

NOISE AND VIBRATION HAZARD IN POLAND

(synthesis of a report)

ZBIGNIEW ENGEL, JERZY SADOWSKI

1. Introduction

This elaboration is a synthesis of the report "Noise and vibration hazard in Poland", prepared by a research group appointed by the Committee on Acoustics of the Polish Academy of Sciences, including Prof. Z. ENGEL (Chairman), Prof. L. GRZEGORCZYK, R. KUCHARSKI, M. Sc., Ass. Prof. A. LIPOWCZAN, Ass. Prof. Cz. PUZYNA, Prof. J. SADOWSKI, Ass. Prof. W. SUŁKOWSKI, with the cooperation of a broad group of experts. The report includes complex information on the noise and vibration hazard in Poland and on all the activities performed here to decrease the level of vibration and noise in the environment of man.

The purpose of the elaboration was to:

1. indicate to the state authorities, in particular the State Council for the Protection of the Environment and to the Board of the Protection of the Environment and Water Management, the state of the noise and vibration hazard;
2. analyse the present state and also the origin of the hazard;
3. evaluate the efficiency of activities in the scope of noise and vibration control;
4. analyse the needs occasioned by the state of the hazard;
5. evaluate the scientific, organizational and control structures engaged in the noise and vibration control;
6. propose conclusions and postulates, resulting from this report to the appropriate authorities.

2. Evaluation of the state of the hazard*2.1. Characteristic of the harmful effect of noise and vibration*

Noise and vibration are forms of the pollution of the environment which are annoying, arduous and quite frequently harmful to man and other live organisms.

On the basis of the data given in the report, it can be stated that the noise and vibration hazard in Poland is so great that it is justified to define it as a general one, since it occurs throughout the country, in all the branches of the national economy, in the environment where man lives, works and rests, including also the natural habitat disturbed by the activities of man.

The noise and vibration hazard affects, to a varying degree, the population of Poland, up to about 40% of its inhabitants, both where they live, work and rest; in health service centres, sanatoria and resorts; in schools; in means of transportation; and also in urban and industrial areas.

Thus, noise and vibration are annoying factors with general social range, occurring in all the fields of the environment of man, affecting all citizens, having a harmful effect on their health, making it difficult for them to rest and regenerate, diminishing the effects of human work and increasing the probability of accidents at work.

2.2. Noise and vibration hazard to the population in urban areas and in housing and public objects

General and, at the same time, most annoying noise sources are the routes and objects of car, tramway, rail and aviation transportation, large industrial plants, small industries and communal objects. Transportation noise is the most annoying. In 1970-1982 the mean level of transportation noise in large Polish cities increased on average by 1 dB(A) per year. In urban areas transportation noise determines the quality of the acoustic climate of the environment. Up to 1983, about 250 acoustic maps of town had been made in Poland. It follows from them that the mean values (for the whole town) of the statistical noise levels L_{50} are as follows:

- in large cities - 61-72 dB(A) (67 dB(A) on average);
- in medium size towns - 57-68 dB(A) (63 dB(A) on average);
- in small towns - 52-69 dB(A) (61 dB(A) on average);
- in spas and holiday resorts - 48-66 dB(A) (58 dB(A) on average). Thus, apart from the spas and holiday resorts, for which L_{50} is 58 dB(A) on average, in the other three groups the level of 60 dB(A) is exceeded. This signifies that over much of urban area situated at transportation routes and streets, levels much higher than 60 dB(A) occur. This is true of 30-90% of the length of urban streets (depending on the characteristic and transportation system of the town).

Heavy vehicles contribute most to high noise levels. About 40% of these vehicles are characterized by noise exceeding 85 dB(A) and as much as 80% of them generate noise exceeding 80 dB(A). The annoying character of noise from road transportation means is also indicated by the number of motor vehicles used in Poland. The total number of about 4 mln vehicles includes about 650 000 lorries and 670 000 agricultural tractors, i.e. those vehicles whose level of external noise varies between 85-92 dB(A). The noise level of the other vehicles, mainly passenger cars, is 75-85 dB(A). These values are true of newly manufactured vehicles. With increasing age of the vehicle, the level of external noise generated by it increases by 2-4 dB(A). The external noise of vehicles does not exhaust the problem of the annoying character of the noise from means of transportation. There still remains the question of the internal noise in vehicles, whose negative effects are very harmful. Although it affects only the users of the vehicles, but taking into account the population using the means of transportation, only in urban transportation, every day the population of 17 mln, since so many persons use means of transportation every day, is exposed to bus internal noise.

