EPA-600/2-76-016a
January 1976

Environmental Protection Technology Series

# ABSTRACTS OF THE 1971-1974 UNITED STATES AND FOREIGN OPEN LITERATURE ON NOISE
## Part I

Office of Research and Development
U.S. Environmental Protection Agency
Washington, D.C. 20460

## RESEARCH REPORTING SERIES

Research reports of the Office of Research and Development, U.S. Environmental Protection Agency, have been grouped into five series. These five broad categories were established to facilitate further development and application of environmental technology. Elimination of traditional grouping was consciously planned to foster technology transfer and a maximum interface in related fields. The five series are:

1. Environmental Health Effects Research
2. Environmental Protection Technology
3. Ecological Research
4. Environmental Monitoring
5. Socioeconomic Environmental Studies

This report has been assigned to the ENVIRONMENTAL PROTECTION TECHNOLOGY series. This series describes research performed to develop and demonstrate instrumentation, equipment and methodology to repair or prevent environmental degradation from point and non-point sources of pollution. This work provides the new or improved technology required for the control and treatment of pollution sources to meet environmental quality standards.

This document is available to the public through the National Technical Information Service, Springfield, Virginia 22161.

EPA-600/2-76-016a
January 1976

# ABSTRACTS OF THE 1971-1974 UNITED STATES AND FOREIGN OPEN LITERATURE ON NOISE

Task Report J6331

Part I

by

E. P. Bergmann
I. B. Fieldhouse

Contract 68-01-2234

Project Officer

E. Berkau
U.S. Environmental Protection Agency
Industrial Environmental Research Lab.
Cincinnati, Ohio 45268

Prepared for
Environmental Protection Agency
Office of Research and Development
Washington, D.C. 20460

## ABSTRACT

This document is a task report of effort directed toward a search of the open literature to provide some insight into the noise reduction effort outside of the Federal Government and in foreign countries. Abstracts from the search covered the period 1971 to 1974. Two primary sources were searched for abstracts: The Engineers Index and Pollution Abstracts.

Nearly 1300 abstracts from 21 countries were screened and segregated into the following categories: Aircraft Noise; Building Noise; General Interest; Machinery Noise; Noise Effects on Health; Noise Measurement Instrumentation; and Transportation Noise. The distribution of abstracts within each technical area is summarized in the report, and a compilation of the abstracts is presented as an appendix and bound separately.

It appears that a substantial level of privately sponsored noise research and development is reflected in open literature publications. Industrial or private sponsorship is indicated in areas in which a regulation demands attention to the noise problem or a product relating to noise is being "advertised". Government sponsorship is indicated in the areas in which there is a potential benefit to the public. University sponsorship appears to be a small part of the total effort and is directed to particular academic interests.



This report is submitted in partial fulfillment of Project Number J6331, Contract Number 68-01-2234, By IIT Research Institute, under sponsorship of the Environmental Protection Agency. Work on this task was completed as of April 1975.

CONTENTS


| | | Page |
|---|---|---|
| Abstract | | ii |
| List of Tables | | iv |
| Acknowlegments | | v |
| Sections | | |
| I | Conclusions | 1 |
| II | Recommendations | 3 |
| III | Introduction | 4 |
| IV | Aircraft Noise | 9 |
| V | Building Noise | 14 |
| VI | General Interest | 17 |
| VII | Machinery Noise | 22 |
| VIII | Noise Effects on Health | 30 |
| IX | Noise Measurement Instrumentation | 34 |
| X | Transportation Noise | 37 |

TABLES


| Number | | Page |
|---|---|---|
| 1 | Distribution of Publications by Country and Area | 6 |
| 2 | Summary of Aircraft Noise Publication Distribution | 10 |
| 3 | Aircraft Noise Publication Distribution | 11 |
| 4 | Summary of Building Noise Publication Distribution | 15 |
| 5 | Building Noise Publication Distribution | 16 |
| 6 | Summary of General Interest Paper Distribution | 18 |
| 7 | General Interest Papers on Noise Publication Distribution | 19 |
| 8 | Summary of Machinery Noise Publication Distribution | 24 |
| 9 | Machinery Noise Publication Distribution | 25 |
| 10 | Summary of Noise Effects on Health Publication Distribution | 31 |
| 11 | Noise Effects on Health Publication Distribution | 32 |
| 12 | Summary of Noise Measurement Instrumentation Publication Distribution | 35 |
| 13 | Noise Measurement Instrumentation Publication Distribution | 36 |
| 14 | Summary of Transportation Noise Publication Distribution | 38 |
| 15 | Transportation Noise Publication Distribution | 39 |

ACKNOWLEGMENTS

IIT Research Institute staff members working on this task were E. P. Bergmann and I. B. Fieldhouse.

Much appreciated technical guidance and assistance were provided by Dr. E. Berkau and S. Cordle of the Environmental Protection Agency.

## SECTION I

## CONCLUSIONS

Based solely on a review of the abstracts, and recognizing that a review of the publications could significantly alter the viewpoint, the following conclusions are offered by area:

- Aircraft Noise. Data in the important technology areas (engine, airframe, etc.) are being distributed into the open literature. The only category which does not appear to have publication is cabin noise.
- Building Noise. If building noise is structured into functional areas, such as floors, ceilings, walls, etc., each area appears to have some literature associated with it. In general, the publications are fairly evenly distributed over the various categories. Little evidence, however, was found of publications considering the building as a system with the associated integration affects.
- General Interest. The general interest category can be viewed from two points: all publications within this category should be distributed to particular technology areas; or this category should serve as a repository for multidisciplined, or multiapplicable technologies. Most programs, or problems, are categorized within one area, e.g., aircraft noise. However, it is recognized that multidisciplined programs do exist and that technology developed for one area should be transferrable to other similar areas. It is, therefore, concluded that the general interest category is desirable but that it should be restructured, at some point in time to better reflect a multidisciplined/multiapplicable structure. A review of the abstracts is insufficient for this activity. The publications must be obtained and reviewed.
- Machinery Noise. Of the 20 industries tabulated under the machinery noise category, seven had no noise related publications and five industries had seven or less publications. On this basis only eight industries had more than a token number of publications.

- Noise Effects on Health. Publications on health effects span the range from annoyance to physical damage. As could be expected, ear damage, aircraft noise effects and criteria represent major areas of interest.

- Transportation Noise. Motor vehicle related noise is treated in 82 percent of the publications, rail systems have 2 percent and public transportation 7 percent. The various functional aspects of motor vehicles noise are, apparently, covered. Rail system noise is covered only in terms of rail yard noise (U.S. publications) and public transportation is generally treated.

## SECTION II

## RECOMMENDATIONS

The abstracts are a poor basis for evaluating the noise abatement technology available to industry because the data is too superficial. They do, however, provide a basis for assessing the areas and the countries with noise related activity. Many of the publications are two to three pages in length and probably contain more propaganda information than real data. However, a useful task may be to gather the publications and structure a compendium of noise abatement technology in each of the technology areas (i.e., aircraft, surface transportation, construction, machiner and health effects).

## SECTION III

## INTRODUCTION

As a part of the program to "Characterize, Evaluate and Coordinate Noise Research Programs in the Federal Government" a search was conducted of the open literature to provide some insight into the noise reduction effort outside of the Federal Government and in foreign countries. Abstracts from the search covered the period 1971-1974.

