tion gauge is a more complex problem than was believed before.

One of the high points of the 1961 vacuum symposium in Washington, D.C., was a report by Lange and Riemersma (Westinghouse) on the desorption of carbon monoxide and nitrogen from a nickel ribbon by means of photons. This was an especially interesting idea because photodesorption allowed the energetics of adsorption to be studied by optical methods. Lange spoke on his later work at this symposium. Using a dynamic vacuum system, he found about the same peak efficiency (10^{-8} molecules per photon) of photodesorption for carbon monoxide on tungsten as on nickel if the tungsten is flashed clean immediately before desorption. The photodesorption competes with a strong thermal desorption when high gas coverage is used.

R. O. Adams (Washington State University) has used a closed vacuum system to study photodesorption from evaporated metal films and from ribbons. His photodesorption measurements for films and ribbons of nickel covered with carbon monoxide yield resonance curves similar to those of Lange with a peak value of 10^{-7} atom per photon at 3000 Å. Attempts to desorb oxygen from iron films gave no detectable results at room temperature but gave detectable photodesorption at −50°C. No photodesorption could be detected for radiation from 5700 Å to 2537 Å when molybdenum or tungsten ribbons were covered with carbon monoxide, carbon dioxide, nitrogen, or hydrogen.

An interesting result was obtained with carbon dioxide on nickel. When gas was adsorbed on a cold ribbon, photodesorption did not occur but when a nickel ribbon was heated to 1000°C and then cooled in 10^{-6} torr of carbon dioxide, photodesorption occurred. Carbon monoxide was probably produced from carbon dioxide at the hot surface and adsorbed as the ribbon cooled.

R. L. Jepsen (Varian Associates) showed that pumping or removal of gas can result from the presence of ionizing discharges or from the deposition of getter films. When these two processes are combined in a single enclosure, the total removal rate for a large number of individual gases seems to be the sum of the adsorption rates due to each process considered separately.

A description of an exotic gettering experiment was presented by A. L. Hunt (Lawrence Radiation Laboratory). A copper surface is cooled to 11°K and a layer of getter gas is condensed on this surface. When hydrogen is allowed to strike the condensed gas surface, it is adsorbed with a sticking probability approaching unity in some cases. This is just one of the cryopumping experiments that have been conducted in the search for cleaner vacuum for Project Sherwood.

On the evening of 17 May, former students and friends of Paul A. Anderson gave a banquet honoring his contributions to surface physics. His pioneering measurements of work functions for clean surfaces made in the 1930's and 1940's were acknowledged.

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Radiation in the Natural Environment

The widespread interest in the effect on the human population of its continuing exposure to natural radiation was the basis for a symposium held at William Marsh Rice University, Houston (10–13 April). More than 120 scientists from 14 countries attended in order to discuss their wide-ranging interests in natural radioactivity and radiation and the methods used in their studies.

A cross-calibration of the instruments used by various groups for measuring natural radiation was carried out. These instruments include air- or tissue-equivalent and high-pressure ionization chambers, portable scintillation detectors, gamma spectrometers, and an aerial monitoring system. Measurements were made at locations on the Rice University campus, at the Galveston beach, and on a pile of zircon sand at a local tin smelter. Preliminary calculations indicated agreement within a range of 10 percent for the measurements made on the ground with ionization chambers. The results of these intercalibrations are expected to be published as an appendix to the printed proceedings.

The many varied aspects of the natural radiation environment which were discussed at the meeting included airborne, surface, and subsurface instrumentation and measuring techniques; geologic and geochemical studies of the natural radioactivity of bedrock types, soils, and broad regions; measurement of the radioactivity in air, water, and soil; the properties of the cosmic radiation, with particular emphasis on the neutron component and its possibly significant dose contribution; and regional studies of natural radiation levels in Brazil, West Germany, India, Niue Island (New Zealand), Spain, the United Kingdom, and the United States.

Several research groups in different countries have developed portable ionization chambers and gamma spectrometers that are quite suitable for quantitative dosimetric studies of natural environmental radiation, but the formidable problems associated with making precise measurements of low-level radiation fields with portable instrumentation were emphasized.

Because of the difficulties associated with the measurements, there is considerable uncertainty as to the dose contribution of the cosmic ray neutron component. Further work in this field would be most useful.

There appear to be only a few areas, including the well known regions in Brazil and India, where large populations are exposed to external natural radiation levels which are above normal by an order of magnitude or more. The study in Brazil involves the analysis of biological samples to provide estimates of ingestion of radioactivity and measurements of population exposure to external radiation.

The difficulty in applying geological data on radioactivity of bedrocks in order to estimate population exposure to natural gamma radiation was emphasized. Radioactivity in soils and man-made structures is generally the main source of this radiation exposure, and these sources may have only an indirect relationship to the underlying bedrock.

Population exposure to internal sources, particularly alpha emitters, is not necessarily directly related to the external gamma radiation environment and in many cases may be much more significant. The ingestion of natural alpha emitters varies by at least a factor of 100 for large human populations.

Several effects causing significant time variations in natural gamma radiation levels were brought out; particularly emphasized was the migration of radon and its daughters out of the upper layers of the soil and the "natural fallout" of the gamma-emitting daughters from the atmosphere. The observable effect of rainfall and snow cover on the gamma levels was also noted.

A number of papers dealt with the determination of exposure levels of large populations to natural radiation,

and served to emphasize the difficulties involved in such studies and the necessity for a great number and a wide variety of measurements. These studies, including the investigation of adequate control populations in regions of lower natural radiation levels, have barely begun and it appeared clear that much more time and effort on the part of workers in many disciplines will be required to isolate any definitive environmental factors, of which natural radiation is only one.