In heavy vehicles, the internal noise reaches 90-92 dB(A). During normal drive in passenger cars, the mean noise level varies between 75 and 80 dB(A) and 80-85 dB(A) in heavy lorries and buses. These are levels to which the users of the vehicles are exposed continuously.

Noise inside the vehicle is accompanied by vibration, which, in particular in agricultural and ballast tractors, is of essential significance.

Noise from railways and airports was found to be very annoying, particularly when they are used close to housing estates (Warsaw, Poznań, Radom, Krakow, Kolobrzeg etc.).

The highly annoying character of transportation noise results from the fact that:

- there is a constant increase in the intensity of transportation;
- there is an increase in the number of vehicles and aircraft with high power and load capacity (lorries and buses). For over more than 20 years there has been no essential progress in decreasing the noisiness of cars, tramways and railways, without which it is impossible to decrease the annoying character of noise of this group to the level defined by standards.

Industrial plants, both large and small (situated as a rule among urban buildings), are highly annoying to the external environment, above all in view of the noisy technological processes, noisy machinery and bad localisation in the environment.

In buildings situated close to transportation routes, particularly those of rail vehicles, there also occurs, apart from noise, vibration, affecting not only people but also the construction of buildings, causing their damage, which requires more frequent repair, and can in some cases cause collapse. Vibration is particularly harmful to objects of historic interest.

Particularly annoying sources of noise and vibration in housing and public buildings are excessively noisy appliances and installations which are part of the equipment of the buildings (the installations of central heating, water supply, ventilation, lifts, in-built transformers). The noise levels generated by these sources, which penetrate into protected interiors, greatly exceed the permissible values. This is caused by the bad quality of these installations, lack of proper conservation and the low resistance of prefabricated ferro-concrete buildings (constituting about 70% of all the buildings erected recently in Poland) to noise and vibration transmission.

Among the most significant causes of noise hazard to the population in housing and public buildings, apart from the continuously deteriorating acoustic climate of the big-city environment, one should include; the insufficient use in practice of the possibilities of urbanistic and construction protection, the excessive noisiness of installations, the localisation of shops and services in housing buildings, the bad quality of construction, resulting from improper design and workmanship, but also from shortage of materials for noise-insulation of buildings.

It is estimated that about 30% of the population of large urban agglomerations is exposed to road noise. In smaller towns this percentage is about 20. Taking into account the additional exposure to transportation noise at housing estates localised close to inter-city trunk roads, it can be assumed that the total population exposed to traffic noise at levels of 40-55 dB(A) in the apartment is about 3.5 mln.

The installation noise hazard in housing buildings affects above all the inhabitants of multi-family apartment blocks built in the 1960's and later. This phenomenon has intensified recently and is related to the deteriorating quality of installations and the tendency of housing all the technical equipment inside the building, with no possibilities of proper insulation of these interiors, particularly in prefabricated buildings.

It should be pointed out, however, that despite the relatively low levels (30-45 dB(A) in average in the apartment), this type of noise is highly annoying, which is reflected in the very negative social evaluation of this phenomenon.

The exposure of inhabitants to installation noise increases in building with mechanical exhaust ventilation. In view of the very bad quality of equipment, lack of materials for duct insulation, improper conservation of already assembled installations; noise levels in apartments, particularly those on the upper two storeys, can reach 50 dB(A).

The exposure of apartments to neighbour noise has tended to increase, particularly over the last 5 years when in largepanel building the use of ceilings with floor finish as the only acoustic insulation has been favoured. This causes a large decrease in the acoustic insula-

tion among apartments, particularly in prefabricated buildings, in which, as a result of bad workmanship, the joints are not tight enough. The percentage exposure to neighbour noise in prefabricated large-panel buildings erected in the 1960's and 1970's is much higher and, depending on the quality of execution and system, varies between a few and even 40%, in particular buildings; whereas in the recent period, after the elimination of floating floors, it has increased to 50-100%, with a simultaneous increase in noise penetrating from adjacent apartments.