Two primary sources were searched for abstracts: The Engineers Index and Pollution Abstracts. Lists of publications searched in these sources are included as Appendix A of this report. Journals covered by the Engineering Index are listed in Pages 1 through 19 of that appendix. Those covered by pollution abstracts in pages 19 through 57. Pollution Abstracts also cover special publications and conferences and they are listed in pages 58 through 112.

Abstracts were gathered and segregated by technical areas. They are compiled as Appendix B to this report. The technical area segregation categories include: Aircraft Noise, Building Noise, General Interest, Machinery Noise, Noise Effects on Health, Noise Measurement Instrumentation, and Transportation Noise.

Nearly 1300 abstracts from 21 countries were screened and segregated. In general, each abstract naturally falls into one of the categories. Some abstracts, however, are sufficiently vague or broad to require the categorization to be somewhat arbitrary. Also, the country of origin was difficult to determine on some abstracts. International conferences and seminars are held and abstracts from their proceedings do not always identify the country of origin adequately. Some of the abstracts, then, may be uninentionally attributed to countries other than the country of origin.

Table 1 is a summary of compilation of the distribution of the publications by technical area and country. A review of the table illustrates:

- The distribution is dominated by U.S. publications (82 percent).
- Foreign publications are predominantly from Germany (88), England (36), Canada (17), Russia (15), Japan (14) and Sweden (10).
- Most of the publications both U.S. and foreign, are directed toward the Machinery Noise category. The U.S. dominates the category with 240 publications followed by Germany with 32. Fourteen of the 21 countries have publications in this category.
- Aircraft Noise is the second largest category with 264 abstracts. A significant number of publications are from Germany (15) and England (9). France, which has a viable aircraft industry, has only one abstract in this technical area. Nine of the 21 countries have publications in this category.
- A considerable number of publications (247) are gathered into the General Interest category. It is possible that many of these publications could be recategorized into one of the special technical areas if the publications, rather than the abstracts, are read. Fourteen of the 21 countries have publications in this category.
- Transportation Noise related abstracts are the fourth largest group with 153. Besides the U.S., with 122 publications, the most abstracts are from Germany (15). Nine of the 21 countries have publications in this category.
- Noise Effects on Health has 143 abstracts from eight countries.
- Building Noise has 98 abstracts from seven countries.
- Noise Measurement Instrumentation has 70 abstracts from four countries.
- Germany, with 88 abstracts, has publications in each category. Most of the publications are in Machinery Noise (32). Aircraft (15), Transportation (15), Building (10) and Health Effects (10) are additional categories in which German publications dominated the foreign distribution.
- English publications (36), although concentrated in General Interest (13) and Aircraft Noise (9), cover all of the categories except Noise Measurement Instrumentation.

As a part of this study it was the intent to investigate the level in which the private sector is involved in noise research, development and demonstration efforts. A screening of the abstracts indicates that insufficient information is contained in the abstracts to draw specific inferences. Some general trends, however, are indicated.

Table 1. DISTRIBUTION OF PUBLICATIONS BY COUNTRY AND AREA

| Country | Aircraft Noise | Building Noise | General Interest | Machinery Noise | Noise Effects on Health | Noise Measurement Instrumentation | Transportation Noise | Σ |
|---|---|---|---|---|---|---|---|---|
| Australia | | | | 1 | | | | 1 |
| Austria | | | | 1 | 2 | | | 3 |
| Belgium | 1 | | | | | | | 1 |
| Canada | 2 | | 10 | 1 | 3 | 1 | | 17 |
| Czechoslovakia | | | | 1 | | | | 1 |
| England | 9 | 1 | 13 | 4 | 5 | | 4 | 36 |
| Finland | | | 1 | | | | | 1 |
| France | 1 | 3 | 3 | 4 | 2 | | 3 | 16 |
| Germany | 15 | 10 | 4 | 32 | 10 | 2 | 15 | 88 |
| India | | | 5 | | | 1 | | 6 |
| Italy | | | | | | | 1 | 1 |
| Japan | 1 | | 1 | 9 | | | 3 | 14 |
| Netherlands | | 3 | 1 | 2 | 1 | | | 7 |
| Poland | | | 1 | 3 | | | | 4 |
| Romania | | | 1 | | | | | 1 |
| Spain | | | | | | | 1 | 1 |
| Sweden | 2 | 1 | 1 | 4 | | | 2 | 10 |
| Switzerland | | 1 | 2 | | | | | 3 |
| United States | 228 | 79 | 203 | 240 | 118 | 66 | 122 | 1056 |
| U.S.S.R. | 5 | | 1 | 5 | 2 | | 2 | 15 |
| Yugoslavia | | | | 1 | | | | 1 |
| TOTALS | 264 | 98 | 247 | 308 | 143 | 70 | 153 | 1283 |

- Most of the open literature in the aircraft noise category appears to be publications of federally sponsored programs. Some university and company sponsored work is indicated in rare instances.
- Most of the open literature in the building noise category appears to be presentations of the results of privately sponsored work. Some aircraft noise related publications appear to reflect federal or local government sponsorship.
- Publications in the general interest category reflect private sponsorship in the treatment of particular noise problems. Government sponsorship is indicated in the areas of surveys, community noise, ordinances, standards and planning.
- Publications in the machinery noise category appear to be predominantly privately sponsored. Some federal sponsorship is indicated in publications relating to mining machinery.
- Publications in the noise effects on health category are apparently distributed between government and private sponsorship. Private sponsorship is indicated in the areas of: industrial noise; guidelines; dosimeters; noise abatement engineering; and health aspects in particular industries. Government sponsorship is indicated in the areas of criteria, exposure and aircraft noise related effects.
- Publications in the noise measurement instrumentation category indicate private sponsorship in the areas of: survey instrumentation; particular instruments; and applications of instruments. Governmental sponsorship is indicated in community noise surveys.
- Transportation noise publications indicate private sponsorship in: truck related areas such as engine, tire and cooling system noise; SAE Standards; and railyard noise. Governmental sponsorship is indicated in the areas of: tire noise, public transportation; traffic noise; highway sound barriers; and highway design and planning

In summary, it appears that a substantial level of privately sponsored noise research and development is reflected in open literature publications. Unfortunately, the level cannot be quantified, even broadly, by a survey of the abstracts. As could be expected, industrial or private sponsorship is indicated in areas in which a regulation demands attention to the noise problem (e.g., machinery noise) or a product relating to noise is being "advertised" (e.g., noise measurement instrumentation). Government sponsorship is indicated in the areas in which there is a potential benefit

to the public (e.g., surveys, ordnances, public transportation). University sponsorship appears to be a small part of the total effort and is directed to particular academic interests.

Remaining sections of this report summarize the distributions of abstracts within each literature search area.

## SECTION IV

## AIRCRAFT NOISE

Abstracts relating to Aircraft Noise were reviewed and distributed over 18 specific technical categories and a general interest category. A summary of the publication distribution is given in Table 2 and the distribution of the publications over the 19 categories is presented in Table 3. The following are observed:

- Publications identified as pertinent to aircraft noise research total 264. Of those publications: 97 relate to engine noise; 15 to propeller or rotor noise; 14 to aerodynamic noise; 48 to flyover noise; 16 to powered lift (V/STOL) aircraft noise; 26 to airport noise; 14 to noise criteria; and the remaining to ancillary categories.
- Jet noise is the category with the most publications (47). This category is dominated by U.S. publications with only the Soviet Union (3), France (1) and Germany (1) with foreign abstracts indicated in this field.
- Fan noise, with 22 publications, has the second largest number of engine related abstracts. The only foreign abstract in this category is from Germany.
- The airport noise category (26 publications) has foreign abstacts from Belgium (1), Canada (1), Germany (2), Japan (1) and Sweden (1). The remaining abstracts (20) are from the United States.
- Based on the contents of the abstracts and a review of the federal programs related to aircraft noise it appears that many of the technology oriented open literature publications (U.S.) are reports based on federally funded research and development.