The symposium was supported by the U.S. Atomic Energy Commission, Division of Radiological Health of the U.S. Public Health Service, and Rice University.

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Forthcoming Events

August

19–30. **Macromolecules**, statistical theory, seminar, Hanover, N.H. (Dean of Summer Programs, P.O. Box 833, Hanover)

19–31. **Geodesy and Geophysics**, 13th general assembly, Berkeley, Calif. (W. E. Smith, AGU, 1515 Massachusetts Ave. NW, Washington 5)

20–23. Western **Electronic** Show and Conf., San Francisco, Calif. (J. D. Noe, WESCON, 701 Welch Rd., San Francisco)

20–24. **Poultry Science** Assoc., Stillwater, Okla. (W. E. Shaklee, Cooperative State Experiment Station Service, USDA, Washington 25)

20–26. **Psychology**, 17th intern. congr., Washington, D.C. (American Psychological Assoc., 1333 16th St. NW, Washington 6)

20–26. **Zoological Nomenclature**, intern. committee meeting, Washington, D.C. (W. E. China, British Museum of Natural History, Cromwell Rd., London S.W.1)

20–27. **Zoology**, 16th intern. congr., Washington, D.C. (Secretary of the Congress, Natl. Acad. of Sciences, 2101 Constitution Ave., NW, Washington 25)

21–23. **Biochemical Conf.**, Pacific Slope annual, Honolulu, Hawaii. (P. E. Wilcox, Dept. of Biochemistry, Univ. of Washington, Seattle 5)

21–29. International Conf. on **Population**, Ottawa, Ont., Canada. (B. Benjamin, Intern. Union for the Scientific Study of Population, General Register Office, Somerset House, London W.C.2, England)

22–24. National Council of Teachers of **Mathematics**, Pittsburgh, Pa. (E. G. Begle, Stanford Univ., Stanford, Calif.)

24–25. **Transactional Analysis**, first summer conf., Monterey, Calif. (E. Berne, Box 5747, Carmel, Calif.)

25–28. **Soil Conservation** Soc. of America, Logan, Utah. (H. W. Pritchard, Soil Conservation Soc., 7515 Northeast Ankeny Rd., Ankeny, Iowa)

25–29. **Medical** Correctional Assoc., Portland, Ore. (F. L. Rouke, 14 Studio Arcade, Bronxville, N.Y.)

26–28. Simulation for **Aerospace Flight**, specialists meeting, Columbus, Ohio. (Inst. of the Aerospace Sciences, 2 E. 64 St., New York 21)

26–28. **Superconductivity**, intern conf., Hamilton, N.Y. (R. W. Schmitt, General Electric Research Laboratory, P.O. Box 1088, Schenectady, N.Y.)

26–29. American **Sociological** Assoc., Los Angeles, Calif. (T. Parsons, Dept. of Social Relations, Harvard Univ., Cambridge 38, Mass.)

26–30. American **Mathematical** Soc., 68th summer, Boulder, Colo. (Mrs. R. Drew-Bear, Special Projects Dept., AMS, 190 Hope St., Providence 6, R.I.)

26–30. **Rheology**, 4th intern. congr., Providence, R.I. (R. S. Rivlin, Brown Univ., Providence 12)

26–30. **Solar Spectrum**, intern. symp., Utrecht, Netherlands. (C. de Jager, Theoretical Dept., Sterrewacht, Servaasbolwerk 13, Utrecht)

26–31. **Haematology**, European Soc., 9th congr. Lisbon, Portugal. (Secretary, Haematology Congr., Dept. of Haematology, Inst. of Tropical Medicine, Lisbon)

27–30. **Alaskan Science** Conf., Anchorage. (A. H. Mick, Alaska Agricultural Experiment Station, Palmer)

27–30. American **Physiological** Soc., Coral Gables, Fla. (M. Edwards, Physiology Dept., Univ. of Miami School of Medicine, Coral Gables 34)

27–30. **Computing Machinery** Assoc., natl. conf., Denver, Colo. (F. P. Venditti, Univ. of Denver, Denver 10)

27–31. American Inst. of **Biological Sciences**, Amherst, Mass. (R. A. Jester, Dept. of Floriculture, Univ. of Massachusetts, Amherst)

27–4. **Automatic Control**, 2nd intern. congr., Basel, Switzerland. (A. von Schulthess, Wasserwerkstr. 53, Zurich 6, Switzerland)

28–31. **Electron Microscope** Soc. of America, 21st annual, Denver, Colo. (V. L. Van Breemen, Mercy Inst. for Biomedical Research, 2920 E. 16 Ave., Denver 6)

28–4. **British Assoc. for the Advancement of Science**, Aberdeen, Scotland. (Sir G. Allen, Burlington House, Piccadilly House, London, England)

29–30. **Solvation** Phenomena, symp., Calgary, Alberta, Canada. (P. J. Krueger, Dept. of Chemistry, Univ. of Alberta, Calgary)

29–31. **Pollen Physiology** and **Fertilization**, symp., Nijmegen, Netherlands. (H. F. Linskens, Dept. of Botany, Univ. of Nijmegen, Driehuizerweg 200, Nijmegen)

29–4. American **Psychological** Assoc., Philadelphia, Pa. (E. B. Newman, Memorial Hall, Harvard Univ., Cambridge 38, Mass.)

30–1. **Pancreatic Islets**, intern. symp., Uppsala, Sweden. (S. Brolin, Univ. of Uppsala, Uppsala)

30–2. Individual **Psychology**, intern. congr., Paris, France. (H. Schaffer, 28 rue des Archives, Paris 4)