The exposure of apartments to noise from services localised in housing buildings is infrequent, as a result of the tendency — correct from the acoustic point of view — to house these services in separate pavilions. In cases when they are situated inside housing blocks, the main sources of acoustic interference are appliances (e.g. compressors and refrigerators) causing noise at levels of 30-50 dB (A) to occur in apartments. Restaurants with recreational activity are also the source of large hazard to apartments.

The acoustic climate in health centres is distinctly bad. About 40% of objects in towns are localised in areas where the noise level exceeds 60 dB (A). Analogously to housing, the problems related to installation noise are also observed to increase, particularly in newly constructed hospitals. Another factor causing an additional deterioration of the internal acoustic climate is the increasingly often used medical equipment, mainly in the operation theatres and post-operational interiors. A gradual improvement in the situation can only be achieved by correct — from the acoustic point of view — localisation of new objects of health service and introduction of means of acoustic protection in typical construction designs.

Analysis of the acoustic conditions in institutions of education indicates the deciding role played by the internal noise in shaping the acoustic climate, related to life and the activities of the institutions themselves.

The children's and youth's activity and overcrowding, combined with the insufficient use of technical means of protection, lead to an excessive increase in the noise level, particularly in the corridors at breaks and lessons, during gym classes or in recreation rooms.

Above all creches and kindergartens are exposed to external noise. Although these institutions usually tend to be better localised, nevertheless in about 10-30% of the objects the external noise can interfere with children's rest and sleep.

The acoustic climate of most sanatoria, centres of preventive treatment and the convalescents' recreation grounds involves relatively favourable conditions for rest and cure. However, some objects are situated in areas hardly different in acoustic terms from city centres or big-city agglomerations.

2.3. Noise hazard in industry

Noise levels at a large number of work posts in industry exceed both the safe noise values (80 dB (A) and the values of 85 dB (A) and 90 dB (A)).

E.g. noise levels at work post in industry are: in heavy industry between 90 and 134 dB (A); in machinery industry between 92 and 125 dB (A), in light industry between 90 and 114 dB (A), in building and construction materials industry between 91 and 119 dB (A), in chemical industry between 90 and 120 dB (A).

There is the following state of hazard:

1) It is estimated that in the work environment about 3.5 mln employees are exposed to noise with levels exceeding 80 dB (A), including more than 600 000 employees working in noise of above 90 dB (A), 116 000 are exposed to noise exceeding 100 dB (A).

2) The number of employees exposed in Poland, to a different degree, to local vibration is estimated at 90 000 persons, and 822 000 persons are affected by general vibration.

3) Noise and vibration in the work environment, depending on the values of the level

and duration of the employees' exposure, are the causes of professional diseases — permanent hearing loss and vibration disease. The occupational deafness is the most frequent among the professional diseases in Polish industry and occurs oftener than skin diseases and acute, permanent poisoning.

4) In 1975–1982 the percentage of occupational hearing loss per 100 000 employees increased from 12.3% in 1975 to 23% in 1982. The number of found cases of the occupational vibration disease increased from 424 in 1970 to 898 in 1981.

5) The highest number of found cases of occupational deafness in 1975–1982 occurred in the industries of: means of transportation (740), coal mining (384), textile (357), machinery (305), iron metallurgy (176), metals metallurgy (169), construction (152), transportation and communications (117).

6) The most cases of the vibration diseases were in 1970–1982 found in the industries of: forestry (247), means of transportation (145), coal mining (113), machinery (96), construction (92) and metals industry (82).

Taking into account the recent results of world research on the harmful effect of noise and vibration, from which it follows that it is only at noise levels below 80 dB (A) that no cases of occupational deafness occur — it should be stated that even when the currently standing permissible value has been decreased from 90 dB (A) to 85 dB (A), still 10% of employees will be endangered by deafness.

