MEETINGS

DINNER MEETING—MAY 11, 1987

IRENA CECH—Biographical Sketch

Dr. Irina Cech is an Associate Professor of Environmental Health and Hydrology at the University of Texas Health Science Center at Houston, School of Public Health. She received her training in Hydrology from the University of Moscow, USSR, and a Ph.D. in Community Health Sciences from the University of Texas. Prior to joining the faculty of the University of Texas, School of Public Health, Dr. Cech worked as a Hydrological Engineer for the Hydrogeological Trust in the USSR and for the International Boundary Commission and Danube River Authorities, in Czechoslovakia.

Dr. Cech's research and teaching concentrate on the effects of inadequate and polluted sources of drinking water on human health. This includes water resources development and management, protection of ground and surface water supplies, hazardous wastes, waterborne carcinogens, and assessment of health risks. Dr. Cech has contributed over 55 articles, reports, book chapters, and proceedings, more than 40 of those in peer-reviewed journals. She has been awarded grants by the National Cancer Institute, National Institute of Health, and other agencies.

Dr. Cech is recognized both nationally and internationally. She has served as a member of the work group and a contributing author to the United States Congress, Office of Technological Assessment, project on Water Related Technologies for Sustaining Agriculture in the U.S. Arid and Semiarid West. She is a consultant to the Pan American Health Organization and holds an honorary appointment as Distinguished Visiting Professor of Hydrology and Environmental Sciences at the School of Engineering and Architecture, University of Cd. Juarez, Mexico. In 1976-77, Dr. Cech served as Program Chairperson for the Texas Chapter of the American Water Resources Association. She is an appointed member of the Editorial Board for the International journal, "Environmental Protection Engineering," published by Politechnica Wroclawska, Poland. Dr. Cech has been nominated for Vice-President of the Houston Chapter of the Association of Women in Science and for the American Association of University Women Achievement Award. Recently, she received a Certificate of Appreciation from the Mexican National Commission of Agriculture and Hydraulics.

AN ASSESSMENT OF RADIUM-226 AND RADON-222 IN WATER SUPPLIES

Ingestion or inhalation of the products of uranium decay, radium (Ra) and radon (Rn), are public health concerns. Epidemiologic studies have established a strong association between bone cancer and certain occupational and therapeutic exposures to Ra. Rn-222, an airborne progeny of decaying Ra-226, has been associated with lung cancer in miners and, recently, has received national attention because of high concentrations observed in houses in some parts of the United States. Several studies also have raised the issue of cancer risk associated with Ra and Rn in domestic water.

Deposits of uranium, the progenitor of Ra-226 and Rn-222, occur in Texas. The major deposits occur in Eocene and younger formations and are believed to be associated predominantly with volcanic ash in the Catahoula formation of Miocene age. In 1984, taking advantage of the cost-effective testing procedure available at the University of Texas School of Public Health laboratory, a study was initiated by our team, in cooperation with several ground water districts and river authorities in Texas, to assess the geographic distribution of Ra-226 and Ra-222 in domestic water in selected regions of Texas. Anomalously high Ra and Rn concentrations were found in the Gulf Coast area, including Harris County.

A more detailed sampling for Ra-226 and Rn-222 was then conducted in and around Harris County to better understand the distribution patterns of these radioisotopes in residential and commercial water supplies, so that some predictive tool could be developed to guide waterworks. A total of 106 samples was collected, 67 of them from distribution systems and 39 directly at the well heads. The observations were synthesized into a series of computer-generated maps in order to depict the distribution of Ra and Rn at the well sites and at the consumers' taps.

In order to assess variations in Ra and Rn as related to location and depth of wells, a subset of 64 points representing the diverse geographic distribution of water sources was formed and subjected to statistical analysis. The general hypothesis investigated by statistical means was that Ra and Rn concentrations are in a function of (a) pumping depth, (b) distance from uranium deposits in sandstone aquifers, and (c) modifying local structural features, in particular, proximity of salt domes or associated faults.

Ra and Rn concentrations in water supplies in Harris County varied, depending on water source. No measurable concentrations of Ra or Rn were found in the surface water-supplied parts of the study area, whereas trace concentrations of Ra and Rn were detected in virtually every sample of well water. In northwest and southwest Harris County, ground water exhibited more than trace levels of Ra and Rn. Elevated concentrations (up to more than 20 pCi/l for Ra and more than 3000 pCi/l for Rn) were associated with wells producing water from a depth between 180 and 320 meters, especially when wells of this depth were developed on the flanks of piercement-type salt domes, along faults, and near streams.

Ra and Rn may be of interest to geologists and hydrogeologists as tracers of fluid flow in the Gulf Coast aquifers. The formations which constitute the Gulf Coast aquifer range in age from Oligocene and Miocene for the Catahoula sandstone to Quarternary for shallow alluvium. The actual production of well water involves strata of the Pliocene-

Pleistocene (Evangeline and Chicot aquifers) rather than Miocene age. The presence of Ra and Rn in ground water from the Evangeline and Chicot aquifers may indicate that waters have flowed around the flanks of salt domes that pierce the aquifers. Uranium deposits have been found in rocks that flank or overlay Gulf Coast salt domes, such as Palangana dome in Duval Co. and Hockley dome, and may be the source for Ra and Rn. Uranium presumably is precipitated in the reducing environment surrounding the dome. As ground water flows past the dome, it entrains the soluble Ra but leaves the insoluble uranium.

An alternative hypothesis for the source of Ra and Rn is that they originated in uranium deposits of the Miocene Catahoula formation and migrated up the dome flanks and associated faults into shallower formations. Whether Ra is related to uranium associated with salt domes or to brine leakage up the flanks of salt domes, it is advisable not to develop public drinking water wells near salt domes, especially medium-to-deep wells.

Natural ground-water flow in the Gulf Coast aquifer is down the stratigraphic dip toward the coast at a rate of approximately 1 m per year; however, heavy pumpage in the Houston area has created an extensive cone of depression and reversed the direction of flow. The presence of high concentrations of Ra hydrologically updip from some of the domes is further evidence of this reversal. The dissolved Ra has been transported up to 4 km over 30 years (the approximate age of the cone of depression); the rate of 130 m per year is significantly greater than natural ground-water flow rates.