Table 2. SUMMARY OF AIRCRAFT NOISE PUBLICATION DISTRIBUTION

| Number (264) | Publications on Aircraft Noise |
|---|---|
| 1 | Belgian publication on airport noise |
| 2 | Canadian publications on airport noise and sonic boom |
| 9 | English publications on engine and aerodymanic noise on criteria and prediction methods |
| 1 | French publication on jet noise |
| 15 | German publications on engine, aerodynamic and airport noise |
| 1 | Japanese publication on airport noise |
| 2 | Swedish publications on sonic boom and aircraft noise |
| 228 | U.S. publications primarily on engine, aerodynamic and airport noise |
| 5 | U.S.S.R. publications on jet, flyover and perceived noise |

Table 3. AIRCRAFT NOISE PUBLICATION DISTRIBUTION

| SIC/Industry/ Technology | Number of Publications | Areas of Publication |
|---|---|---|
| Engine Inlet Noise | 4 | • Four abstr, U.S. |
| Duct Noise - General | 3 | • Three abstr, U.S. |
| Sound Absorbent Material | 5 | • Five abstr; 4 U.S., 1 England |
| Fan Noise | 22 | • Fan Noise Generation (9 abstr, U.S.)<br>• Effects (6 abstr; 5 U.S., 1 Germany)<br>• Design for Noise Reduction (5 abstr, U.S.)<br>• Sonic Fatigue in Structures (1 abstr, U.S.)<br>• Transmission of Sound Waves Through Blade Row (1 abstr, U.S.) |
| Compressor Noise | 2 | • Two abstr; 1 U.S., 1 Germany |
| Jet Engine Noise | 16 | • Refanned Commercial Gas Turbine Engines (1 abstr, U.S.)<br>• Gas Turbine Exhaust Model (1 abstr, U.S.)<br>• Bypass Lift Engines (1 abstr, Germany)<br>• High Bypass Turbofan Engines (6 abstr; 5 U.S., 1 Germany)<br>• Noise Reduction Progress (3 abstr, U.S.)<br>• Advanced Engines (4 abstr, U.S.) |
| Jet Noise | 47 | • Directivity of Jet Noise (2 abstr, U.S.)<br>• Measurement Techniques (3 abstr, U.S.)<br>• Influence of Crossflow (2 abstr, U.S.)<br>• Subsonic Jet Noise (9 abstr, U.S.)<br>• Supersonic Jet Noise (6 abstr, U.S.)<br>• Jets with Combustion (2 abstr, U.S.)<br>• Prediction and Correlation (4 abstr, U.S.)<br>• Screened Jets (2 abstr, U.S.)<br>• General Group (17 abstr; 12 U.S., 3 U.S.S.R., 1 France, 1 Germany) |

Table 3 (continued). AIRCRAFT NOISE PUBLICATION DISTRIBUTION

| SIC/Industry/ Technology | Number of Publications | Areas of Publication |
|---|---|---|
| Propeller Noise | 4 | • Four abstr, U.S. |
| Helicopter Rotor Noise | 11 | • 11 abstr, U.S. |
| Aerodynamic Noise | 14 | • Aerodynamic Noise Theory (1 abstr, Germany)<br>• Configuration Related Noise (2 abstr, U.S.)<br>• Boundary Layer Associated Noise (3 abstr, U.S.)<br>• Wake Vortices (1 abstr, U.S.)<br>• Miscellaneous (7 abstr; 6 U.S., 1 England) |
| Equipment Noise | 4 | • Four abstr, U.S. |
| Sonic Boom | 28 | • Theory (9 abstr, U.S.)<br>• Interaction with Water (2 abstr, U.S.)<br>• Flight Profile for Avoidance (2 abstr, U.S.)<br>• Simulation (2 abstr, U.S.)<br>• Measurement (4 abstr, U.S.)<br>• Miscellaneous (9 abstr; 5 U.S., 1 Canada, 1 England, 1 Germany, 1 Sweden) |
| Flyover Noise | 20 | • Noise Signatures (3 abstr, U.S.)<br>• Flight Path Control (4 abstr; 2 U.S., 1 U.S.S.R., 1 Germany)<br>• Flyover Noise Effects on Urban Areas (2 abstr, U.S.)<br>• Propagation and Absorption (3 abstr, U.S.)<br>• Jet Aircraft Noise Survey (1 abstr, U.S.)<br>• Aircraft Noise Duration (1 abstr, U.S.)<br>• Helicopter Flyover Noise (6 abstr, U.S.) |

Table 3 (concluded). AIRCRAFT NOISE PUBLICATION DISTRIBUTION

| SIC/Industry/ Technology | Number of Publications | Areas of Publication |
|---|---|---|
| Powered Lift Aircraft Noise | 16 | • STOL Noise (8 abstr; 5 U.S., 2 England, 1 Germany)<br>• VTOL Noise (6 abstr; 5 U.S., 1 Germany)<br>• Design Studies (2 abstr, U.S.) |
| Airport Noise | 25 | • Noise Contours (4 abstr; 3 U.S., 1 Japan)<br>• Particular Airport Noise (5 abstr; 2 U.S., 1 Belgium, 1 Germany, 1 Sweden)<br>• L1011 Noise (1 abstr, U.S.)<br>• Annoyance (6 abstr; 5 U.S., 1 Canada)<br>• Noise Monitoring (2 abstr, U.S.)<br>• General Interest (7 abstr, 6 U.S., 1 Germany) |
| Prediction and Measurement | 7 | • Aircraft Engine Noise (2 abstr, U.S.)<br>• Attenuation & Absorption (2 abstr; 1 U.S., 1 England)<br>• Miscellaneous (3 abstr, U.S.) |
| Preceived Noise Level | 3 | • Three abstr; 2 U.S., 1 U.S.S.R. |
| Criteria | 14 | • Intl Noise Certification (1 abstr, U.S.)<br>• Noise Cost Effectiveness (1 abstr, U.S.)<br>• Proposed Test Method (1 abstr, U.S.)<br>• Engine Noise (3 abstr; 2 U.S., 1 Germany)<br>• Aircraft Related (8 abstr; 6 U.S., 1 England, 1 Germany) |
| General Interest | 19 | • Engine Technology (5 abstr; 4 U.S., 1 Germany)<br>• Technology Applications (3 abstr, U.S.)<br>• Miscellaneous (11 abstr; 9 U.S., 2 England) |

## SECTION V

## BUILDING NOISE

Abstracts from the literature search relating to Building Noise were reviewed and their areas of activity distributed over 10 categories. A summary of the publication distribution is given in Table 4 and the distribution of the publications over the 10 categories is presented in Table 5. A review of these tables indicates:

- Ninety-eight abstracts were identified and distributed by functional areas. Publications are relatively evenly distributed over eight of these areas. Measurements, an ancillary category, has the least number of abstracts (3); and sources of noise, a general category, has the most (23).
- In terms of foreign publications Germany has abstracts in five categories, Netherlands in three categories and France in two categories. England, Sweden and Switzerland have publications in one category.