3. Evaluation of the current situation in terms of prevention

3.1. General evaluation of the progress in research and utilization of its results

Over the last decade in Poland there has been a dynamic development of objects of industry transportation, housing and general construction. At the same time, the annoying character of towns has increased. These has occurred the necessity of limiting the annoying character of noise in construction and industry, causing also the need for scientific research on the protection of the environment of man from noise and vibration and for dissemination of the research in a large number of fields of the national management. Hence, the period 1970–1982 was characterized by the undertaking of large complex research programs with essential significance for the national management, aimed at considerable application of the research results in practice. It involved an intensive development of research and utilization cadres, whose scientific level greatly improved, and was related to the development of the already existing and the formation of new research centres, both at universities and in industrial departments. An important role in this development was played by the undertaking of large research programs also in the range of anti-noise and anti-vibration protection and expansion of collaboration with other countries.

The research up to 1983 in the range of the protection of the environment from noise and vibration covered in fact most problems related to this protection, while the development of research in this period was very dynamic, even when taking into account all kinds of difficulties in which this period abounded.

Due to progress in the research, necessary legal acts were formulated in the protection of the environment from noise and vibration, permitting the implementation of this protection in practice, although the activity in the field of standardization is not organized in a correct way.

Methods were developed for noise and vibration control in the work environment, in the home and in urbanized areas, including automation and computerisation of the measurements, which permitted the intensification of control activities, preliminary studies of the

environment, and also the evaluation of the vibroacoustic quality means of transportation and communications, machinery, tools and installations, construction materials, products and elements in urban areas and interiors in buildings.

The progress in the research in 1970–1982 permitted:

- the decrease in the noisiness of some machinery and devices e.g. moulding machines, vibratory screens, energy media discharge stations, some construction machines, tools, devices and installations in buildings e.g. central heating centres, transformer stations, mechanical ventilation;

- the starting of the production of anti-noise units and devices sound-absorbing structures and absorbers, sound-absorbing and insulating barriers, soundproof cabins etc.;

- the improvement of the acoustic quality of blocks of flats built by industrial methods;

- the introduction, in newly designed housing estates, of a number of planner designs, to limit the penetration of traffic noise into the estates;

- the elaboration and introduction in practice of methods for the determination of anti-noise protection zones round the industrial plants;

- the consideration of acoustic planning solutions in designing some transportation routes.

Despite the undoubted progress made in 1970–1982, the progress in means of noise and vibration control, necessary for effective protection of the environment from noise and vibration, has not been made to a sufficient degree, which still prevents efficient noise and vibration control in the environment. There has been no progress in the research and utilization related to decreasing the noisiness of motor and rail vehicles. The decrease in the levels of transportation noise in buildings is achieved by planning and construction means, which is neither correct nor justified economically.

Because of the investment restrictions in 1976–1982, the research base in Poland did not develop to a necessary degree. The lag between the research base of the Polish research centres leading in the field of acoustics and that of the Western countries has continuously widened to the disadvantage of Poland, both in view of lack of laboratory space, research posts, lack of modern equipment and the rapid outdateding of the existing one, which is also caused by the lack of the possibility of buying spare parts. Unless this state changes over the next few years, it will not be possible at all to undertake some studies, requiring special research posts and modern equipment.

There has been no sufficient progress in the development of the industry of measurement devices for the research on noise and vibration, which prevents the possibilities of correctly organized monitoring of the environment from the point of view of noise and vibration.

There has been hardly any research on the degree of noise hazard in administration buildings and special communal objects.

Analysis of data acquired from the research carried out by institutions of scientific research and the control examinations performed by sanitary-epidemiological stations indicates that the population is exposed to noise in housing and public buildings.

The considerable progress in the research on the evaluation of transportation noise and the elaboration, for a large number of towns and cities, of acoustic maps provide the basis for estimating the degree of transportation noise hazard to the population in housing and public buildings. However, the complexity of the phenomena and the variety of planning situations bring about the necessity of further intensive studies, in order to grasp the causal relationships and specify the procedures.

There has been a distinctly insufficient progress in the research on the exposure of housing and public buildings to external noise, generated by industry and communal objects.

Research in the field of the anti-noise protection of housing and public buildings currently performed in Poland does not cover new future material and construction solutions,

such as e.g. skeleton systems. A barrier preventing the undertaking of research of this type is above all the lack of an appropriate research base. In this field, the Polish lag is estimated at about 10-15 years with respect to the level in the West European countries.

