values of a and b (Part 3) we obtain

$$1/24 \sum_{i=1}^{24} 10^{0.1L_i} = 2.42 \cdot 10^6 \times \bar{I} - 2.27 \cdot 10^6 \quad (4)$$

where

$$\bar{I} = 1/24 \sum_{i=1}^{24} I_i \quad (5)$$

is an average day-night CO level.

Substitution of Eq. (4) into Eq. (3) yields

$$L_{eq} = 10 \log (2.24 \cdot 10^6 \bar{I} - 2.27 \cdot 10^6) \quad (6)$$

In the United States, noise pollution is rarely evaluated in terms of L_{eq}. The day-night level L_{dn} is more often used as a noise index. To find a relationship between $\bar{L}_{eq}$ and $\bar{L}_{dn}$ characterizing the space average noise pollution for entire towns, we make use of noise measurements performed by Galloway, McK.Eldred and Simpson.[3] Application of LRA gives:

$$\bar{L}_{dn} = 0.98\, \bar{L}_{eq} + 4.4 \quad \text{with } r = 0.97 \quad (7)$$

From Eqs. (6,7) we obtain (Figure 3):

$$\bar{L}_{dn} = 9.8 \log (2.42\bar{I} - 2.27) + 63.2 \quad [\text{dB}] \quad (8)$$

and by simple algebra

$$\bar{I} = 1/2.42\; 10^{(\bar{L}_{dn}/9.8 - 6.45)} + 0.94 \quad [\text{ppm}] \quad (9)$$

where $\bar{I}_{co}$ is the average day-night CO level (Eq. 5) and $\bar{L}_{dn}$ is space average L_{dn}:

$$\bar{L}_{dn} = 1/N \sum_{j=1}^{N} L_{dn}^{(j)} \quad (10)$$

Here N is the number of measuring points located within any urban area.

Both values, $\bar{I}_{co}$ and $\bar{L}_{dn}$, describe the environmental quality for the whole region covered by the array of measuring points.

Noise and CO Pollution Versus Average Population Density. From the above mentioned EPA report,[3] we obtain the space average $\bar{L}_{dn}$ (Eq. 10) for a few U.S. towns (Table 1), and using the *U.S. Statistical Abstracts* for 1973 we obtain the average population densities $\bar{\rho}$ for each of these towns. Application of LRA gives:

$$L_{dn} = 0.5266\bar{\rho} + 57.10 \quad \text{with } r = 0.80 \quad (11)$$

Substituion of Eq. (11) into Eq. (9) yields:

$$\bar{I} = 1/2.42 \times 10^{(0.054\bar{\rho} - 0.623)} + 0.94 \quad (12)$$

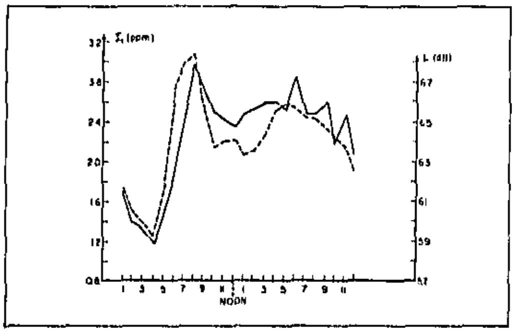

Figure 1. Day-night changes of noise and CO levels.

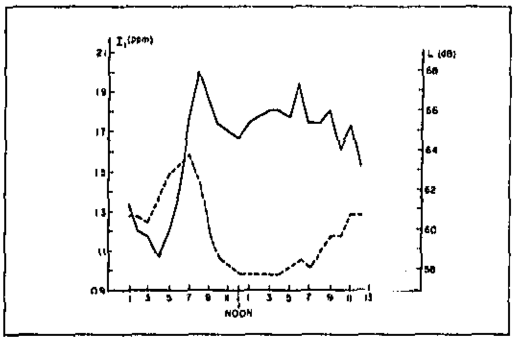

Figure 2. Day-night changes of noise and HC levels.

