United States and Polish Scientists Confer on Health Effects of the Micro-Environments of Housing

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SIXTY-THREE U.S. and Polish experts gathered at Jadwisin, Poland, a town near Warsaw, December 4–8, 1972, to discuss health aspects of residential dwelling design and construction. The 5-day symposium on "The Influence of the Micro-Environment of Dwellings upon the Health of Residents" was sponsored by the Bureau of Community Environmental Management (BCEM) of the Health Services and Mental Health Administration and organized by the Polish Association of Building Engineers and Technicians (PZITB), in cooperation with the Polish Ministry of Construction and Building Materials Industry. U.S.-owned Polish currency, generated under the Agricultural Trade Development and Assistance Act of 1954 (PL 83-480 as amended) was used to finance the symposium.

The meeting was the first exchange following an agreement on cooperation in science and technology, signed November 1, 1972, by the United States and Poland. That pact was the first such U.S. agreement with an Eastern European Socialist bloc country.

The purpose of the symposium was to develop among the Polish and U.S. specialists an understanding of the significance of and need for research on the influence of the micro-environment of dwellings on the health of their residents. It was intended to acquaint both sides with the results of scientific research already conducted, with the methodology applied in that research, and with the associated nomenclature used by scientists both in the United States and in Poland.

American participants at the symposium were led by BCEM director Robert Novick. For the Polish hosts, Czeslaw Przewozniak, vice-minister for construction, opened the proceedings.

At general sessions of the symposium, Polish authors presented four lectures of broad scope and 15 papers on specific subjects ranging from thermo-humidity, ventilation, and noise problems in housing, to economic and sociological evaluation of changes in human morbidity caused by harmful parameters in the micro-environment of the dwelling. Authors and titles of the 15 papers are listed on page 435. U.S. experts responded to each of these papers.

The U.S. presentations centered around four basic themes. The first of these, "Man, Environ-

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mental Hazards, and the Control of Accidental Injury," was set forth in a paper presented by Dr. Barry G. King of BCEM's Division of Community Injury Control. King began with a discussion of the three basic health hazards to man in both his macro- and his micro-environment—communicable disease, chronic disease, and accidental injury. The magnitude of these hazards may be measured in terms of death rates, morbidity rates for disease and accidental injury, and economic loss. In the United States, he pointed out, deaths from accidental injuries are greater than the combined deaths from all infections and communicable diseases, and one-tenth the rate of combined deaths from heart disease, cancer, and stroke.

The differences in physical and cultural environments associated with ecological differences can be expected to influence the rates and relative impact of various external causes and types of injury. Communication of accident experience and collaboration in injury research among countries are therefore especially important and mutually beneficial, King suggested. Understanding of causation and methods of control can be increased by studies of the similarities and differences in the accidental injury experience of different countries.

Prevention of accidents related to fires demands further study of the spatial distribution of temperatures and determination of the distribution, concentration, nature, and toxicity of the pyrolysis and combustion products of materials that may be burned in residential fires. To carry out such studies, the results of which may prove crucial in preventing accidents due to fires, the development of representative, reliable small-scale models provides the means for rapid, inexpensive testing of a variety of materials, building designs, and ventilation systems. Such simulation work had been started by Factory Mutual Research Corpo-

Dr. Jerzy Sadowski, Institute of Building Technology, Warsaw, lectures on the acoustic climate of dwellings. Seated (left to right) are Dr. J. Borowski, Prof. Jerzy Hryniewiecki, and Robert Novick.

Modern housing development of Żolibórz Orchards in a new neighborhood of Warsaw

ration in Norwood, Mass., with BCEM support, King noted, and he hoped it might also be pursued in Poland.

The second U.S. theme paper, "Noise Control in Dwellings," was given by Dr. Theodore J. Schultz, principal acoustics scientist of Bolt Beranek and Newman, Inc. Schultz cited current studies which show that people repeatedly exposed to typical city noise levels exhibit increased irritability and discomfort, severe nervous tension, loss of ability to concentrate, impaired ability to perform even simple tasks, and loss of sleep. Conclusive evidence that these and other noise-related problems produce permanent health effects is lacking, but people are nevertheless demanding action to abate this increased annoying and disruptive noise.