The state of Polish studies on the acoustic climate in the interiors of public buildings is insufficient. This applies both to research on the degree of noise hazard to the interiors and to studies in the field of technical design of these objects. There is no full understanding whether the incorrect acoustic conditions in most public buildings (mainly hospitals and schools) are the results of bad design or the poor quality of the installations and faulty workmanship.

3.2. Detailed evaluation of the state in the field of standardization

From the division and juxtaposition of the current standards presented in the report, it may appear that they represent correctly and many-sidedly the vibroacoustic problems. However, analysis indicates that this is only apparent. The Polish standards mentioned in the report were constructed in 1961-1983, of which more than half were formulated in 1973-1975. They are greatly outdated. Most of them are attest standards; they apply to the state of technical solutions and constructions which are the objects of the standards, based, however, on the technological level current when they were formulated. The maintaining of standards and regulations for a long time (6-8 years on average) prevents no doubt technological progress, since it does not enforce the need for modernisation and updating of given industrial goods. When consideration is given to the general world developments in technology, where the question of occupational hazards and working comfort have become the element of economic competition, more often than not a deciding factor in large exports contracts, it becomes clear that a correct standardisation policy should be the main stimulus for technological progress rather than a barrier.

In the light of the previous experiences, it seems justified that a different form of standardisation should be proposed. Assuming at the first stage that preliminary projects will still be formulated in the departmental centres, it is proposed that a specific opinion-making group should be set up, consisting of experts named. The lists of experts authorized to evaluate draft standards in particular fields should periodically be established by the Committee on Acoustics of the Polish Academy of Sciences as the most competent and well-versed expert institution.

The final establishment of a given standard should take place among experts, who, apart from specific written remarks at the preliminary stage, establish by expert discussion the final form of the standard. In the further succession, it would be necessary to establish units, mainly research ones, authorized to formulate standards, which would undertake their elaboration.

The more active exports, as predicted within the economic reform, will require increasingly that most of exported industrial goods should undergo attest measurements. The necessity of collaboration among the national and foreign centres indicates the urgent need for regulating the contribution and activity of Poland also on the international standardisation forum.

3.3. The state in the field of standardisation on the antinoise protection in building and planning

The state of standardisation in the field of the protection of housing and public buildings from noise, although not totally satisfactory, achieves in many points at least the average

world level. This is true particularly of the requirements in the range of permissible noise levels inside interiors, and also, to some extent, of the required acoustical parameters of partitions in public buildings. Requirements on the acoustic parameters of inter-apartment partitions are on a level occurring in all the socialist countries, but lower with respect to that demanded in West-European countries. It is necessary to undertake research on the final coordination of all standards and regulations in the field of anti-noise protection of housing and public buildings, with particular consideration given to the following problems:

- the limitation of the acoustic power of equipment installed at housing and public buildings;
- the specification and uniformization of the permissible levels of installation noise;
- the increased requirements on partitions in housing construction by regarding the previous requirements as the standards, but introducing higher demands as objective;
- the introduction of the principles of acoustic classification of areas destined for housing and public construction, taking into account the basic sources of external noise and the possibility of acoustic — construction protection of the objects.

4. Evaluation of the existing organizational structures

4.1. Significance of organizational structures

The shaping of the correct acoustic climate of the environment of man and the implementation of the effective protection of man from noise and vibration requires the coordination of activities in all the fields of the national management. All the undertakings in planning, communications and transportation industry and construction, and also in other fields of life, should take into account, to an appropriate degree, the needs for the protection of the environment of man from noise and vibration. In particular, it is necessary that the following activities should be performed:

- the permanent research on the state of the acoustic environment and the evaluation of the sources of noise and vibration from the point of view of the shaping of the correct acoustic climate in the environment;
- the formulation of legal acts permitting the correct shaping of the acoustic climate in the environment;
- the development, creation and application of technology, means of transportation and communications, appliances, machinery, tools and installations, not generating excessive noise and vibration;
- the elaboration and utilization of technical solutions in communications, transportation, industry, planning and construction, permitting the correct protection of man from noise;
- the continuous control of the acoustic parameters of the sources of noise and vibration and the environment, and continuous activities towards the improvement of the acoustic state of the environment;
- the continuous didactic and educational activities.

