During the year under review 1,122 papers and documents were published and in addition some 420 classified and unclassified reports were issued to Government agencies. A comprehensive list of these is given in the appendix to the report. The periodicals published by the Bureau include *Journal of Research*, which is issued in four separate sections—A (Physics and Chemistry) bimonthly, B (Mathematics and Mathematical Physics) quarterly; C (Engineering and Instrumentation) quarterly; D (Radio Propagation) bimonthly—and *Technical News Bulletin*, which is a monthly in which present-day research, development and test activities of the Bureau are summarized. In addition, various non-periodical series publications, the Monograph, Handbook, Miscellaneous Publications, and Technical Notes series, are issued at frequent intervals. Monograph No. 56, *Systems of Electrical Units*, by F. B. Silsbee, is an excellent survey of the various systems of units used in electricity and traces briefly their historical development. *Tensile and Impact Properties of Selected Materials from* 20° *K to* 300° *K* (Monograph No. 63) is concerned with structural materials for use in low-temperature applications, and data relating to their tensile strength, yield strength, elongation, stress–strain curves, and impact properties are given. *Standard X-ray Diffraction Powder Patterns* (Monograph 25) is the twelfth in the series with this title and contains 37 standard patterns of value to chemists in the identification of unknown crystalline materials.

A 16-mm colour film, *Scatter Radar: Space Research from the Ground*, released during 1963, tells the story of the Bureau's new Jicmarca Observatory situated near Lima, Peru. The Observatory has a 22-acre radar aerial and is used to measure at 50 Mc/s the characteristics of ionization in the ionosphere and exosphere. It has made observations of the planet Venus, and will investigate the solar corona and solar gases. The Bureau participated in 18 scientific and technological exhibitions, and as part of the sixtieth anniversary celebrations of the Department of Commerce the Bureau's Washington laboratories were opened to the public for the first time for many years on May 11, 1963. Some 7,000 visitors toured the 100 laboratories and saw the special exhibits on display.

S. WEINTROUB

ROAD RESEARCH

IN recommending that the Road Research Laboratory should be transferred to the proposed Industrial Research and Development Authority, the Trend Committee had reservations as to whether the arrangement should be permanent and suggested that the position should be reviewed after a reasonable interval, with the view of the possible transfer of the management of the Station to the Ministry of Transport. This would be in line with present-day opinion for the strengthening of the scientific resources within the several Departments, but in spite of this the Road Research Report Board in its annual report for 1963* expresses the emphatic view that the value of the Laboratory's research is enhanced by its independence and by the fact that it is seen to be independent by the public and the many authorities and other bodies who benefit from its work. It regards the Laboratory as carrying out its task with conspicuous success within the limits of its resources, but it should be noted that it does not consider that it is the function of a research organization, or within its competence, to apply the results itself, although it admits that a research organization must accept some responsibility for effectively disseminating the results of its researches. The Board reiterates a recommendation it made early in the year, as to the importance that plans should provide for the large staff that will be needed in the near future in view of the great increase forecast for road traffic and road building. The Board welcomes the Laboratory's concern with research on road casualties and urges that prompt action should be taken to apply such measures as research has shown to be appropriate to diminish this continuing loss of life and limb. On lighting problems, in view of the demonstration by the Laboratory's investigations that the accident rate is greater at night than by day and that effective street lighting appreciably reduces the night accident figures, it recommends that an investigation should be made of the effect on accidents and traffic flow of lighting other busy rural roads carrying fast traffic, including motorways. It also welcomes the arrangements now being made in Birmingham and other cities for further trial this winter of the use of dipped headlights in all streets. The large-scale road experiments, which are now an essential part of the Laboratory's research, throw light on many problems of design which face the road engineer and which can be solved only from an examination of results obtained in the prevailing conditions of traffic and climate. It is of the first importance that such experiments should be made and their performance recorded and assessed with a view to the earliest possible application of the results. A further investigation of the effect of frost on the performance of existing road pavements is to be made and a paper on the design of urban sewer systems was published, outlining the recommended procedures for the application of the new design method for surface water sewerage systems: more than a dozen applications have already been received from Local Authorities in England.