Three basic approaches are available for reducing noise: (*a*) elimination, limitation, relocation, or shielding of noise sources; (*b*) alterations to the noise path; and (*c*) relocation or shielding of the human receiver. These approaches were dealt with by Schultz, with particular emphasis on (*b*). Specific measures for control, through the housing design, of both exterior and interior noise were discussed. It was noted that current acoustical technology is probably inadequate and could doubtless benefit from further basic research, particularly since the best technological means presently known for soundproofing buildings increases costs appreciably. Three other significant factors, however, were also brought out:

1. Considerations other than acoustical requirements are given priority in determining building structure, assembly, and materials.

2. An acoustically good structural design of a building can be spoiled by failure of the designer to work out architectural details carefully so that its intrinsic isolation is not bypassed by "leaks" and "flanking transmission."

3. Those who actually construct a building, lacking knowledge of or interest in acoustical

problems, may unknowingly thwart the acoustic design by introducing onsite changes from the specifications out of force of habit, personal convenience, cost-saving considerations, unavailability of specified materials, and so forth.

To deal with these problems, Schultz suggested that stringent building code requirements for noise control be devised and vigorously enforced, with enforcement measures that include noise control evaluation upon completion of construction for units constructed on the site. He further urged that the use of prefabricated housing systems having good acoustical design built into them be encouraged.

Prof. Michael Brill, School of Architecture and Environmental Design, State University of New York at Buffalo, presented the third U.S. theme paper, "A Survey of Present Research: the Impact of the Residential Environment on Health." He discussed this topic primarily from the standpoint of the residence as a product, surveying the research which has been done in the United States on the health effects of the materials, components, and subsystems of the residence; the health effects of the residence as a unit; and those of the total residential community.

Brill noted that much of the research in materials, components, and subsystems that would impact on health is done by individual companies which do not perceive it as primarily health-related and, because of the competitive nature of the industry, do not make it available to the public. Further, because the system under study is complex, with many factors operating, and because there is often much time or space, or both, between the cause and the health effect, causality is not easy to determine, and the results of such studies as have been done are not widely recognized as conclusive enough to be the basis for imposing requirements on industry. As a consequence, research connecting housing to health and safety has not had the public support necessary for a major effort.

"Housing and Mental Health," the fourth U.S. theme paper, was presented by Prof. E. M. Gruenberg, MD, College of Physicians and Surgeons, Columbia University. He began by stating his opinion that the proper role of public health is to make the human habitat safer—not necessarily to improve living conditions but to minimize the adverse consequences of existing conditions on health. "Health-protecting techniques exist which are adaptable to a wide diversity of patterns, and in each there are a few fundamental principles of hygiene which must be observed in order to protect the people's health. The choice will not be made on the basis of which is more suited to protecting the people's health, but on what social man wants for himself."

In discussing the relationship between habitat characteristics and the incidence of mental disorders, Gruenberg observed that lead-based paint peeling from walls was the most well-established and best illustration of the facts that (*a*) habitat can affect the risk of mental disorder, (*b*) solutions can be defined, but they will require both money and the authority to act, and (*c*) despite inability to define how great the risk is, the relationship is clear enough to call for action. He also noted that mental hospital utilization rates have been found to be higher among people who live in multiple-family dwelling areas than for persons from single-family dwelling areas, regardless of their income.

Gruenberg entered a plea for the design of housing in such a way as to accommodate handicapped and chronically ill persons so that their conditions do not make them unable to function. Finally, he suggested that hypotheses regarding the influence of habitat materials or design on the incidence of mental disorders be systematically tested by prospective studies in new public housing projects.