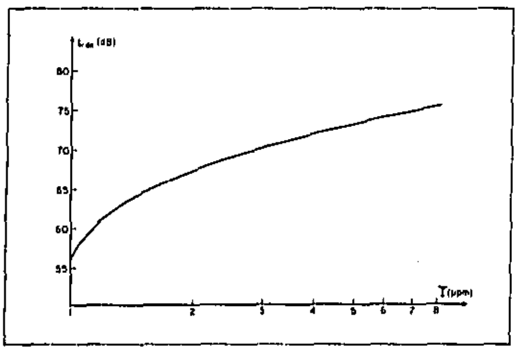

Figure 3. Dependence of space average noise pollution $\bar{L}_{dn}$ upon the space average CO level $\bar{I}$.

It is seen that $\bar{\rho}$, a macroscopic parameter describing any urban area, correlates with space average day-night level $\bar{L}_{dn}$ and then with CO pollution, $\bar{I}$.

Conclusion

To quantify air quality, we may use an air quality index (AQI) developed by the Interdisciplinary Center for Aeronomy and (other) Atmospheric Sciences (ICAAS), which takes into account all major air pollutants. One of them has been developed by Green *et al.*:[4]

$$AQI(ICAAS) = [(\bar{I}/S_{co})^2 + \sum_{i=2} (C_i/S_i)^2 + b_{ij}(C_i/S_i)\,(C_j/S_j)]^{1/2}$$

where $\bar{I}$ and C_i are average day-night CO concentrations and other pollutant levels, S_{co}, S_2, . . . are scale factors, b_{ij} is an interaction term.

In view of Eqs. (9,12) it is clear that AQI may be considered

Table 1. Noise, population and area data for 14 U.S. cities.

	Space Average Day-Night Level $\bar{L}_{dn}$ (dB)	Population (thousands)	Area (mi^2)	Average Population Density (th/mi^2)
Atlanta.	63.42	497	131	3.78
Boston.	62.62	641	46	13.94
Chicago.	65.54	3367	222	15.13
Dallas	60.63	844	265	3.18
Denver.	59.39	515	95	5.40
Kansas City.	58.67	507	316	1.60
Los Angeles.	57.88	2816	464	6.07
Miami	63.45	335	34	9.76
New York.	71.34	7895	300	26.34
Pittsburgh	62.82	520	55	9.42
St. Louis	61.31	622	61	10.17
San Francisco . . .	65.85	716	45	15.76
Seattle	53.67	531	84	6.35
Washington, D.C.	65.82	757	61	12.32

as a function of average density $\bar{\rho}$ or as a function of noise pollution expressed in terms of $\bar{L}_{dn}$:

$$AQI(ICAAS) = [1/5.28 S_{co}^2 \{10^{(\bar{L}_{dn}/9.8 - 6.45)} + 2.27\}^2 + \sum_{i=2} (C_i/S_i)^2 + b_{ij}(C_i/S_i)\,(C_j/S_j)]^{1/2}$$

This formula directly relates noise index $\bar{L}_{dn}$ to an air pollution index AQI(ICAAS).

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State Noise Restrictions: 1979

Fred G. Haag, New York State Department of Environmental Conservation, Albany, New York*

Tables 1, 2 and 3 below update the summary of statewide noise restrictions that was presented in the December 1977 issue of S)V. The criterion for inclusion in the tabulation is for the state to have a sound level limitation expressed in decibels which is applicable throughout the state. Many of the states with a negative response have requirements on noise suppression equipment, chiefly mufflers.

References

1. Personal communication.
2. Noise Regulation Reporter Reference File through Supplement No. 27, November 6, 1978.
3. Personal communication, International Snowmobile Association, October 28, 1977.
4. Personal communication, Boating Industry Association.
5. U.S. Environmental Protection Agency, *Noise Source Regulation in State and Local Noise Ordinances*, February 1975.
6. Noise Regulation Reporter No. 107, June 19, 1978, p. c-1.
7. Motorcycle Industry Council Bulletin GR78-009, March 1, 1978.
8. Noise Regulation Reporter No. 64, October 25, 1976, p. A-2.