The Board notes that the Department of Technical Co-operation has now decided to devote almost one-tenth of its research allocation to provide for the continuation of the activities of the tropical section of the Laboratory. These activities are dealt with more fully in an appendix to the report. They include further investigation of road-making materials from tropical countries with the object of expanding knowledge of overseas soils and of determining the causes of unusual properties, as well as a review of pavement design and soil-moisture movement in tropical and sub-tropical countries. The Board emphasizes the continuing need to make the Laboratory's work better known overseas, and it considers that the primary need in developing countries is knowledge of their own soils and of the other road-making materials available to them. The Board's own report includes the report of the Director of Road Research and appendixes giving details of the committees, staff and publications of the Station during the year. The activities of the Research Station on road systems and layout and parking needs have provided much of the fundamental information required in planning for traffic in towns and elsewhere. Much attention is being given to safety matters and for the first time for 10 years 1962 showed a significant decrease in the proportion of skidding accidents on wet roads. Prevention of some 2,000 accidents is attributed largely to the use of 'dead' rubber for tyre treads and of road materials with a high resistance to polishing under the action of traffic. Research on safety belts and harnesses continued along four main lines, including assistance to the British Standards Institution Committee on seat belts in the specification of a dynamic form of test for safety belts, studies of design, and performance surveys of the usage of the belt, and analyses of

* Department of Scientific and Industrial Research, *Road Research 1963: The Report of the Road Research Board with the Report of the Director of Road Research*. Pp. vi + 168 + 12 plates. (London: H.M. Stationery Office, 1964.) 11*s*. 6*d*.

accidents in which safety belts were worn. Analysis of 600 accidents in which 837 drivers or front-seat passengers were wearing safety belts at the time of the accidents indicated that serious injuries were reduced by about 80 per cent and overall reduction in injuries was about 50 per cent. Six accidents on motorways during the past $2\frac{1}{2}$ years were attributed to spray obscuring a driver's vision and problems involving splashing and production of spray by commercial vehicles are being investigated. A preliminary study has shown that the front wheels are particularly important in producing spray because they generally run in a thicker film of water than the rear wheels, and that the pattern of distribution of spray behind the vehicle depends largely on its shape. Work on road pavements is mainly directed at the construction and observation of full-scale experimental roads, generally on routes carrying heavy traffic, and to theoretical and field studies of the stresses and deflexions in multi-layer pavements and the influence on them of repeated loadings. In the experimental section constructed in 1957 on the A1 at Alconbury Hill the best sections continue to be those with 4 in. asphalt surfaces on a 9-in. lean concrete base and on a 6-in. asphalt base. Studies are in progress on the amount of control testing that should be carried on large road construction projects, to assess the practical limits for the number of tests, the man-power required to carry out the testing, and the cost of testing in relation to the total cost of each project. The first study suggests that tentative proposals made by the Laboratory are likely to be suitable. To determine the effect of wet weather on the construction of earthworks and to provide some indication of the amount of working time likely to be lost through wet weather, records of the utilization of plant at major earthwork sites have been collected to compare the actual performance each day with the performance during dry weather. Weather at the site has been recorded or records are being obtained from nearby stations of the Meteorological Office. Computer programmes are now available for carrying out the calculations involved in the Road Research Laboratory's hydrographic method of sewer design. The Laboratory is also attempting to supply more precise information on the loads imposed on bridges by moving vehicles. This is required in estimating the fatigue life of the structure, and a short-term study is being made of the way in which traffic flow data can be converted into traffic loading data, and a long-term collation of information on vehicle axle weights, using electronic weighbridges at selected sites. The effects of temperature, creep and shrinkage on the performance of a structure are being investigated by measurements on a number of bridges, including the Hammersmith Flyover and the Medway Bridge, and the results have indicated how the behaviour of a structure can be affected by its form and environment.

