

former Research Director of ORNL. It was therefore natural that ORNL be put forward as a possible site for one of the civil defense laboratories proposed by Project Harbor. This idea met with the approval of both the AEC, which has some statutory responsibility in civil defense, and the Department of Defense, and a civil defense project was established at ORNL in 1964. The project has been rather small—about 20 engineers, natural scientists, and social scientists—and its total budget is around \$730,000 of which DOD (OCD and ARPA) contributes \$580,000, AEC \$150,000. Though the group is small, it is one of the few groups that looks at the problem of civil defense from a global, coherent viewpoint. It therefore probably has had more influence on our country's civil defense policies than its small size would suggest.

*Co-carcinogenesis and other Involvements with NIH.*—ORNL has always been extremely strong in the biological sciences: the largest single division at the laboratory (450 scientists and technicians) is the biology division. The laboratory has always been concerned with the genetic and somatic effects of radiation. Since radiation is only one of the many physical insults to the biosphere, it seemed natural to many of us at ORNL (and this came out of one of our advanced technology seminars) to see whether we could contribute to resolving biological problems caused by environmental contaminants other than radiation. Our interest came to a head at about the same time the Government began to take a serious interest in the "Rachel Carson" problem, as I like to call it, which is the growing deterioration of our biological environment as a result of the spread of chemical agents of one sort or another.

These concerns led to conversations with the National Institutes of Health, particularly with the National Cancer Institute, and a joint ORNL-NCI program aimed at elucidating the synergistic action of radiation and chemicals in inducing cancer was set up. At present this co-carcinogenesis program runs at about \$2 million per year.

Another important involvement with NIH came about through our development of the zonal centrifuge, an outgrowth of the centrifuges developed for uranium isotope separation. In this case, Dr. Norman Anderson saw the usefulness of these devices for separating biological moieties of various sorts. This was a matter of obvious interest to NIH as well as to AEC, and a joint program to develop zonal centrifuges for biomedical use was undertaken. The program has been a success: this past year ORNL zonal centrifuges have been used to purify flu vaccine for human use, and it is likely that, before too long, many vaccines will be routinely processed by means of ORNL-NIH developed zonal centrifuges.

We find ourselves being further drawn into work of interest to, and supported by, NIH: bioengineering, automation of clinical chemistry, and large-scale separation of transfer RNA's. In most of these cases the unique characteristic of ORNL—a mission-oriented, interdisciplinary institution in which strong biology and strong engineering coexist—seems to be a strong attractant for NIH. At present ORNL spends \$4,500,000 per year for biomedical research sponsored by NIH.

*Other Involvements.*—ORNL also does work for NASA and various defense agencies. The total of all non-AEC work comes to