Table 4. SUMMARY OF BUILDING NOISE PUBLICATION DISTRIBUTION

| Number (98) | Publications on Building Noise |
|---|---|
| 1 | English publication on noise sources |
| 3 | French publications on rooms and HVAC |
| 10 | German publications on damping materials, walls, standards, HVAC and sources of noise |
| 3 | Netherlands publications on rooms, floors and sources |
| 1 | Swedish publication on measurement |
| 1 | Swiss publication on sources |
| 79 | U.S. publications in 10 categories - fairly evenly distributed |

Table 5. BUILDING NOISE PUBLICATION DISTRIBUTION

| SIC/Industry/ Technology | Number of Publications | Areas of Publication |
|---|---|---|
| Damping and Insulation Materials | 9 | • Wood Framed Buildings (2 abstr, U.S.)<br>• Plasterboard Panels (1 abstr, U.S.)<br>• Brick and Masonry (2 abstr, U.S.)<br>• Materials (4 abstr, 3 U.S., 1 Germany) |
| Windows | 8 | • Eight abstr, U.S. |
| Coupled Rooms and Corridors | 16 | • Office Noise (1 abstr, U.S.)<br>• Laboratory Noise (1 abstr, France)<br>• Acoustical Flanking (2 abstr, U.S.)<br>• Corridors and Large Halls (3 abstr; 2 U.S., 1 France)<br>• Partitions (2 abstr, U.S.)<br>• Coupled Rooms (7 abstr, 6 U.S., 1 Netherlands) |
| Walls | 8 | • Eight abstr; 6 U.S., 2 Germany |
| Ceilings | 6 | • Six abstr, U.S. |
| Floors | 7 | • Seven abstr; 6 U.S., 1 Netherlands |
| Standards and Criteria | 11 | • 11 abstr; 9 U.S., 2 Germany |
| Measurement | 3 | • Three abstr; 2 U.S., 1 Sweden |
| HVAC Systems | 7 | • Seven abstr; 5 U.S., 1 France, 1 Germany |
| Noise Sources | 23 | • General (16 abstr, 10 U.S., 1 Netherlands, 3 Germany, 1 Switzerland, 1 England)<br>• Mechanical Equipment (2 abstr, U.S.)<br>• Aircraft Associated (5 abstr; 4 U.S., 1 Germany) |

## SECTION VI

## GENERAL INTEREST

General Interest literature represents a collection of abstracts which, when reviewed, were either difficult to distribute into a particular technology oriented area or were broad enough in scope to be potentially applicable to more than one area. Accordingly the abstracts compiled under "General Interest" were distributed over 14 categories. A summary of the publication distribution is given in Table 6 and the distribution of the publications over the 14 categories is presented in Table 7. A review of these abstracts indicates:

- From 14 countries 247 publications were identified. The two categories with the most abstracts are "Laws and Ordinances" (37) and "Conferences, Seminars and Bibliographies" (36). Categories with the smallest numbers of abstracts are "Equipment" (3) and "Sport Equipment" (4).
- The 37 abstracts in the Law and Ordinances category are primarily U.S. publications (33) dealing with attitudes toward legislation (3 abstracts), the laws (18 abstracts), standards (3 abstracts), and discussions of standards (9 abstracts).
- Of the 36 publications on Conferences, Seminars, etc., 19 are U.S. abstracts. The remaining publications are distributed over seven countries: Canada (4), England (8), France (1), India (1), Romania (1), Switzerland (1) and Russia (1).
- Foreign publications are mainly in the areas of: Sources of Noise (6), Laws and Ordinances (4), Measurements (4), Modeling (2), Planning (6) and Conferences (17).
- U.S. publications are the only abstracts identified in: Damping and Absorption (21), Ducts (10), Equipment (3), Criteria (8) and Sport Equipment (4).

Table 6. SUMMARY OF GENERAL INTEREST PAPERS DISTRIBUTED

| Number (247) | Publications in the General Interest Category |
|---|---|
| 10 | Canadian publications on surveys, sources, laws, modeling, planning and conferences |
| 13 | English publications on sound barriers, laws, technical notes and conferences (8) |
| 1 | Finnish publication on law |
| 3 | French publications on sources, measurements, and conferences |
| 4 | German publications on sources, measurements, modeling and planning |
| 5 | Indian publications on sources, planning and conferences |
| 1 | Japanese publication on measurement |
| 1 | Netherlands publication on measurement |
| 1 | Polish publication on sources |
| 203 | U.S. publications on 14 areas |
| 1 | Swedish publication on planning |
| 2 | Swiss publications on surveys and conferences |
| 1 | Romanian publication on conferences |
| 1 | U.S.S.R. publication on conferences |

Table 7. GENERAL INTEREST PAPERS ON NOISE PUBLICATION DISTRIBUTION

| SIC/Industry/ Technology | Number of Publications | Areas of Publication |
|---|---|---|
| Damping and Absorption | 21 | • Damping Materials and Their Application (8 abstr, U.S.)<br>• Theory of Diffusion and Diffusers (1 abstr, U.S.)<br>• Vibration Isolation (3 abstr, U.S.)<br>• Absorption and Attenuation (9 abstr, U.S.) |
| Noise Surveys | 12 | • Noise Source Surveys in Communities (5 abstr; 2 Canada, 1 Switzerland, 2 U.S.)<br>• Community Noise Survey Approaches (2 abstr, U.S.)<br>• State of the Art (2 abstr, U.S.)<br>• General (3 abstr, U.S.) |
| Ducts | 10 | • Theory Measurement and Response of Ducts (2 abstr, U.S.)<br>• Impedences and Reflection Coefficients (1 abstr, U.S.)<br>• Pipe Covering (1 abstr, U.S.)<br>• Lined Ducts (6 abstr, U.S.) |
| Sources of Noise and Basic Phenomena | 29 | • Noise Sources in Community (5 abstr; 1 Canada, 2 India, 2 U.S.)<br>• Equipment Sources (3 abstr, U.S.)<br>• Sports Ground Sources (1 abstr, U.S.)<br>• Plate Noise Radiation (3 abstr, U.S.)<br>• Basic Phenomena (17 abstr, 1 France, 1 Poland, 1 Germany, 14 U.S.) |
| Design and Sound Barriers | 13 | • Engines, Mufflers and General Practices (4 abstr, 1 England, 3 U.S.)<br>• Partitions and Enclosures (4 abstr, U.S.)<br>• Barriers (5 abstr, U.S.) |

Table 7 (continued). GENERAL INTEREST PAPERS ON NOISE PUBLICATION DISTRIBUTION

| SIC/Industry/ Technology | Number of Publications | Areas of Publication |
|---|---|---|
| Equipment | 3 | • Sound Generation and/or Reduction Equipment (3 abstr, U.S.) |
| Law, Ordinances, Etc. | 37 | • Attitudes Toward Legislation (3 abstr, U.S.)<br>• Laws and Ordinances (22 abstr; 18 U.S., 2 England, 1 Finland, 1 Canada)<br>• Standards (3 abstr, U.S.)<br>• Discussions on Standards (9 abstr, U.S.) |
| Criteria | 8 | • Evaluation and Use (1 abstr, U.S.)<br>• Loudness and Annoyance (1 abstr, U.S.)<br>• Trends (1 abstr, U.S.)<br>• Level (1 abstr, U.S.)<br>• Quality and Economic Factors (2 abstr, U.S.)<br>• Frequency Analysis (2 abstr, U.S.) |
| Technical Notes | 8 | • Miscellaneous Subjects (7 abstr; 6 U.S., 1 England)<br>• Glossary (1 abstr, U.S.) |
| Measurement | 22 | • Insulation Measurement (2 abstr, U.S.)<br>• Soundfields (2 abstr, U.S.)<br>• Community Noise (2 abstr, U.S.)<br>• Transmission Loss (2 abstr, U.S.)<br>• Reverberant Chamber (4 abstr, U.S.)<br>• Miscellaneous (10 abstr; 6 U.S., 1 France, 1 Germany, 1 Japan, 1 Netherlands) |
| Modeling | 15 | • Reduction of Atomospheric Noise Data (2 abstr, U.S.)<br>• Reverberation Room Data Reduction (3 abstr, U.S.)<br>• Miscellaneous Studies (10 abstr, 8 U.S., 1 Canada, 1 Germany) |