Specially prepared lectures by Polish participants gave a general scientific overview of the following four major facets of housing and health:

1. "Problems of the Human Dwelling Environment in the Light of the Material of the European Economic Conference's Prague Symposium and the United Nations Stockholm Conference," by Dr. A. Czyzewski, president of the Polish Central Technical Organization's Environment Protection Commission. This report discussed in detail an

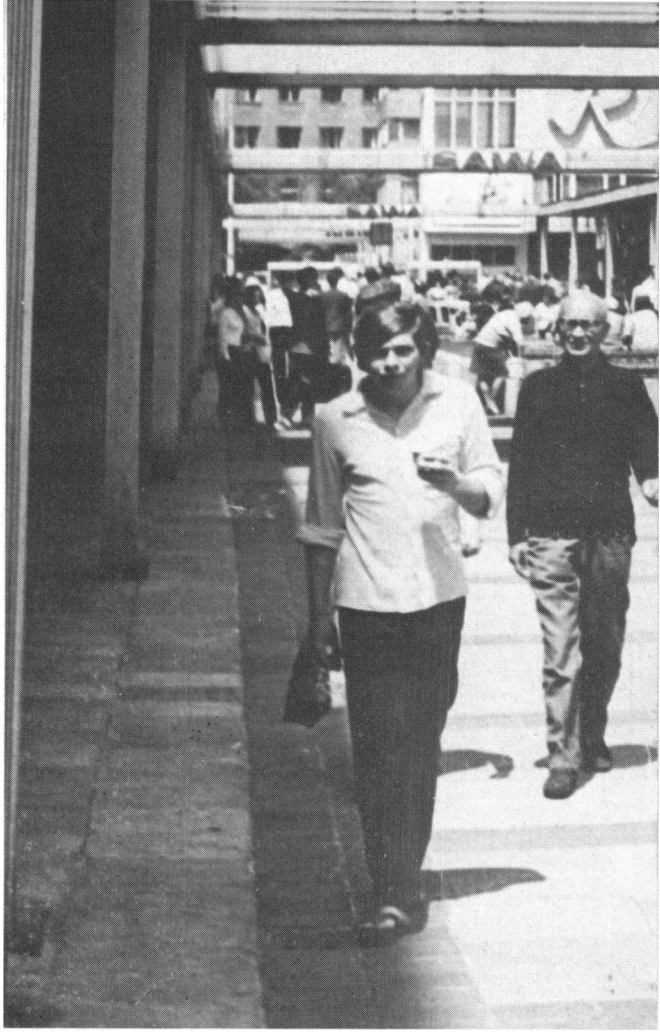
Modern housing project in Warsaw

approach to protection of the dwelling and its environment, including an analysis of the concept of "dwelling." Czyzewski also discussed, from the point of view of quality of the environment, the significance and purpose of the planned administration of residential areas having a concentration of people.

2. "Problems of the Influence of the Micro-Environment of Dwellings on the Biological and Psychological Development of Man," by Prof. Jozef Kolaczkowski, MD, Poznan Medical Academy. His paper discussed the interrelations between the micro-environment and the nervous system, concentrating on the routes of information transfer from the micro-environment to the nervous system and the influence of both favorable and harmful information on the operation of the neurohormonal system. Kolaczkowski described how the operation of this neurohormonal system affects the functions of the other systems of the human organism, particularly how disturbances of the neurohormonal system affect the overall function of the nervous system. His lecture also shed light on the direct influence of the micro-environment on the human organism without the mediation of the nervous system; it proposed directions for new research into the direct influence of the micro-environment on human and lower animal organisms.

3. "The Influence of Various Kinds of Partitions and Climatic Arrangements on the Interior Micro-Climate in Residential Housing," by Prof. Jozef Kozierski, Institute of Architectural Planning, Warsaw. This lecture took up the problem of the relationship between the exterior climate and the micro-climate of the interior of dwellings. Kozierski discussed the purposes of exterior partitions in the light of new achievements of architectural physics, including such aspects as heat flow through the walls in winter and summer, the infiltration of moisture and air through the walls, acoustic insulation of walls, and specifications for ceiling-roofs. He also discussed the problems of choice of colors, heat value of floors, and air quality inside the dwelling.

