utilizing a special form of water-cooled winding, and employing a coating of copper sprayed on to the thick-walled steel pipe constituting the test-section. The heaters have been designed and constructed in the Laboratory in consultation with the patentees of certain features incorporated in the design. The heaters give a uniform power input over the heated length of the test-section, and by alternative methods of series and parallel connexion of the coils and groups of coils constituting the winding, the total power input may be varied over a considerable range in a number of steps without the use of a voltage regulator. The water-cooling provides a ready means of determining the lost power, the small rise in temperature of the inductor cooling water being measured by triple-point differential thermocouples.

In addition to measurements of drop in pressure, the flow conditions are being studied with the aid of a gamma-ray device supplied on loan by the Atomic Energy Research Establishment at Harwell. In this device, a beam of gamma-rays from a radioactive isotope of cæsium is passed transversely through the pipe at test-section outlet. An ionization chamber placed diametrically opposite the source gives a measure of the emergent radiation, which is a function of the density of the fluid cross-section at the scanning point. With this determination of the apparent density of the fluid and a knowledge of the flow-rate and heat input in the test-section, the respective velocities of the steam and water phases at the scanning point may be estimated, for the steam and water do not generally flow along the pipe as a homogeneous mixture. This information is also necessary for the respective drops in pressure due to acceleration and wall friction in the horizontal pipe to be separately estimated. Provision is being made for the installation of further scanning points at intermediate positions along the length of the test-section when it is in the vertical position, since density determination is then more important for an analysis of the pressure drop. As there is little space between the induction heating units at these intermediate points, small ionization chambers, filled with argon under pressure, are being developed to provide higher sensitivity.

Tests have been completed with a test pipe of 1 in. bore in the horizontal position. These tests have been made at varying flow-rates and heat inputs, and at pressures of 250, 600, 1,250, 2,100 and 3,000 lb. in.$^{-2}$. The results of these tests, together with those obtained with other pipe sizes at various inclinations, will be published in due course. Preparations are at present being made for tests on the 1-in. pipe in the vertical position.

[1] Haywood, R. W., "Research into the Fundamentals of Boiler Circulation Theory", Proceedings of the General Discussion on Heat Transfer, September 1951, p. 63 (Institution of Mechanical Engineers and American Society of Mechanical Engineers, 1951).

# HAZARDS ASSOCIATED WITH THE DEVELOPMENT OF WEAPONS OF MASS DESTRUCTION

## INTERNATIONAL MEETING OF SCIENTISTS

TWO years ago a statement, referred to as the 'Russell–Einstein Appeal', was issued under the signatures of its sponsors and eight other scientists, directing attention to the hazards which would face humanity should another world war break out, a war in which the widespread use of nuclear weapons would be almost certain. The appeal suggested that a meeting of competent scientists ought to take place, to make a true and independent assessment of the dangers.

Through the initiative of Lord Russell and the generous hospitality of Mr. Cyrus Eaton, such a meeting was held in the fishing village of Pugwash, Nova Scotia, during July 6–11. About forty invitations were issued, so chosen as to ensure that the composition of the Conference would be representative of a wide range of opinion on social, economic and political matters, with members competent in the scientific disciplines relevant to the discussion. Twenty-two scientists were able to accept the invitation, and at the end of the meeting a statement was issued, the substance of which is as follows.

In a brief preamble an outline is given of the background to the meeting, and a summary of the most important developments since the original Russell–Einstein appeal was issued. The statement continues: "The general belief that a full-scale nuclear war would bring universal disaster upon mankind, and the recognition that it is technically possible for both the two great contending groups of powers to visit any desired degree of destruction upon an enemy, as well as certain political developments, have created an atmosphere in which it was possible for us to meet, and to discuss dispassionately, many important and highly controversial issues".

The main work of the meeting was centred around three principal topics: (1) the hazards arising from the use of atomic energy in peace and war; (2) problems of the control of nuclear weapons; and (3) the social responsibility of scientists. Three committees were established to give detailed consideration to these topics. In presenting the findings, the signatories remark that the international problems which have arisen with the development of atomic energy are of two kinds—technical and political. Men of science can discuss with special competence only the scientific and technical implications of atomic energy; but their discussions can only be fruitful if they take account of the political problems which form the background to international negotiations. In formulating their conclusions, they state that they have attempted to avoid any exacerbation of the differences between the Powers which might follow, for example, from emphasis on technical considerations unwelcome to one or another of the two groups of Powers.

The committee on the hazards associated with the application of atomic energy found that estimates of the effect of 'fall-out', carried out independently in Great Britain, Japan, the United States and the U.S.S.R., were in good agreement; it reached the conclusion that the dangers from the test explosions carried out hitherto are small compared with those to which mankind is subject from natural causes.

©1957 Nature Publishing Group

Nevertheless, because of the world-wide distribution of fission products, and the fact that some areas may be subject to effects much above the average, close attention to the dangers should be maintained, especially if tests of bombs which give large radioactive 'fall-out' continue to be made.