Table 7 (concluded). GENERAL INTEREST PAPERS ON NOISE PUBLICATION DISTRIBUTION

| SIC/Industry/ Technology | Number of Publications | Areas of Publication |
|---|---|---|
| Planning | 29 | • Control (3 abstr, U.S.)<br>• Bibliography (1 abstr, U.S.)<br>• Loudness Ratings and Assessment (4 abstr, U.S.)<br>• General Discussion (2 abstr; 1 U.S., 1 Sweden)<br>• Planning (19 abstr; 14 U.S., 2 India, 1 England, 1 Germany, 1 Canada) |
| Conferences, Seminars, Compendia and Bibliographies | 36 | • Canada (4 abstr)<br>• England (8 abstr)<br>• France (1 abstr)<br>• India (1 abstr)<br>• Romania (1 abstr)<br>• Switzerland (1 abstr)<br>• U.S. (19 abstr)<br>• U.S.S.R. (1 abstr) |
| Sport Equipment | 4 | • Boats (1 abstr, U.S.)<br>• Snowmobiles (3 abstr, U.S.) |

## SECTION VII

## MACHINERY NOISE

Abstracts from the literature search relating to machinery noise were reviewed and their areas of activity distributed over the 20 industries. Abstracts which indicate apparent application to several industries were distributed into a "mixed category". A summary of the publication distribution is given in Table 8 and the distribution of the publications over the 21 categories is presented in Table 9. Briefly, the following comments are given:

- Identified as pertinent to machinery noise research are 308 publications; 248 are primarily industry oriented and 60 are in the mixed category. The majority (240) are U.S. publications. Sixty-eight foreign publications from 13 countries are identified.
- United States publications are distributed into 13 of the 20 industrial categories. No publications were identified in:

  Tobacco manufacturing
  Apparel manufacturing
  Furniture and fixtures
  Printing and publishing
  Leather and leather goods
  Electrical machinery
  Transportation equipment

  The industry with the most publications is chemical and allied products with 63 publications. Machinery, except electrical, has 35, petroleum and coal products has 31 publications, utilities has 26 and construction 24. Of the 11 publications in primary metals, only 3 are from the United States.
- Foreign publications are primarily from Germany (32), and Japan (9). Both of these countries' publications are broadly scattered throughout the categories but pockets of concentration appear in primary metals and fabricated metal products industries and in the mixed category.

- The review of the abstracts resulted in virtually no quantitative technical information which could be used in either assessing machine noise levels, nose reduction techniques, or the effectiveness of the application of technology. The reports must be gathered and reviewed before any assessment of this type can be made.

- Generic noise problems seem to be treated by several industries. For instance:

  Valve Noise reduction activity is evident in the utilities and in chemical and allied products.

  Pump Noise is treated by chemical and allied products in the mixed category.

  Piping System Noise reduction techniques are used by utilities and chemical and allied products.

  Combustion Noise has literature in petroleum and coal products, utilities and chemical and allied products and in the mixed category.

  Fan Noise reduction activity is identified with petroleum and coal products, utilities and in the mixed category.

It would appear, therefore, that the transfer of the noise reduction technology across industries should be effective and research activities could be defined which have relatively broad applicability to several industries.

Table 8. SUMMARY OF MACHINERY NOISE PUBLICATION DISTRIBUTION

| Number (308) | Publications on Machinery Noise |
|---|---|
| (248) | (publications which are primarily industry oriented) |
| (60) | (publications in mixed categories applicaboe to several industries) |
| 1 | Australian publication on fan noise |
| 1 | Austrian publication on industrial noise survey |
| 1 | Canadian publication on underground operations of coal mines |
| 1 | Czechoslovakian publication on power plant turbines |
| 4 | English publications on chemical and allied products, primary metals, utilities and plant noise control |
| 4 | French publications on construction equipment, chemical and allied products and HVAC |
| 32 | German publications in 11 C111 areas with emphasis on chemical and allied products, primary metals and machinery except electrical |
| 9 | Japanese publications on chemical and allied products, fabricated metal products, machinery except electrical, utilities, criteria and HVAC |
| 2 | Netherlands publications on utilities |
| 3 | Polish publications on chemical and allied products and machinery except electrical |
| 4 | Swedish publications on food and kindred products, primary metals and fabricated metal products |
| 240 | U.S. publications broadly scattered |
| 5 | U.S.S.R. publications primarily on utilities |
| 1 | Yugoslavian publication on metal cutting |

Table 9. MACHINERY NOISE PUBLICATION DISTRIBUTION

| SIC/Industry/ Technology | Number of Publications | Areas of Publication |
|---|---|---|
| Construction Equipment | 24 | • Construction Site Noise (6 abstr; 5 U.S., 1 Germany)<br>• Pneumatic Rock Drill (3 abstr, U.S.)<br>• Pile Drivers (2 abstr; 1 U.S., 1 Germany)<br>• General Discourse (4 abstr, U.S.)<br>• Construction Equipment in General (3 abstr, U.S.)<br>• Cooling Systems (2 abstr; 1 U.S., 1 France)<br>• Compressors (2 abstr, U.S.)<br>• Pneumatic Equipment (2 abstr, U.S.) |
| Food and Kindred Products | 13 | • Agricultural Machinery (10 abstr; 9 U.S., 1 Sweden)<br>• Brewery Noise (1 abstr, U.S.)<br>• Cap Manufacturing Plant (1 abstr, U.S.)<br>• Processing Operations (1 abstr, U.S.) |
| Tobacco Manufacturers | None | |
| Textile Mill Products | 6 | • Rotating Textile Spindles (1 abstr, U.S.)<br>• Textile Machinery Noise (2 abstr, U.S.)<br>• Manufacturer's Noise Sources (1 abstr, U.S.)<br>• Guidelines for Noise Control (2 abstr, U.S.) |
| Apparel Manufacturers | None | |
| Lumber and Wood Products | 7 | • General Interest (2 abstr, U.S.)<br>• Saws (3 abstr; 2 U.S., 1 Germany)<br>• Planers (2 abstr, U.S.) |
| Furniture and Fixtures | None | |

