



DEPARTMENT OF HEALTH & HUMAN SERVICES

PB90179276



National Institute for
Occupational Safety and Health
Centers for Disease Control
Atlanta GA 30333

TESTIMONY OF

PHILIP J. BIERBAUM

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

CENTERS FOR DISEASE CONTROL

PUBLIC HEALTH SERVICE

DEPARTMENT OF HEALTH AND HUMAN SERVICES

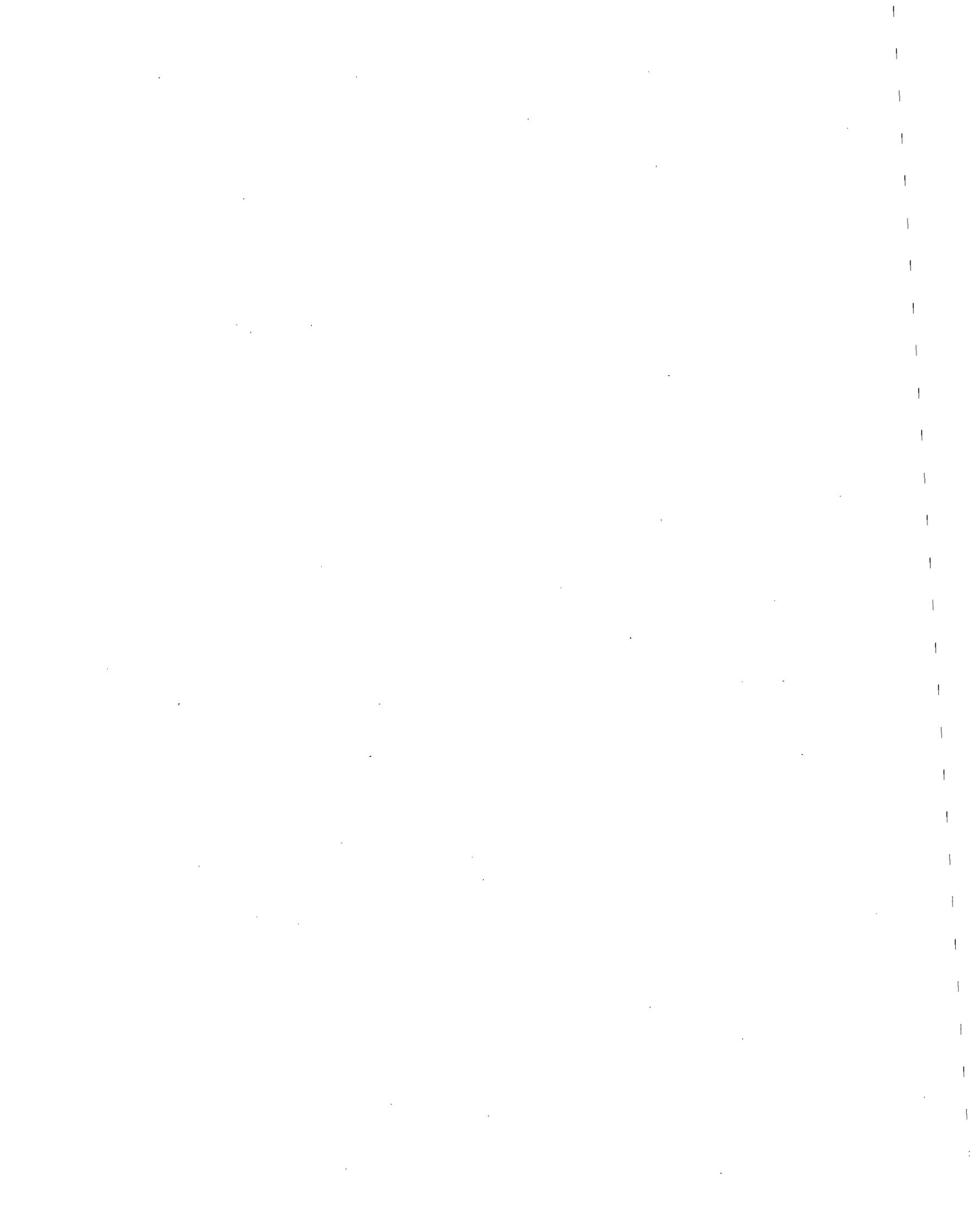
BEFORE THE

COMMITTEE ON GOVERNMENTAL AFFAIRS

U.S. SENATE

APRIL 22, 1985

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U.S. DEPARTMENT OF COMMERCE
NATIONAL TECHNICAL INFORMATION SERVICE
SPRINGFIELD, VA. 22161