*Now with the staff of the New York Public Service Commission.

Table 1. New product sound level limits.

State	On-Road Motor Vehicles	On-Road Motorcycles	Off-Road Motorcycles	Off-Road Vehicles	Snowmobiles	Motorboats
AL	-	No[7]	No[7]	-	No[3]	-
AK	-	No[7]	No[7]	-	No[3]	-
AZ	-	No[7]	No[7]	-	No[3]	-
AR	-	No[7]	No[7]	-	No[3]	-
CA	Yes[2]	Yes[2]	Yes[2]	Yes[2]	Yes[2]	Yes[2]
CO	Yes[2]	Yes[2]	Yes[2]	Yes[2]	Yes[3]	-
CT	-	No[7]	No[7]	-	Yes[3]	Yes[6]
DE	-	No[7]	No[7]	-	No[3]	-
FL	Yes[2]	Yes[2]	No[7]	-	No[3]	-
GA	-	No[7]	No[7]	-	No[3]	-
HI	-	No[7]	No[7]	-	No[3]	-
ID	-	No[7]	No[7]	-	No[3]	-
IL	-	No[7]	No[7]	-	No[3]	-
IN	-	No[7]	No[7]	-	No[3]	-
IA	-	No[7]	No[7]	-	Yes[3]	-
KS	-	No[7]	No[7]	-	No[3]	-
KY	-	No[7]	No[7]	-	No[3]	-
LA	-	No[7]	No[7]	-	No[3]	-
ME	-	No[7]	No[7]	-	Yes[2]	-
MD	-	Yes[7]	No[7]	-	Yes[3]	-
MA	-	No[7]	No[7]	Yes[5]	Yes[3]	-
MI	Yes[2]	Yes[2]	Yes[7]	-	Yes[3]	-
MN	Yes[2]	Yes[2]	No[7]	-	Yes[3]	-
MS	-	No[7]	No[7]	-	No[3]	-
MO	-	No[7]	No[7]	-	No[3]	-
MT	-	No[7]	No[7]	-	Yes[2]	-
NE	Yes for over 10,000 lb.[2]	No[7]	No[7]	-	No[3]	-
NV	Yes[2]	Yes[2]	No[7]	-	No[3]	-
NH	-	No[7]	No[7]	-	Yes[3]	Yes[4]
NJ	-	No[7]	No[7]	-	No[3]	Yes[4]
NM	-	No[7]	No[7]	-	Yes[3]	-
NY	No	No	No	No	Yes	No
NC	-	No[7]	No[7]	-	No[3]	-
ND	-	No[7]	No[7]	-	No[3]	-
OH	-	No[7]	No[7]	-	Yes[3]	-
OK	-	No[7]	No[7]	-	-	-
OR	Yes[2]	Yes[2]	Yes[7]	Yes[7]	Yes[2]	-
PA	No[7]	No[7]	No[7]	-	Yes[2]	-
RI	-	No[7]	No[7]	-	Yes[3]	-
SC	-	No[7]	No[7]	-	No[3]	-
SD	-	No[7]	No[7]	-	No[3]	-
TN	-	No[7]	No[7]	-	No[3]	Yes[4]
TX	-	No[7]	No[7]	-	No[3]	-
UT	-	No[7]	No[7]	-	Yes[3]	-
VT	-	No[7]	No[7]	-	Yes[2]	-
VA	-	No[7]	No[7]	-	No[3]	-
WA	Yes[2]	Yes[2]	No[7]	-	Yes[3]	-
WV	-	No[7]	No[7]	-	No[3]	-
WI	-	No[7]	No[7]	-	Yes[2]	-
WY	-	No[7]	No[7]	-	No[3]	-

Table 2. In-use level limits.