The organizational structures are of very essential significance in implementing the above objectives. Correct organizational structure facilitate these activities; incorrect ones successfully hamper them.

4.2. Central structures

Central structures are of deciding significance for the efficient protection of the environment.

At present, there are in Poland:

- the State Council for the Protection of the Environment (an advisory organ of the Prime Minister);
- the Board of the Protection of the Environment and Water Management;
- the Ministry of Health and Social Security;
- the Ministry of Work, Pay and Social Matters;
- the Polish Committee for Standardisation and Measures;
- the Ministry of Science and Higher Education;
- the Polish Academy of Sciences;
- the State Inspection of Work.

These are the most important central organs deciding on the protection of the environment (also from noise and vibration). From the point of view of the protection of the environment from noise and vibration, the number of the central structures is sufficient. However, their activity will be fully sufficient when, in the matters of the protection of the environment, the Board of the Protection of the Environment and Water Management has effective influence on the other departments, above all the industrial and economic ones and those of communication and construction. It is essential to create appropriate relations among the Board of the Protection of the Environment and the particular Ministries and Central Offices, permitting the correct functioning of the mechanisms of the protection of the environment from noise and vibration and the successful control of the implementation in this range.

4.3. Control activity

The control activity related to noise and vibration is carried out by:

- the department of the protection of the environment at the Board of the Protection of the Environment and Water Management (and partly in the Ministry of Administration and Town Planning).

- the sanitary department in the Ministry of Health and Social Security,

- the department of the protection of the environment in economic and industrial ministries, occupational security and hygiene services and the State Work Inspection. There is no unified coordination of the activities of control services belonging to three departments and no distinct division of competence. As a result of which, some of the control activities are sometimes carried by two institutions, others are not performed at all.

There is excessive partition of control sections, experts and equipment, to the disadvantage of the efficiency and quality of work. An example of this can be quantitative control without going deeper into the causes and effects, and the possibilities of decreasing excessive noise and vibration.

The services of the particular departments apply the different methods of evaluating noise and vibration, often reaching divergent conclusions.

All this suggests the necessity of unified coordination of the control activity, the introduction of unified control methods, the establishment of the range of activity and competence for the particular departments of control services. However, it would be best to organize these services in such a way so that they would be subordinated to one central organ.

4.4. Research, design and other centres

There is a sufficient number of research institute and centres for the performance of studies in the range of the protection of the environment from noise and vibration. However, the possibilities of performing research by the existing institutes are limited by the insuf-

ficient research base, whose projected extension in 1970-1980 was unfortunately effectively stopped. Therefore, the basic condition for the implementation of correct research is the establishment of opportunities of the development and updating of the research base and the complementation of the research equipment both in the leading ministerial and high-education institutes.

In design vehicles, ships, machinery, appliances, tools and installations, and also in designing industrial technologies, no account at all, or insufficient, is taken of the acoustic requirements related to the emission of noise and vibration by these pieces of equipment.

This results from the lack of appropriate standards, regulations, control and also from the lack of experts in the design offices. The solution of the problems of the protection from noise and vibration in designing transportation routes, industrial plants, housing estates and other areas and objects, which should be protected from noise and vibration, is similarly neglected.

This also results from the lack of appropriate regulations and control in the process of design and implementation, and the damage to the environment caused by this is often irreversible. Thus, the process of designing and constructing the objects mentioned above needs improvement.

Acousticians' proposals related to the need for the formation of an industry of means of noise and vibration control have not been implemented so far. The sporadically produced anti-noise materials and systems are made on a scale far from necessary, with more than modest variety of the means produced. If noise control is to be really implemented, it will be necessary to develop in Poland a network of enterprises producing the means of protection from noise and vibration.

In Poland there is a sufficient number of scientific, technical and social organizations engaged in the protection of the environment from noise and vibration, both in the field of scientific research and in the range of technical, educational and popularizing activities. An essential problem is here the directing of the activities of the existing organizations and structures.