Table 9 (continued). MACHINERY NOISE PUBLICATION DISTRIBUTION

| SIC/Industry/ Technology | Number of Publications | Areas of Publication |
|---|---|---|
| Paper and Allied Products | 4 | • Health Aspects (2 abstr, U.S.)<br>• Paper Converting Machinery (1 abstr, U.S.)<br>• Nylon Gears (1 abstr, U.S.) |
| Printing and Publishing | None | |
| Chemical and Allied Products | 63 | • Valve Noise (24 abstr; 22 U.S., 1 France, 1 Germany)<br>• Piping Noise (2 abstr, U.S.)<br>• Combustion Noise (12 abstr; 8 U.S., 1 England, 3 Germany)<br>• Compressors (4 abstr; 3 U.S., 1 Germany)<br>• Pumps (7 abstr; 4 U.S., 1 Japan, 2 Poland)<br>• Heat Exchangers (1 abstr, U.S.)<br>• Stock Preparation Machinery (2 abstr, U.S.)<br>• Feeder Noise (1 abstr, U.S.)<br>• Process Noise (10 abstr, U.S.) |
| Petroleum and Coal Products | 31 | • Process Machinery Noise (6 abstr, U.S.)<br>• Fans (1 abstr, U.S.)<br>• Burners (1 abstr, U.S.)<br>• Steam Pipelines (2 abstr, U.S.)<br>• Stacks (1 abstr, U.S.)<br>• Flares (2 abstr, U.S.)<br>• Refinery (8 abstr, U.S.)<br>• Drilling (1 abstr, U.S.)<br>• Coal Preparation Plants (3 abstr, U.S.)<br>• Underground Operations (5 abstr; 4 U.S., 1 Canada)<br>• Coal Unloading (1 abstr, U.S.) |
| Rubber and Plastic Products | 5 | • Plant Noise Sources (1 abstr, U.S.)<br>• Machinery (3 abstr, U.S.)<br>• Materials Handling Systems (1 abstr, U.S.) |

Table 9 (continued). MACHINERY NOISE PUBLICATION DISTRIBUTION

| SIC/Industry/ Technology | Number of Publications | Areas of Publication |
|---|---|---|
| Leather and Leather Goods | None | |
| Stone, Clay and Glass Products | 4 | • Ball Mills (1 abstr, U.S.)<br>• Cement Plant (3 abstr; 1 U.S., 2 Germany) |
| Primary Metals | 11 | • Steel Plant Noise (2 abstr; 1 England, 1 Germany)<br>• Forging (2 abstr; 1 U.S., 1 Germany)<br>• Foundry (7 abstr; 2 U.S., 4 Germany, 1 Sweden) |
| Fabricated Metal Products | 20 | • Impact Machines (2 abstr, U.S.)<br>• Metal Forming (2 abstr; 1 Japan, 1 U.S.S.R.)<br>• Riveting Machine (2 abstr, U.S.)<br>• Cablemaking Machine (2 abstr; 1 U.S., 1 Germany)<br>• Conveyor (1 abstr, Germany)<br>• Presses (5 abstr; 3 U.S., 2 Sweden)<br>• Boiler Room (1 abstr, U.S.)<br>• General Equipment (5 abstr; 4 U.S., 1 Germany) |
| Machinery Except Electrical | 35 | • Impact (3 abstr, U.S.)<br>• Measurements (5 abstr, U.S.)<br>• Gears (8 abstr; 6 U.S., 1 Poland, 1 Japan)<br>• Miscellaneous Sources (1 abstr, Germany)<br>• Damping (1 abstr, U.S.)<br>• Bearings (2 abstr, U.S.)<br>• Belt Drive (1 abstr, Japan)<br>• Grinding (1 abstr, Germany)<br>• Hammering (1 abstr, Germany)<br>• Cutting (1 abstr, Yugoslavia)<br>• Clutch (1 abstr, U.S.)<br>• General (10 abstr; 8 U.S., 2 Germany) |

Table 9 (continued). MACHINERY NOISE PUBLICATION DISTRIBUTION

| SIC/Industry/ Technology | Number of Publications | Areas of Publication |
|---|---|---|
| Electrical Machinery | None | |
| Transportation Equipment | None | |
| Utilities | 26 | • Steam Piping (1 abstr, U.S.)<br>• Fans (1 abstr, Japan)<br>• Power Plants (2 abstr, U.S.)<br>• Valves (1 abstr, U.S.)<br>• Machinery (2 abstr, U.S.)<br>• New Plant Planning (1 abstr, U.S.)<br>• Turbines (10 abstr; 7 U.S., 1 Czechoslovakia, 1 U.S.S.R., 1 Japan)<br>• Compressor Stations (6 abstr; 2 Netherlands, 3 U.S.S.R., 1 England)<br>• Cooling Tower (1 abstr, U.S.)<br>• Furnace (1 abstr, Germany) |
| Mixed Category | 16 | Industrial Noise Sources<br>• Plant Noise Control (5 abstr; 3 U.S., 1 England, 1 Germany)<br>• Criteria (3 abstr, U. S.)<br>• Noise Surveys (5 abstr; 3 U.S., 1 Germany, 1 Austria)<br>• Community Reactions (2 abstr, U.S.)<br>• Health Effects (1 abstr, U. S.) |
| | 3 | Noise Measurement Techniques (3 abstr, U.S.) |
| | 4 | Noise Criteria and Standards (4 abstr; 3 U.S., 1 Japan) |
| | 3 | Mechanical Equipment (3 abstr, U. S.) |
| | 2 | Pneumatic Equipment (2 abstr, U.S.) |
| | 4 | Hydraulic Equipment (4 abstr, U.S.) |

Table 9 (concluded). MACHINERY NOISE PUBLICATION DISTRIBUTION

| SIC/Industry/ Technology | Number of Publications | Areas of Publication |
|---|---|---|
| Mixed Category (concl) | 5 | Acoustic Treatment (5 abstr; 4 U.S., 1 Germany) |
| | 22 | Heating, Ventilating and Air Conditioning<br>• Compressors (2 abstr; 1 U.S., 1 Germany)<br>• Fans (9 abstr; 1 Australia, 6 U.S., 2 Japan)<br>• Chillers (2 abstr, U.S.)<br>• Pumps (1 abstr, Germany)<br>• Air Conditioning Cabinet (1 abstr, Germany)<br>• Heat Exchangers (1 abstr, U.S.)<br>• Exhaust Vent (1 abstr, U.S.)<br>• HVAC Systems (5 abstr; 2 U.S., 2 France, 1 Germany) |

## SECTION VIII

## NOISE EFFECTS ON HEALTH

Abstracts from the literature search relating to noise effects on health were reviewed and their areas of activity distributed over 17 categories. A summary of the publication distribution is given in Table 10 and the distribution of the publications over the 17 categories is presented in Table 11. A review of these tables indicates:

- Publications identified as related to noise effects on health totaled 143. From the United States 113, and 30 were from seven foreign countries.
- One-third (10) of the foreign publications were German. These abstracts were distributed over five categories. England had five publications distributed over three categories. The remaining foreign countries had between one and three publications identified.
- The ear damage category had the most abstracts (30). This was about three times the number of any other technical category. Ear damage also had the most foreign abstracts (9) from four countries (Austria, 2; England, 3; Germany, 3; and Russia, 1).
- Other categories with eight or more abstracts are: General Interest (17), Criteria (10), Aircraft Noise Related (10), Protection (9), Nonauditory Effects (9), Psychological Effects (8), and Impulsive Noise (8).
- Only seven categories had solely U.S. publications; Exposure (5), Effects on Sleep (1), Intermittent Noise (4), Intense Noise (4), Loudness (9), Masking (7), and Dosimeter (4).
- None of the categories is dominated by foreign publications.