4. "The Influence of Urban Planning and Architectural Solutions on the Acoustic Parameters of the Environment," by Dr. Jerzy Sadowski, director, Department of Acoustics, Institute of Building Technology, Warsaw. This paper discussed, among other topics, noise as a disturbing factor in the environment and pointed out the great significance of exterior noises and urban



Promenade in the Centrum shopping center in Warsaw

elements on the acoustic climate inside dwellings and in their immediate surroundings. He showed acoustics maps of several Polish cities that had been prepared to assist the urban planner by demonstrating how various types of construction influenced the distribution of sound in adjoining areas. Sadowski cited, as an important factor in the design of urban areas, how various types of construction in one area of a settlement can influence the pattern of noise both inside and outside the buildings.

In addition to the general sessions, in which the papers described previously were presented and responded to, three working groups were formed

Residential apartments loom over commercial area in a busy intersection of downtown Warsaw

to allow more detailed discussion among professionals concentrating on particular subject areas. Prof. Jerzy Hryniewiecki, director of the Institute for Architectural Projects at Warsaw Technical University, headed the first section on building, town planning, and architecture. In this group's discussions, it was noted that there has been little research dealing with the effect of the growth of automotive traffic on urban planning and siting of new houses and housing projects. Insufficient data are presently available on these problems. Present research is too narrow in scope, and it is unable to answer a number of questions dealing with the relationship of man to his immediate surroundings. Differences of opinion among U.S. construction engineers as to the function and the form of construction were also discussed. The question of the urgent need for centrally controlled urban planning was raised, as well as the problem of selection and optimum employment of the wide variety of new construction materials. With little data available to them, architects and engineers often encounter great difficulty in assessing the influence of these new materials on the physical health and emotional well-being of residents, as well as in identifying any actual safety hazards inherent in their use.

Dr. Antoni Rogucki of the Institute of Economy, Warsaw, led the second working group's discussions on economic, sociologic, and epidemiologic considerations in housing design and construction. The topics considered by this group of Polish and U.S. scientists were, among others:

- Possibilities for applying existing statistical data to design and produce formal models relating health status to aspects of the environment.
- Advancement of programing and wider use of computers in the socioeconomic planning of new dwellings.
- Research efforts relating socioeconomic position to the health of the mobile population in industrial areas, as conducted by various research institutes in Poland.
- Influence of international and internal migrations on economic and housing conditions, as well as on the health status of residents among various social and national groups.
- The relationship between housing conditions and the lifestyle, professional activities, and income level of residents, as well as the consumption standards and health status influenced by and resulting from these relationships. It was emphasized that settlements should be fully equipped with commercial, social, and cultural facilities and services, optimally no farther away than a 10-minute walk, and with recreation space for children, teenagers, adults, and the aged within a 6-minute walk of each dwelling.

The third working group, chaired by Sadowski, discussed the subject of physics and physiography. Their deliberations centered around the following topics:

- The influence of air-conditioning and ventilation, as well as thermo-humidity factors, on the micro-climate of the dwellings, and particularly on the health of residents, in high-rise buildings.
- Treatment of ventilation noise as a part of total communication noise inside dwellings.
- Negative factors associated with the use of air-conditioning and ventilation systems applied in conjunction with hermetization of dwellings, necessary in order to achieve noise abatement.
- Ionization of the air as a bioclimate parameter, and as a parameter of sanitary conditions in dwellings. A. H. Frey, technical director of the U.S. materials research firm, Randomline Inc., reported on investigations relating to the ionization of the air and its influence on rats. In the investigations, rats in an atmosphere of ionized air were compared with other groups of rats treated with chemical compounds and with control groups.

In the final session of the symposium, Novick and Hryniewiecki presented a summary of the conference and evaluated its results. In their opinion, the meeting covered four major areas:

1. Physical, chemical, biological, and social parameters of the residential environment as they influence the health and development of man.
2. The use in construction of housing of materials and design that may exacerbate the impact of these physical, chemical, biological, and social parameters on the health and development of man.
3. Methodology used in and findings of some investigations of these phenomena pertinent to the technology of residential construction.
4. The use of economic systems analysis to determine optimal designs and construction materials which should be used to prevent exposures adverse to health.