The studies of the hazards of test explosions permitted a closer examination to be made of the probable consequences of an unrestricted war with nuclear weapons; this led to the unquestioned conclusion that such a war would represent a disaster of unprecedented magnitude. "In the combatant countries, hundreds of millions of people would be killed outright, by blast, heat and ionizing radiations, at the instant of the explosion, whether the so-called 'clean' or 'dirty' bombs were employed." If 'dirty' bombs were employed, "additional hundreds of millions would die from the delayed effects of radiation from local 'fall-out'—some from direct radiation injury, and some in later generations from genetic effects". Large-scale genetic injury might also follow from global 'fall-out'.

The committee which considered problems of control reached the conclusion that the principal objective of all nations must be the elimination of war, and the threat of war, from the life of mankind. For this purpose, it is necessary to reduce tension among the nations; to promote mutual understanding among the peoples; to strive for the ending of the arms race; and to provide an adequate control system so as to give substantial protection, and permit the development of mutual confidence. "It is unrealistic to depend upon any sudden increase in mutual confidence; it is more likely to grow from small beginnings. In this situation, even small agreements covering limited fields could be of great importance."

The committee which discussed the responsibilities of scientists in the modern world summarized its findings under eleven headings. Among many points of importance, two deserve particular attention: Point 9 states that "Tradition tends to place the emphasis in the education of youth on separate ideals of single nations, including the glorification of war. The atomic age urgently requires a modification of these traditions. Without abandoning loyalty to the national heritage, or to the fundamental principles of the different societies, education must emphasize the fundamental and permanent community of the interests of mankind, in peace and co-operation, irrespective of national boundaries and differences in economic or political systems"; and Point 11, "Science develops most effectively when it is free from interference by any dogma imposed from the outside, and permitted to question all postulates, including its own. Without this freedom of scientific thought, and the freedom to exchange information and ideas, full utilization of the constructive possibilities of science will not be possible".

The conference was unique in that never before had a group of scientists, so widely representative, met to discuss topics of such general importance. It is remarkable that it was possible to issue a statement, with such a measure of agreement, on many issues which might have appeared highly controversial and unlikely to receive general support. The statement concludes by giving expression to the unanimity in the conference on fundamental aims: "We are all convinced that mankind must abolish war or suffer catastrophe; that the dilemma of opposing power groups and the arms race must be broken; and that the establishment of lasting peace will mark the opening of a new and triumphant epoch for the whole of mankind. We earnestly hope that our conference may make a modest contribution to these great aims".

The signatories were: *Australia*, Prof. M. L. E. Oliphant; *Austria*, Prof. H. Thirring; *Canada*, Dr. G. Brock Chisholm; *China*, Prof. Chou Pei Yuan; *France*, Prof. A. M. B. Lacassagne; *Great Britain*, Prof. C. F. Powell, Prof. J. Rotblat; *Japan*, Prof. I. Ogawa, Prof. H. Yukawa, Prof. S. Tomonaga; *Poland*, Prof. M. Danysz; *U.S.A.*, Prof. D. F. Cavers, Prof. H. J. Muller, Prof. P. Doty, Prof. E. Rabinowitch, Prof. W. Selove, Prof. V. Weisskopf; *U.S.S.R.*, Academician A. M. Kuzin, Academician D. F. Skobeltzyn, Academician A. V. Topchiev.

# OBITUARY

## Mr. R. G. K. Lempfert

METEOROLOGISTS learned with great regret of the sudden death on June 24 of R. G. K. Lempfert, formerly assistant director of the Meteorological Office. Sir Napier Shaw recorded that when he became the effective head of the Meteorological Office nearly sixty years ago, one of its peculiarities was that none of the members of the staff had had any preliminary scientific training. (This does not mean that they lacked ability—far from it. For example, out of a small staff one became Mayor of Camberwell and another Mayor of Fulham.) Shaw's first step to remedy the obvious defect was to appoint Lempfert, who had taken a 'first' at Cambridge in both parts of the Natural Science Tripos, in 1896 and 1898, to a specially created post of scientific assistant. Not surprisingly, this appointment in 1902 has been abundantly justified both by the investigations Lempfert undertook or shared and by the influence he exerted on meteorological administration and operational meteorology for a quarter of a century.

Lempfert's scientific investigations covered a wide field. Many were made in collaboration with others. He began with studies of London fog and of a fall of 'red rain', found to be due to dust the track of which was traced back around the Iberian peninsula to North Africa. Soon he was tackling, with Shaw, the "Life History of Surface Air Currents". Lempfert's part was mainly the critical examination and co-ordination of the records and observations from which the divergent sources and tracks of the air in a number of typical or outstanding meteorological situations could be identified and delineated. But he also made a separate special study of the line-squall, one of the most significant and qualitatively foreseeable meteorological phenomena—the simultaneous occurrence of squalls, sometimes of great violence, along a line which may be hundreds of miles long and which may advance at 5 or at 50 miles per hour. These investigations, revealing as they did unsuspected discontinuities in the earlier simplified structure of 'depressions', paved the way for the

©1957 Nature Publishing Group