State	On-Road Motor Vehicles	On-Road Motorcycles	Off-Road Motorcycles	Off-Road Vehicles	Snowmobiles	Motorboats
AL	-	No[7]	No[7]	-	No[3]	-
AK	-	No[7]	No[7]	-	No[3]	-
AZ	-	No[7]	No[7]	-	No[3]	Yes[2]
AR	-	No[7]	No[7]	-	No[3]	-
CA	Yes[2]	Yes[2]	-	-	No[3]	Yes[2]
CO	Yes[2]	Yes[2]	Yes[2]	Yes[2]	Yes[3]	Yes[1]
CT	Yes[2]	Yes[2]	No[7]	-	Yes[2]	Yes[6]
DE	-	No[7]	No[7]	-	No[3]	-
FL	Yes[2]	Yes[2]	No[7]	-	No[3]	-
GA	-	No[7]	No[7]	-	No[3]	-
HI	Yes[2]	Yes[2]	No[7]	-	No[3]	-
ID	Yes, for passenger motor vehicles[2]	Yes[2]	Yes, on public lands[7]	-	No[3]	-
IL	Yes[2]	Yes[2]	No[7]	-	No[3]	-
IN	Yes[2]	Yes[2]	No[7]	-	No[3]	-
IA	-	No[7]	No[7]	-	Yes[2]	-
KS	-	No[7]	No[7]	-	No[3]	-
KY	-	No[7]	No[7]	-	No[3]	-
LA	-	No[7]	No[7]	-	No[3]	-
ME	-	No[7]	No[7]	-	Yes[2]	-
MD	-	Yes[7]	Yes[7]	Yes[7]	Yes[3]	Yes[4]
MA	-	No[7]	No[7]	Yes[5]	Yes[3]	-
MI	Yes[2]	Yes[2]	Yes[7]	Yes[1]	Yes[3]	-
MN	Yes[2]	Yes[2]	No[7]	-	No[3]	-
MS	-	No[7]	No[7]	-	No[3]	-
MO	-	No[7]	No[7]	-	No[3]	Yes[4]
MT	-	Yes[2]	No[7]	-	Yes[2]	-
NE	Yes for over 10,000 lb.[2]	No[7]	No[7]	-	No[3]	-
NV	Yes[2]	Yes[2]	No[7]	-	No[3]	Yes[4]
NH	-	No[7]	Yes[2]	Yes[2]	Yes[2]	Yes[4]
NJ	-	No[7]	No[7]	-	No[3]	Yes[2]
NM	-	No[7]	No[7]	-	No[3]	-
NY	Yes, for over 10,000 lbs.	No	No	No	Yes	No
NC	-	No[7]	No[7]	-	No[3]	-
ND	-	No[7]	No[7]	-	No[3]	-
OH	-	No[7]	No[7]	-	Yes[3]	-
OK	-	No[7]	No[7]	-	No[3]	-
OR	Yes[2]	Yes[2]	Yes[2]	Yes[2]	Yes[3]	Yes[2]
PA	Yes[2]	Yes[2]	No[7]	-	Yes[2]	-
RI	-	Yes[7]	No[7]	-	-	-
SC	-	No[7]	No[7]	-	-	-
SD	-	No[7]	No[7]	-	-	-
TN	-	No[7]	No[7]	-	-	Yes[4]
TX	-	No[7]	No[7]	-	-	-
UT	-	No[7]	No[7]	-	-	-
VT	-	No[7]	No[7]	-	Yes[2]	-
VA	-	No[7]	No[7]	-	-	-
WA	Yes[2]	Yes[2]	Yes[7]	Yes[7]	-	-
WV	-	No[7]	No[7]	-	-	-
WI	-	No[7]	No[7]	-	Yes[2]	-
WY	-	No[7]	No[7]	-	-	-

Table 3. Property line sound level limits.