It was concluded that the papers given at the symposium, their thrust, and the discussion they provoked were enough evidence to warrant further interdisciplinary, controlled studies of the relations between health of residents and the environmental parameters of structures having cer-

tain characteristics in terms of design, materials, and construction. These investigations should employ appropriate experimental and control samples. Furthermore, such studies should seek to determine the thresholds for several parameters which can serve as health criteria for standards of design, construction, and use. It was determined that there could be a helpful, continuing exchange between the United States and Poland regarding research design, methodology, and techniques.

In addition to experimental investigations seeking to explain the phenomena involved in producing a residential environment conducive to health, the symposium discussions indicated a need for more specific studies of the application of particular material and residential designs, including cost-benefit analysis and analyses of health effects. There was a general recognition of the need for greater understanding of the social and economic consequences of the use of various materials and designs, and it was proposed that systems models should be developed to predict economic alternatives.

It also became evident during the discussions that, to achieve the aforesaid research objectives, it would be necessary to develop interdisciplinary and interagency coordination. This necessity poses scientific and administrative challenges in both countries and warrants consideration of cooperative efforts. Speaking in this spirit at the final session of the symposium, Novick proposed that the scientific cooperation which began with the symposium be continued with the exchange of scientists, on both short- and long-term visits. He suggested as well that an information exchange be set up and a formal information retrieval system be made available. In his view, also, the concept of paired cities could be used in programing future collaborative research by the U.S. and Poland, so that the results of micro-environment research performed in similar cities could be exchanged.

In addition to these professional discussions, the scientists of the two nations made many personal contacts and, in some cases, regular exchange of scientific information already has begun. Participants from both sides almost universally emphasized that this meeting should be regarded only as the beginning of much broader cooperation. A number of scientists looked forward to similar meetings where feedback could be provided on the results of the interim research, new tasks planned, and ideas exchanged.

Papers by Polish Scientists

Adamski, F. (Institute of House-Building, Warsaw): Some thermo-humidity and ventilation problems in housing built using new materials and construction concepts.

Bogucki, J. (Institute of Physical Training and Sport, Poznan), and Wiatrak-Bogucka, J.: Set of thermo-humidity parameters for evaluating the comfort of the micro-environment of a dwelling.

Bogusz, J. (Institute of Dwelling Administration, Warsaw): The problem of considering the utilized value in determining the effectiveness of housing investments.

Borowski, J. (Institute of Building Techniques, Warsaw) and Grabczewska, M.: The effect on resident health of materials used and designs applied in dwelling units.

Gacka-Grzesikiewicz, E. (Institute of Urban Planning and Architecture, Warsaw): The influence of the structure and method of development of housing sites on their climatological and health conditions.

Glinkowski, S. (Institute of Economy, Warsaw): Evaluation of the economic and social effects of morbidity resulting from the action of harmful parameters in the micro-environment of the dwelling.

Grabczewska, M. (Institute of Building Techniques, Warsaw): Problems of the influence of the micro-environment in dwellings on the health of their residents.

Grottel, K. (Poznan Medical Academy, Poznan): Remarks with regard to the scope and organization of investigations of the influence of building materials on human health, from the viewpoint of coordination of experimental studies with medical observations.

Hertz, Z. (Institute of Industrial Chemistry, Warsaw), and Sklodowska-Weigt, B.: Problems concerning the influence of plastics on the human organism.

Maczyński, B. (Balneoclimatological Institute, Poznan): The dependence of biometeriological properties of the air in housing on the materials and construction of buildings.

Pensko, J. (Central Laboratory for Radiological Protection, Warsaw), Mamont, K, and Wardaszko, T.: Measurement of ionizing radiation in some buildings in Poland.

Pogorzelski, J. A. (High School of Agriculture, Olsztyn): The problem of protecting dwellings which are not air-conditioned against excessive insolation.

Rogucki, A. (Institute of Economy, Warsaw): Synthetic method for verifying the studies of the effect of micro-environmental parameters on human biological and mental development.

Tyczka, S. (Balneoclimatological Institute, Poznan): Ionization of the air as a bioclimatic and hygienic factor.

Walkowski, J. (Institute of Technology and Building Construction, Poznan): The temperature and humidity of the air, studied during winter in prefabricated reinforced concrete dwelling houses.