1) It is postulated that the State Council for the Protection of the Environment, by evaluating the state of exposure of the environment to noise and vibration, should, through the Council of Ministers, bring the central ministries to take decisions related to:

a) the coordination of scientific research on the protection of the environment of man from noise and vibration, carried out by services at a large number of national ministries, in order to direct them correctly;

b) the granting to the Board of the Protection of the Environment and Water Management of all the decision-making, coordination and control powers to permit effective complex control of the protection of the environment. This Board should bear full responsibility for all decisions related to the protection of the environment of man, including also that from noise and vibration;

c) the creation of appropriate relations among the Board of the Protection of the Environment and Water Management and other ministries;

d) the improvement, or organization in particular ministries, of services carrying out tasks in the field of noise and vibration control.

2) It is indispensable to begin the implementation of the act on the protection and shaping of the environment, and also to include the vibroacoustic problems in this act. It is also necessary to update the Regulation of the Council of Ministers from 30 September, 1980, on the protection from noise and vibration.

3) It is indispensable to elaborate new important standards and to revise and update the existing ones. It is necessary to elaborate the design norms taking into account the vibroacoustic problems, and also to elaborate and pass the appropriate regulations of technical nature, e.g. the regulation recognizing the parameter of "quiet run" as equally important as the other parameters applied in evaluating machinery and appliances.

4) It is indispensable to unify and coordinate the control activity, which is now carried out independently by several ministries and institutions.

5) The achievement of real progress in the range of the protection of the environment from noise and vibration is indispensably conditioned by limiting the emission of noise and vibration by means of transportation, machinery, appliances, installations and tools. It is postulated that decisions should be made on the projected decrease in their noisiness over two time intervals, by the following values:

Sources	Postulated noise level decrease in dB (A)	
	up to 1995	up to 1990
lorries, buses, tractors road and construction vehicles,	10-15	7
passenger cars	10	5
rail vehicles, locomotives, trains, tramways	10-15	7
airplanes, helicopters	10-20	10
technology, machinery, appliances and tools in industry	10-33	10-15

The above values should also be observed in the import of these pieces of equipment.

6) It is postulated that the maximum permissible level should be established for the installations in housing, as follows:

- water pumps 55 dB (A),
- dry transformers 55 dB (A),
- lifts 63 dB (A),
- sanitary appliances 45 dB (A),
- ventilators 50 dB (A).

The above values should, at the same time, be observed in the possible import of these pieces of equipment.

7) It is postulated that appropriate means of the protection from noise should be introduced in town planning by:

- the use of appropriate methods for evaluating the acoustic climate in towns and housing estates;
- the observation of the principles of the protection from noise in the process of accepting for general use of building materials, elements and constructions;
- the control of the observation of acts and regulations;
- the appropriate design of transportation route;
- the creation of protective zones;
- the elimination of particularly annoying objects from the areas of towns and housing estates.

8) It is postulated that appropriate structural changes should be introduced and means of vibroacoustic protection should be created in means of transportation.

9) In view of the fact that the production of equipment for the study and control of vibroacoustic phenomena is insufficient, appropriate steps should be taken to ensure the elaboration and production of the basic equipment. A similar situation occurs in the range of sound-insulating and vibration-insulating materials and systems.

10) In view of the fact that the state of education of cadres engaged in the problems

of vibroacoustic protection is insufficient, appropriate steps should be taken to ensure:

- the development of post-graduate studies,
- the organization of specialist courses,
- the further organization of scientific-technological seminars and conferences,
- the performance of educational and popularizing activities by scientific, technical and social organizations.

11) In the scientific research, it is necessary:

- a) to coordinate all scientific research on the protection of the environment from noise and vibration,
- b) to coordinate and intensify the activities in the framework of international cooperation, mainly within the Council for Mutual Economic Aid,
- c) to take steps to modernize and develop the research base and provide the leading scientific centres with sophisticated research equipment,
- d) to create conditions permitting an improvement of the present state of utilization of the research results.