State	Construction Sites	Industrial and Commercial Operations	Relationship to Local Noise Ordinances
AL . .	-	-	-
AK . .	-	-	-
AZ . .	-	-	-
AR . .	-	-	-
CA . .	-	Must develop model local noise ordinances[2]	Local gov't must furnish copy of ordinance to State[2]
CO . .	Statutory st'ds enforced by citizen suit[2]	Statutory st'ds enforced by citizen suit[2]	Does not preempt "no less restrictive" st'ds[2]
CT . .	-	Have adopted regulations[2]	State must approve local ordinances[2]
DE . .	May adopt regulations[2]	May adopt regulations[2]	State must approve local noise ordinances[2]
FL . . .	May adopt regulations[2]	May adopt regulations[2]	-
GA . .	-	-	-
HI . .	May adopt regulations[2]	May adopt regulations[2]	-
ID . .	-	-	-
IL . . .	May adopt regulations[2]	Have adopted regulations[2]	State preempts[8]
IN . . .	-	-	-
IA . . .	-	-	-
KS . .	-	-	-
KY . .	May adopt regulations[2]	May adopt regulations[2]	Local gov't can not be stricter[2]
LA . .	Must adopt standards[2]	Must adopt standards[2]	-
ME . .	-	-	-
MD . .	Have adopted regulations[2]	Have adopted regulations[2]	Local gov't may be strict but must transmit copy to State[2]
MA . .	Adopted regulation prohibiting "unnecessary emission" of noise	Adopted regulation prohibiting "unnecessary emission" of noise	-
MI . .	-	-	-
MN . .	May adopt regulations[2]	Have adopted regulations[2]	Local gov't can not be stricter
MS . .	-	-	-
MO .	-	-	-
MT . .	-	-	-
NE . .	-	-	-
NV . .	-	-	-
NH . .	-	-	-
NJ . .	May adopt regulations[2]	Have adopted regulations[2]	Local gov't may be stricter, but requires State approval[2]
NM . .	Must adopt regulations[2]	Must adopt regulations[2]	-
NY . .	May adopt regulations	May adopt regulations	Local gov't may be stricter
NC . .	-	-	-
ND . .	May adopt regulations[2]	May adopt regulations[2]	-
OH . .	May adopt regulations[1]	May adopt regulations[1]	Local gov't may be stricter, but must transmit copy to State[1]
OK . .	-	-	-
OR . .	May adopt regulations[2]	Have adopted regulations[2]	Local gov't must be at least as stringent[2]
PA . .	May adopt regulations[2]	May adopt regulations[2]	-
RI . . .	-	-	-
SC . .	-	-	-
SD . .	-	-	-
TN . .	-	-	-
TX . .	-	-	-
UT . .	-	-	-
VT . .	-	-	-
VA . .	-	-	-
WA . .	May adopt regulations[2]	Have adopted regulations[2]	Local gov't may be stricter, but requires State approval
WV . .	-	-	-
WI . .	-	-	-
WY . .	-	-	-

Product Literature

Digital Correlators
Langley-Ford digital correlators are available with an analog input which will extend their use to noise and vibration analysis, stimulus response studies, pulse echo ranging or any other application requiring the correlation of an analog signal. The analog input will accept signals in the 1 volt range, dc to 5 MHz. In addition to autocorrelation of any type of signal, cross correlation is permitted between analog and pulse signals, between analog and analog, or between pulse and pulse signals. *Langley-Ford, Amherst, MA.*

Circle 201 on Reader-Service Card

Spectrum Analyzer
Bulletin SP 4/79 describes the Spectra-Tester which provides automated, on-line inspection based on spectrum analysis, i.e. breaking down a device's noise or vibration pattern into individual frequencies. The technique is simple, fully automatic, and eliminates personal bias from inspection. It also pinpoints the cause of substandard performance, allowing re-work personnel to go directly to the problem without complete teardown or rebuilding. The Spectra Tester is also valuable for continuous, on-line monitoring of critical production and support machines. By comparing specific vibration data signals, e.g. from bearings and gear trains, with past history levels, it can warn of deteriorating performance before major failure occurs. *Spectral Dynamics, San Diego, CA.*

Circle 202 on Reader-Service Card

Personnel Enclosures
Bulleting 105-379 describes a line of pre-assembled and portable acoustical personnel enclosures, A.P.E.'s. Dimensions for five standard sizes are shown along with acoustical performance and available features. These enclosures are offered as a practical method to protect people from unacceptable noise levels. *Noise Control Products, Inc., New Hyde Park, NY.*