Table 10. SUMMARY OF NOISE EFFECTS ON HEALTH PUBLICATION DISTRIBUTION

| Number (143) | Publications on Noise Effects on Health |
|---|---|
| 2 | Austrian publications on ear damage |
| 3 | Canadian publications; two on aircraft noise related effects, and one general paper |
| 5 | English publications on nonauditory effects, protection and ear damage |
| 2 | French publications on impulsive noise and protection |
| 10 | German publications on aircraft noise effects, psychological effects, annoyance, measurement and ear damage |
| 1 | Netherlands publication on criteria |
| 118 | U.S. publications on 17 areas |
| 2 | U.S.S.R. publications; one on ear damage, and one general paper |

Table 11. NOISE EFFECTS ON HEALTH PUBLICATION DISTRIBUTION

| SIC/Industry/ Technology | Number of Publications | Areas of Publication |
|---|---|---|
| Criteria | 10 | • Damage-Risk Criteria (7 abstr, U.S.)<br>• Industrial Noise (3 abstr, 2 U.S., 1 Netherlands) |
| Exposure | 5 | • Five abstr, U.S. |
| Impulstive Noise | 8 | • TTS from Impulsive Noise (2 abstr, U.S.)<br>• Susceptibility to Damage (2 abstr, U.S.)<br>• Perceived Levels and Differences (2 abstr, U.S.)<br>• Pathological Effects (1 abstr, France)<br>• Conchlear Degeneration (1 abstr, U.S.) |
| Effects on Sleep | 1 | • One abstr, U.S. |
| Intermittent Noise | 4 | • Four abstr, U.S. |
| Aircraft Noise Related | 10 | • Effects of Aircraft Noise on Sleep (3 abstr, U.S.)<br>• Noise Disturbance Prediction (1 abstr, U.S.)<br>• Hearing Acuity with Age and Flying Time (1 abstr, Germany)<br>• Sonic Boom Effects (5 abstr; 3 U.S., 2 Canada) |
| Psychological Effects | 8 | • Eight abstr; 6 U.S., 2 Germany |
| Intense Noise | 4 | • Four abstr, U.S. |
| Annoyance | 4 | • Four abstr; 3 U.S., 1 Germany |
| Loudness | 9 | • Nine abstr, U.S. |

Table 11 (concluded). NOISE EFFECTS ON HEALTH PUBLICATION DISTRIBUTION

| SIC/Industry/ Technology | Number of Publications | Areas of Publication |
|---|---|---|
| Nonauditory Effects | 9 | • Nine abstr; 8 U.S., 1 England |
| Masking | 7 | • Seven abstr, U.S. |
| Measurement | 4 | • Four abstr; 2 U.S., 2 Germany |
| Dosimeter | 4 | • Four abstr, U.S. |
| Protection | 9 | • Nine abstr; 7 U.S., 1 France, 1 England |
| Ear Damage | 30 | • Kryter's Impairment to Hearing from Exposure to Noise and Comments and Countercomments (5 abstr, U.S.)<br>• Industrial Noise Effects (5 abstr; 1 U.S., 1 England, 3 Germany<br>• Effects on Animals (2 abstr, U.S.)<br>• TTS (4 abstr, U.S.)<br>• Medical Aspects (3 abstr; 1 U.S., 2 Austria)<br>• General (11 abstr; 8 U.S., 2 England, 1 U.S.S.R.) |
| General Interest | 17 | • 17 abstr; 14 U.S., 1 Canada, 1 Germany, 1 U.S.S.R. |

## SECTION IX

## NOISE MEASUREMENT INSTRUMENTATION

Abstracts from the literature search relating to noise measurement instrumentation were reviewed and distributed into nine categories. A summary of the publication distribution is given in Table 12 and the distribution of the abstracts over the nine categories is presented in Table 13. A review of these tables indicates:

- Seventy publications are identified as relating to noise measurement instrumentation. Only four of these publications are foreign; one Canada, two Germany, and one India.
- The nine categories are dominated by: Instruments with 21 publications; Diagnostic Techniques with 17 publications; and Noise Survey Instrumentation with 11 abstracts.
- The Diagnostic Technique category, with 17 publications, has abstracts on such a variety of subjects that further subgrouping is difficult without a review of the publication.
- Noise Survey Instrumentation, with 11 abstracts, has publications almost evenly divided between Instrumentation and Industrial Noise Surveys (6) and Instrumentation for Community Noise Surveys (5).
- The category on instruments, with 21 abstracts, has abstracts which treat topics such as: Laser Analysis (1), Microphones (2), Shock Tubes (1), Space Averaged Measurements (1), Wedge Design (1), and Impulse Sound Measurement (3).

Table 12. SUMMARY OF NOISE MEASUREMENT INSTRUMENTATION PUBLICATION DISTRIBUTIONS

| Number (70) | Publications on Noise Measurement Instrumentation |
|---|---|
| 1 | Canadian publication on dosimeter |
| 2 | German publications on diagnostic techniques and instruments |
| 1 | Indian publication on diagnostic techniques |
| 66 | U.S. publications primarily on instruments, diagnostic techniques and surveys |

Table 13. NOISE MEASUREMENT INSTRUMENTATION PUBLICATION DISTRIBUTION

| SIC/Industry/ Technology | Number of Publications | Areas of Publication |
|---|---|---|
| Noise Survey Instrumentation | 11 | • Industrial Noise Survey Instrumentation (6 abstr, U.S.)<br>• Community Noise Survey Instrumentation (5 abstr, U.S.) |
| Sound Power Instrumentation | 4 | • Four abstr, U.S. |
| Sound Pressure Instrumentation | 1 | • One abstr, U.S. |
| Dosimeter | 4 | • Four abstr; 3 U.S., 1 Canada |
| Loudness Measurements | 4 | • Four abstr, U.S. |
| Diagnostic Techniques | 17 | • 17 abstr; 1 Germany, 15 U.S., 1 India (Variety of Subjects) |
| Noise Rating Methods | 2 | • Two abstr, U.S. |
| Instruments | 21 | • Laser Analysis (1 abstr, U.S.)<br>• Microphones (2 abstr, U.S.)<br>• Shocktubes (1 abstr, U.S.)<br>• Space Averaged Measurements (1 abstr, U.S.)<br>• Wedge Design for Anechoic Chamber (1 abstr, U.S.)<br>• Impulse Sound Measurement (3 abstr, U.S.)<br>• General (12 abstr; 1 Germany, 11 U.S.) |
| Standards | 6 | • General (6 abstr, U.S.) |

## SECTION X

## TRANSPORTATION NOISE

Abstracts from the literature search relating to transportation noise were reviewed and their areas of activity distributed over 15 categories. A summary of the publication distribution is given in Table 14 and the distribution of the publications over the 15 categories is presented in Table 15. The following comments relative to these tables are offered:

- Abstracts identified totaled 153; 133 were U.S. publications and 31 were from seven foreign countries.
- Diesel Engine Noise, with 26 abstracts, represents the category with the most publications. Noise reduction efforts are directed toward Techniques (17 abstracts), Operational Changes (4 abstracts) and Covers and Shields (5 abstracts). Seven foreign publications were identified: Germany (6) and Japan (1).
- Vehicle Design had 24 abstracts associated with this category. Specific subtopics included: Damping Materials (1); Noise Sources (1); Engine Encapsulation (2); Passenger Compartment Treatment (6); and Noise Reduction in General (5). Only three foreign publications were identified in this category: England (1), France (1), and Germany (1).
- Highway planning and design had 21 publications on a wide variety of subtopics. Four foreign abstracts were identified from Germany (3) and Spain (1).
- Nine out of the 15 categories are associated with motor vehicle transportation. In terms of publications, 126 of the 153 abstracts are distributed through these nine categories.
- Rail transportation is associated with two categories and three abstracts (U.S., 2 and Sweden, 1).
- Public transportation is treated in one category with 10 publications.
- Foreign publications are directed, mainly, to Engine Noise (11), Traffic Noise (5), Highway Design and Planning (4), and Vehicle Design (3).