REPORT DOCUMENTATION PAGE	1. REPORT NO.	2.	3. Recipient's Accession No. PB90-179276
4. Title and Subtitle NIOSH Testimony on the Safety of Nuclear Facility Workers by P. J. Bierbaum, April 22, 1985			5. Report Date 85/04/22
7. Author(s) NIOSH			6.
8. Performing Organization Name and Address NIOSH			8. Performing Organization Rept. No.
12. Sponsoring Organization Name and Address			10. Project/Task/Work Unit No.
			11. Contract (C) or Grant(G) No. (C) (G)
			13. Type of Report & Period Covered
			14.
15. Supplementary Notes <i>National Institute of Occupational Safety and Health</i>			
16. Abstract (Limit: 200 words) This testimony concerned (NIOSH) activities related to the health and safety of workers employed at nuclear facilities. Three NIOSH studies were noted, including an evaluation in progress at the Feed Materials Production Center in Fernald, Ohio, a study of radiation exposure at the Goodyear Atomic Corporation (GAC) in Piketon, Ohio, and a study of deaths from cancer at the Portsmouth Naval Shipyard in Kittery, Maine. In the first study the union representatives at the FMPC had several health and safety issues that they wanted NIOSH to evaluate. However, the necessary information has not been forwarded by the company so that these matters could be examined. Additional requests have been made by the union at this facility in relation to reported uranium (7440611) releases from the site. NIOSH recommended that all potentially exposed workers undergo bioassay testing to determine lung burdens of uranium. Efforts along these lines were continuing. At GAC workers requested an evaluation by NIOSH particularly because of exposure to radiation from uranium-hexafluoride (7783815). Total mortality for radiation workers was significantly below that expected, including cancer deaths, even those from leukemia. Total mortality for nonradiation exposed workers indicated an increase in the number of deaths due to leukemia. In a further study a significantly increased risk for workers whose cumulative lifetime exposure was at least 1.00 rem was noted for malignancies of the trachea, bronchus, or lung.			
17. Document Analysis a. Descriptors			
b. Identifiers/Open-Ended Terms NIOSH-Publication, NIOSH-Author, NIOSH-Testimony, Bierbaum-P-J, Nuclear-reactors, Radiation-exposure, Risk-analysis, Epidemiology, Respiratory-system-disorders, Carcinogenesis, Cancer-rates, Mortality-data			
c. COSATI Field/Group			
18. Availability Statement		19. Security Class (This Report)	21. No. of Pages 18
		22. Security Class (This Page)	22. Price

Mr. Chairman and Members of the Committee, I am Philip J. Bierbaum, Deputy Director, Division of Surveillance, Hazard Evaluations, and Field Studies, National Institute for Occupational Safety and Health (NIOSH) of the Centers for Disease Control. With me today is Dr. James Melius, Chief, Hazard Evaluations and Technical Assistance Branch. We are pleased to appear before this Committee to discuss NIOSH activities relating to the health and safety of workers employed at nuclear facilities.

In comparison with the number of epidemiologic studies NIOSH has conducted over the years in other areas of American industry, our experience with nuclear facilities has been minimal. We have conducted only three major studies involving Federal operations: (1) an evaluation currently in progress of the Feed Materials Production Center (FMPC) in Fernald, Ohio, operated by National Lead Company of Ohio, Inc. (NLO); (2) a study of radiation exposures at the Goodyear Atomic Corporation (GAT) in Piketon, Ohio; and (3) a study of deaths from cancer at the Portsmouth Naval Shipyard (PNS) in Kittery, Maine.

NIOSH is mandated to conduct epidemiologic field research in general industry through the Occupational Safety and Health Act and in mining through the Federal Mine Safety and Health Act. These Acts provide us with right-of-entry into general industry and into mines. However, they do not provide right-of-entry into Federal facilities or into facilities operated by Federal contractors unless we have the cooperation of the

Agency in charge. Our responsibilities for Federal facilities are outlined in Executive Order 12196. Requests for our assistance to evaluate potential problems at these facilities can come from the agency, the employees or their representatives, or agency management and employees jointly. For the three studies we are discussing today, the requests for our involvement came from the unions representing workers at the facilities.