**INTERNATIONAL COMMISSION ON ACOUSTICS
ICA/INFORMATION AND COORDINATION SERVICE
Plzenska 66, 151 24 Prague 5**

Acoustical Events
1987-1989

1987

February 1987 in Rostock

German Democratic Republic

III. Conference on Hydro-and Geophysical Acoustics

Details from: Prof. Dr. Schommartz

Wilhelm Pieck Universität Rostock

Sektion Technische Elektronik

Albert-Einstein-Str. 2

DDR-2500 Rostock 1

May 11-15, 1987, Indianapolis, Indiana

USA

Meeting of the Acoustical Society of America

Details from: Mrs. Betty Goodfriend, Secretary

Acoustical Society of America

335 East 45 Street

New York, N. Y. 10017

May 19-21, 1987, Gdańsk University

Poland

International Conference on "How to teach acoustics"

- presentation, discussion and exchange of experience in teaching - programs, methods in various specializations and in different relations to educational disciplines of various schools -

Details from: Prof. Dr. A. Śliwiński

University of Gdańsk,

Institute of Experimental Physics

80-952 Gdańsk, Wita Stwosza 57

June 1-4, 1987, Portorož Slovenia

Yugoslavia

XXX Etan Conference

— all branches of acoustics —

Details from: Prof. P. Pravica
Electrotechnical Faculty
Bulevar revolucije 73
Yu-11000 Belgrade

June 23-25 1987, Lisabon

PORTUGAL/SPAIN

5th FASE Congress

— Advances in the domain of Physical Acoustics,
— Oceanographic Acoustics, Use of Acoustics in Bio-engineering, Harmonization of legislation on the protection of hearing —
The Congress will be preceded by a specialized scientific conference on "Acoustics and Ocean Bottom" on June 19, 1987, in Madrid

Secretariat: SPA — FASE 87

Lab. Nac. Engenharia Civil
Av. Brasil
1799 Lisboa Codex
of the conference:
SEA — FASE 87
Calle Serrano 144
Madrid 6

beginning of October 1987, High Tatra

Czechoslovakia

26th Acoustical Conference on "Noise and Environment"

Details from: House of Technology

Ing. Goralikova
Škultétyho ul. 1
832 27 Bratislava

middle of October, 1987, Varna

Bulgaria

"Acoustique' 87"

— l'acoustique architecturale et de la construction, l'électro-acoustique, le bruit et les vibrations, l'acoustique de la parole et physique —

Details from: Unions Scientifiques et
Techniques de Bulgarie
Ing. I. Ivantchv, Secrétaire
Ul. Rakovski 108, BP 431
1000 Sofia

November 16-20 1987, Miami, Florida

USA

Meeting of the Acoustical Society of America

Details from: Mrs. Betty Goodfriend
Acoustical Society of America
335 East 45 Street
New York, N. Y. 10017

1988

May 16-20, 1988, Seattle, Washington

USA

Meeting of the Acoustical Society of America

Details from: Mrs. Betty Goodfriend

Acoustical Society of America
335 East 45 Street
New York, N. Y. 10017

- August 29 – September 1, 1988, Edinburgh U. K.
7th FASE SYMPOSIUM on "Speech"
Details from: Mrs. Cathy Mackenzie
Institute of Acoustics
25 Chambers Street
Edinburgh EH1 1HU
- beginning of October 1988, High Tarta Czechoslovakia
27th Acoustical Conference on Electroacoustics
Details to be announced
- November 14-18, 1988, Honolulu, Hawaii USA
**2nd Joint Meeting of the Acoustical Society of America and
The Acoustical Society of Japan**
Details to be announced

1989

- May 22-26, 1989, Syracuse, New York USA
Meeting of the Acoustical Society of America
Details from: Mrs. Betty H. Goodfriend
Acoustical Society of America
335 East 45 Street
New York, N. Y. 10017
- April 1989, Rostock German Democratic Rep.
VI Symposium on Maritime Electronics
Details to be announced
- middle August 1989 preliminary date, Belgrade Yugoslavia
13th ICA-CONGRESS (Congress of the International Commission on
Acoustics)
2 Symposia are foreseen in Zagreb and Dubrovnik
Details to be announced
- October (beginning) 1989, High Tatra Czechoslovakia
28th Acoustical Conference on "Physiological Acoustics,
Acoustics of Speech and Music"
Details to be announced
- November 6-10, 1989, St. Louis, Missouri USA
Meeting of the Acoustical Society of America
Details from: Mrs. Betty H. Goodfriend
Acoustical Society of America
335 East 45 Street
New York, N. Y. 10017