USE OF WHOLE-BODY COUNTERS IN RADIOLOGICAL PROTECTION

"THE Use of Whole-body Counters in Radiological Protection" was the title of a symposium held at the Middlesex Hospital Medical School on April 7, 1964. It was the eighth in a series sponsored by the Joint Health Physics Committee * and on this occasion was organized for the Committee by the Radiological Protection Service. The proceedings were divided into two sessions, the first being devoted to a review of the development of whole-body counters and an account of experience in their use over a period of more than six years at two centres undertaking this work in the United Kingdom, and the second to reports of some special problems encountered in several laboratories. Mr. W. Binks (Radiological Protection Service) acted as chairman of the first session and Prof. F. W. Spiers (University of Leeds) of the second.

In his opening address to the first session Prof. Spiers (University of Leeds) traced the history of the development of whole-body counters from the early work by Schlundt, Barker and Flinn (1929), and Schlundt, Nerancy and Morris (1933), using ionization chambers, to the highly sophisticated apparatus of the present day utilizing scintillation detectors and multi-channel analysers (Table 1).

From this it could be seen that, after Schlundt *et al.* had made improvements in the ionization-chamber method, there was an additional improvement in sensitivity with the advent of high-pressure ionization chambers, bringing the sensitivity in the region necessary for the measurement of the natural γ-ray emission of the body. The use of large scintillation counters in 1956 brought about a further increase in the sensitivity and it was this order of sensitivity that had provided the health physicist with a powerful tool for measuring body radioactivity far below the maximum permissible values.

Prof. Spiers stressed that, for a high detection efficiency, both high counting rates and large signal-to-background ratio were important, as could be seen from the well-known formula:

$$S.E.\ (\text{as percentage of } S) = \frac{100}{S}\left(\frac{B}{t_B} + \frac{B+S}{t_S}\right)^{\frac{1}{2}} = \frac{100}{(aS)^{\frac{1}{2}}}\left(\frac{1}{t_B} + \frac{1+a}{t_S}\right)^{\frac{1}{2}}$$

(where $S.E.$ is the standard error as a percentage of S, the counts per sec due to the source, B is the counts per sec due to background, $a = S/B$, and background observations are made for t_B sec and source observations for t_S sec). In order to make the standard error small, S should be large, which meant a physically large detector should be used, and a should be increased as far as possible by reducing B.

Table 1. DEVELOPMENT OF WHOLE-BODY COUNTING SINCE 1929

Date	Experimenter and apparatus	Subject observation time	Approximate limit of detection (or standard error): As μg ^{226}Ra equivalent *	Approximate limit of detection (or standard error): As a percentage of total body potassium
1929	Schlundt *et al.*, Ion chamber at 1 atm.		~5	
1933	Schlundt *et al.*, Ion chamber at 1 atm.		~0·2	
1937	Evans, Geiger-Müller tube		0·1	
1947	Hess and McNiff, Ion chamber at 1 atm.		0·03	
1951	Sievert, High-pressure ion chamber	2 h	0·005 (*S.E.*)	~50 (*S.E.*)
1953	Burch and Spiers, Differential high-pressure ion chambers	2 h	0·003 (*S.E.*)	~30 (*S.E.*)
1956	Sievert, High-pressure ion chambers underground	3–4 h	0·001 (*S.E.*)	~10 (*S.E.*)
1956 to 1960	Los Alamos, 4π liquid scintillator (Anderson, 1956)	15 min	~0·0001 (*S.E.*)	1 (*S.E.*)
	Argonne National Laboratory, NaI scintillator (Marinelli, 1956)	15 min	~$0{\cdot}0003_5$ (*S.E.*)	3·5 (*S.E.*)
1960	Leeds, Plastic scintillator apparatus (Bird and Burch, 1958)	15 min	~$0{\cdot}0001_5$ (*S.E.*)	1·5 (*S.E.*)

* By 'μg ^{226}Ra equivalent' is meant μg ^{226}Ra with all daughter products in equilibrium.

* The Joint Health Physics Committee consists of representatives of the British Institute of Radiology, the British Occupational Hygiene Society, the Central Electricity Generating Board, the Faculty of Radiologists, the Hospital Physicists' Association, the Institute of Physics and the Physical Society, the Radiological Protection Service, the Society for Radiological Protection and the United Kingdom Atomic Energy Authority.