Table 14. SUMMARY OF TRANSPORTATION NOISE PUBLICATION DISTRIBUTIONS

| Number (153) | Publications on Transportation Noise |
|---|---|
| 4 | English publications on vehicle design, tire noise, engines and intake and exhaust noise |
| 3 | French publications on vehicle design, public transportation and highway sound barriers |
| 15 | German publications primarily on diesel engines, traffic and highway design and planning |
| 1 | Italian publication on general interest |
| 3 | Japanese publications on engine and traffic noise |
| 1 | Spanish publication on highway design and planning |
| 2 | Swedish publications on locomotive and traffic noise |
| 122 | U.S. publications on 14 areas primarily on vehicle design, diesel engine noise and highway design and planning |
| 2 | U.S.S.R. publications on engine noise |

Table 15. TRANSPORTATION NOISE PUBLICATION DISTRIBUTION

| SIC/Industry/ Technology | Number of Publications | Areas of Publication |
|---|---|---|
| Vehicle Design | 24 | • Application on Damping Material (1 abstr, U.S.)<br>• Identification of Noise Sources (10 abstr; 8 U.S., 1 France, 1 Germany)<br>• Engine Noise Encapsulation (2 abstr; 1 U.S., 1 England)<br>• Passenger Compartment Noise (6 abstr, U.S.)<br>• Noise Reduction (5 abstr, U.S.) |
| Tire Noise | 12 | • Tire Noise Characteristics (3 abstr, U.S.)<br>• Preliminary Investigations (2 abstr; 1 England, 1 Germany)<br>• Standards and Practices (2 abstr, U.S.)<br>• Subjective Evaluations (3 abstr, U.S.)<br>• "Good Tire" Characteristics (1 abstr, U.S.)<br>• Effects of Operating Parameters (1 abstr, U.S.) |
| Diesel Engine Noise | 26 | • Noise Reduction Techniques (17 abstr; 14 U.S., 3 Germany)<br>• Operational Changes (4 abstr; 3 U.S., 1 Japan)<br>• Covers and Shields (5 abstr; 2 U.S., 3 Germany) |
| Other Engines | 7 | • Seven abstr; 3 U.S., 1 England, 1 Japan, 2 U.S.S.R. |
| Intake and Exhaust Noise | 10 | • Ten abstr; 8 U.S., 1 England, 1 Germany |
| Automotive Equipment | 5 | • Cooling System (2 abstr, U.S.)<br>• Air Bag (1 abstr, U.S.)<br>• Transmission (1 abstr, U.S.)<br>• Axle Gear (1 abstr, U.S.) |
| Magnetic Propulsion | 1 | • One abstr, U.S. |

Table 15 (concluded). TRANSPORTATION NOISE PUBLICATION DISTRIBUTION

| SIC/Industry/ Technology | Number of Publications | Areas of Publication |
|---|---|---|
| Locomotive Noise | 1 | • One abstr, Sweden |
| Rail Yard Noise | 2 | • Two abstr, U.S. |
| Public Transportation Noise | 10 | • Ten abstr; 9 U.S., 1 France |
| Traffic Noise | 15 | • Design and Planning (2 abstr; 1 Germany, 1 Sweden)<br>• Control (3 abstr; 2 U.S., 1 Germany)<br>• Modeling (5 abstr; 4 U.S., 1 Germany)<br>• Surveys (4 abstr, U.S.)<br>• Annoyance (1 abstr, Japan) |
| Highway Sound Barriers | 6 | • Six abstr; 5 U.S., 1 France |
| Highway Design and Planning | 21 | • 21 abstr; 17 U.S., 3 Germany, 1 Spain |
| Regulations and Standards | 4 | • Four abstr, U.S. |
| General Interest | 9 | • Nine abstr; 8 U.S., 1 Italy |



☆ U.S. GOVERNMENT PRINTING OFFICE: 1975—210-810:71

## TECHNICAL REPORT DATA
*(Please read Instructions on the reverse before completing)*

| | | |
|---|---|---|
| 1. REPORT NO. EPA-600/2-76-016a | 2. | 3. RECIPIENT'S ACCESSION NO. |
| 4. TITLE AND SUBTITLE ABSTRACTS OF THE 1971-1974 UNITED STATES AND FOREIGN OPEN LITERATURE ON NOISE - Part I | | 5. REPORT DATE January 1976 |
| | | 6. PERFORMING ORGANIZATION CODE |
| 7. AUTHOR(S) E. P. Bergmann, I. B. Fieldhouse | | 8. PERFORMING ORGANIZATION REPORT NO. |
| 9. PERFORMING ORGANIZATION NAME AND ADDRESS IIT Research Institute, 10 W. 35th Street, Chicago, Illinois 60616 | | 10. PROGRAM ELEMENT NO. |
| | | 11. CONTRACT/GRANT NO. 68-01-2234 |
| 12. SPONSORING AGENCY NAME AND ADDRESS Office of Research and Development, U.S. Environmental Protection Agency, Washington, DC 20460 | | 13. TYPE OF REPORT AND PERIOD COVERED Final |
| | | 14. SPONSORING AGENCY CODE EPA-ORD |
| 15. SUPPLEMENTARY NOTES | | |

16. ABSTRACT

This document is a task report of effort directed toward a search of the open literature to provide some insight into the noise reduction effort outside of the Federal Government and in foreign countries. Abstracts from the search covered the period 1971 to 1974. Two primary sources were searched for abstracts: The Engineers Index and Pollution Abstracts.

Nearly 1300 abstracts from 21 countries were screened and segregated into the following categories: Aircraft Noise; Building Noise; General Interest; Machinery Noise; Noise Effects on Health; Noise Measurement Instrumentation; and Transportation Noise. The distribution of abstracts within each technical area is summarized in the report, and a compilation of the abstracts is presented as an appendix and bound separately.

It appears that a substantial level of privately sponsored noise research and development is reflected in open literature publications. Industrial or private sponsorship is indicated in areas in which a regulation demands attention to the noise problem or a product relating to noise is being "advertised". Government sponsorship is indicated in the areas in which there is a potential benefit to the public. University sponsorship appears to be a small part of the total effort and is directed to particular academic interests.

17. KEY WORDS AND DOCUMENT ANALYSIS

| a. DESCRIPTORS | b. IDENTIFIERS/OPEN ENDED TERMS | c. COSATI Field/Group |
|---|---|---|
| Accoustic Noise | Transportation noise | 01C |
| Aircraft noise | Foreign abstracts | 13F |
| Noise reduction | Noise measurement | 21E |
| Abstracts | Building noise | 05B |
| | 1971-74 | |

| | | |
|---|---|---|
| 18. DISTRIBUTION STATEMENT Release to Public | 19. SECURITY CLASS *(This Report)* Unclassified | 21. NO. OF PAGES |
| | 20. SECURITY CLASS *(This page)* Unclassified | 22. PRICE |

EPA Form 2220-1 (9-73)