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Signal Processing Filter
The Model 751A Brickwall™ filter is a wide range, tunable, bandpass filter that provides for independent programming

of LP and HP cutoffs, allowing the user to set both center frequency and bandwidth anywhere in the 1 Hz to 100 kHz band. This model achieves values of 0.3 dB peak-to-peak passband ripple and 85 dB stopband attenuation with a high rolloff rate of better than 115 dB per octave, both above and below the selected cutoff frequencies. Typical applications include signal tracking, waveform analysis, noise studies, data recording/playback, and digital signal processing. *Rockland Systems Corporation, Rockleigh, NJ.*

Circle 204 on Reader-Service Card

Soundproof Factory Offices

Bulletin 6.05H details how to assemble soundproof offices from pre-engineered components where plant personnel can confer, do paperwork, communicate intelligibly with each other over the phone, without leaving the factory floor. The booklet presents full technical information on the noise reducing modular components available in assembly kits from which 70 in-plant offices ranging in size from 88 to 950 sq. ft. can be erected on site by plant personnel. Ten design and engineering properties of the system are listed along with a table showing the typical noise reduction, certified in lab tests, to be on the order of 30 dBA overall and 42 dB in the speech frequencies. *Industrial Acoustics Company, Inc., Bronx, NY.*

Circle 205 on Reader-Service Card

Noise Monitoring System Option

The Model 614 microprocessor-controlled portable noise monitoring system can identify the source of noises in the single event noise exposure level (SENEL) mode by utilizing a built-in optional audio cassette recorder in the case. It can be programmed with any threshold within its 100 dB dynamic range. Events which exceed that level are then recorded on an internal printer providing the user with date, time, and sound level; the audio tape recording can be used to identify the sound source, i.e., airplane, car, dog, etc. *BBN Instruments Company, Cambridge MA.*

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Sound Control Blanket

Whispermat is a flexible sound control blanket that features a naturally limp, highly dense and impermeable plastic barrier for optimum transmission loss, combined with layers of acoustical foam for noise absorption. Easily die-cut or manually fabricated, it may be ordered with perforated vinyl facing or with a variety of impervious facings to resist moisture, dust, oil and particle mists. Offered with a pressure sensitive backing for ease of installation, Whispermat is available with a 1/4" to 3" acoustical urethane foam absorption layer, a 4 oz. to 2 lb./sq. ft. plastic barrier, and a foam isolation layer, if required. *American Acoustical Products, Natick, MA.*

Circle 207 on Reader-Service Card

Noise and Vibration Control Equipment

New catalog features acoustical enclosures, panels, duct silencers, curtains, foams, steel spring isolators, elastomer mounts, and pads. The indexed catalog provides general equipment data and specifications, dimensional drawings and photographs, and technical and application information. *Korfund Dynamics Corporation, Westbury, NY.*

Circle 208 on Reader-Service Card

Acoustical Enclosure Systems

The Product HP acoustical systems combine noise reduction with electrical interlock systems for all the hinged panels to provide total safety guarding. A wide range of custom and modular designs are available. *Gordon J. Pollock and Associates, Inc., Rocky River, OH.*

Circle 209 on Reader-Service Card

Consultant's Corner

Ronald A. Darby & Associates, Kailua, HI, has become **Darby-Ebisu & Associates, Inc.** with the addition of Yoichi Ebisu as a principal.

Terence H. Larbes and Robert G. Schallip, Jr. have joined **Anatrol Corp.**, Cincinnati, OH, as Project Engineers. Mr. Larbes will be responsible for conducting noise and vibration consulting projects for original equipment manufacturers and also plant noise control projects. Mr. Schallip will be involved in operating and maintaining a new engine dynamometer facility installed at Anatrol. This facility will be used to study noise and vibration problems in both gasoline and diesel engines and to evaluate noise control treatments designed for various engine components.

Structural Dynamics Research Corporation (SDRC), Milford, OH, and GenRad, Inc. have announced that SDRC MODAL-PLUS and SDRC SABBA software programs are now available for use on the GenRad 2508 Structural Analysis System. MODAL-PLUS is an interactive software package that collects, analyzes, and displays data from artificial excitation tests of mechanical structures. SABBA is an interactive system analysis software package that determines the dynamic response of complex machinery.

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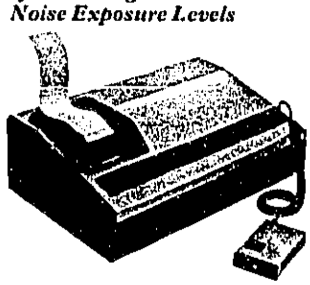

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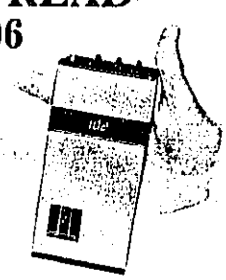

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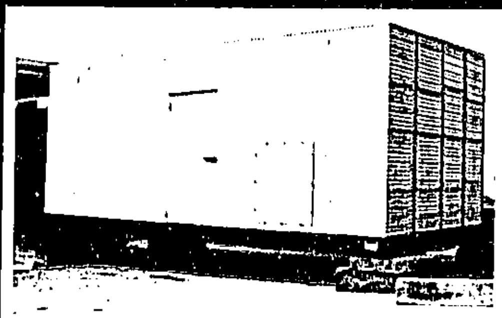
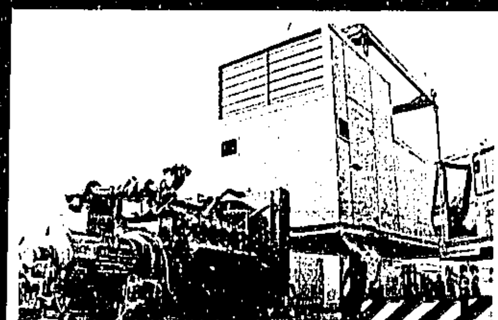


500 kw diesel engine generator set has a noise output of less than 65 dBA at 50 ft as a result of the Moduline Enclosure equipped with IAC Quiet-Duct® Silencers.



Design of enclosures for diesel engine generator sets permits easy removal and replacement during servicing. Enclosures reduce noise from 101-107 dBA to 76 dBA, at one foot.

Diesel engine generator sets used in utility blackstart systems, in emergency standby power installations, in urban construction and maintenance, or in other operations can get a great deal of attention. But it will be the adverse kind. Why?

Because diesel engine generator sets so employed are usually located close to where people are. In building basements, on city streets, in industry equipment rooms, or near residential areas. So "gen-sets" high noise levels, which far exceed OSHA noise-exposure criteria and can be ear-shattering elements in community and industry environments, are virtually certain to be sources of strong complaints.

But noise can be controlled by isolating each mobile or stationary deisel engine generator set with a complete enclosure built from components of Industrial Acoustics Company's Moduline® System. Featuring all-steel, UL fire-rated Noishield® Components including 4-inch-thick Walls, Noise-Lock® Doors, and Intake/Exhaust Silencers, the System promotes tailormaking enclosures to suit individual operational requirements.

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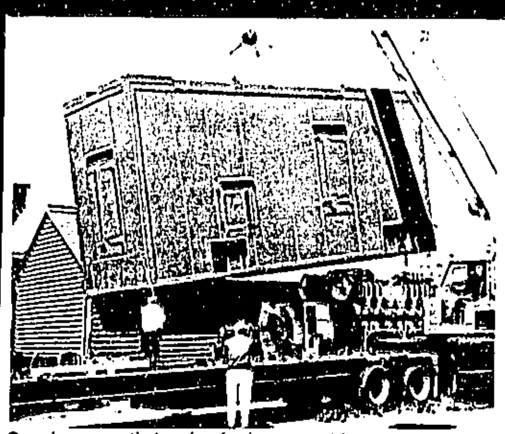

One-piece acoustic housing for large portable generators results in overall noise reduction of 40 dBA.

IAC-designed Moduline Enclosure featuring Quiet-Duct Silencers for emergency power systems reduces noise from 105 dBA to 62-68 dBA. Structural design properties assure optimum balance between acoustic and aerodynamic performance.

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