UPDATE OF NIOSH ACTIVITIES AT FMPC

1. Overall Evaluation.

In February, 1983, NIOSH received a request to conduct a general health hazard evaluation of workers at the Feed Materials Production Center (FMPC), in Fernald, Ohio, operated by NLO, Inc. The International Association of Machinists and Aerospace Workers, one of 14 separate unions comprising the Atomic Trades and Labor Council (ATLC) at NLO, submitted this request. The plant, in operation since the early 1950's, processes uranium-bearing ores and residues into fuel elements for the U.S. Department of Energy (DOE).

From February through March 1983, NIOSH investigators contacted representatives of the Union, NLO, and DOE to obtain background information about the plant operations, to obtain more information on the nature of employee concerns, and to arrange with DOE for a visit to the facility.

On October 12, 1983, NIOSH investigators visited NLO and conducted a walk-through inspection of the facilities. Discussions at that time led NIOSH to request copies of all available NLO health and safety reports and to request access to NLO medical and environmental records to help us determine how to proceed. In January 1984, DOE forwarded to us copies of 16 published and internal reports (covering 1956-1975). DOE did not release access to personnel exposure and medical records because these records are maintained under the authority of the Privacy Act of 1974. DOE's "routine use" regulations under that Act had to be amended before access to these records could be granted to NIOSH.

DOE proposed giving NIOSH access to these records in an amendment to their regulations published in the Federal Register notice on November 2, 1984. The notice of the final DOE decision to grant NIOSH access to these records was published in the Federal Register on February 21, 1985, and became effective March 25, 1985.

On March 14, 1985, NIOSH medical investigators met with DOE, union, and NLO representatives at the FMPC. The union presented a comprehensive list of health and safety issues that they wanted NIOSH to evaluate. The NIOSH investigators then reviewed at the plant the medical and exposure record systems and requested copies of certain documents and data; most importantly, we requested the individually identified urine uranium monitoring results from all workers for several selected years. We have not received this information.

When we receive this information, we plan to analyze the urine uranium data to determine the extent of exposure to uranium and to determine whether workers in certain areas of the Plant have substantially higher or lower exposures than the workforce as a whole. We plan to evaluate the effects of uranium exposure on the kidneys and lungs, but when we have the results of the uranium analysis, we will be able to decide what type of study to do or which workers to include.

In the spring of 1984, as part of this evaluation, NIOSH became aware of a recently published doctoral thesis (by Jerome Wilson) which reported an increased incidence in non-malignant respiratory disease at NLO. This study had, however, a number of limitations. DOE plans to conduct further epidemiological studies to address some of these limitations. The NIOSH investigators recently met with epidemiologists from Oak Ridge Associated Universities, who will perform these studies, to discuss their studies at NLO and any data they may have available which might be useful in the NIOSH study.

2. Plant 9 Uranium Releases

In December 1984, NIOSH received an additional request from the NLO unions to assess the potential health effects to workers of uranium releases recently reported for NLO Plant 9 operations. The major issue here is to determine whether or not workers have internal body burdens of uranium in excess of the maximum permissible amounts as a result of exposure.

To address this issue, NIOSH investigators met with representatives of DOE, NLO, and the ATLC on December 17 and, based on a review of the information available, NIOSH recommended that all potentially exposed Plant 9 workers undergo bioassay testing to determine lung burdens of uranium using the DOE in vivo mobile counter. This was recommended because the counter was readily available and would be able to address the question concerning internal radiation burden. On January 11, 1985, NIOSH recommended lung burden counting on 4 workers by a second laboratory, Argonne National Laboratory, for comparison with the DOE mobile counter results. Results from the independent laboratory differ from the results from the DOE mobile counter. NIOSH cannot resolve the apparent discrepancies with the present data. Therefore, to further evaluate whether or not workers have absorbed excessive amounts of radiation, we recommended to the company and the union on March 25, 1985, that additional testing be conducted by the Battelle Pacific Northwest Laboratory. The in vivo system at that laboratory offers significantly better capabilities, a lower detection limit for uranium 235, and higher resolution than the previous two counters used. On March 27, 1985, NIOSH met with NLO, DOE, and the workers to discuss these findings and make the above-mentioned recommendations. The workers and the union are now determining whether they will participate in this additional testing.

UPDATE OF NIOSH ACTIVITIES AT GAT

In 1979, the Oil Chemical and Atomic Workers (OCAW), which represent the workforce at the Goodyear Atomic Corporation (GAT), located in Piketon, Ohio, requested that NIOSH evaluate occupational exposures and their effect on the health of workers at this plant. The OCAW was concerned primarily about exposures to radiation from uranium hexafluoride, which is enriched to 98% uranium 235 at the plant. They were concerned that these exposures may have produced excess cancer among the workers.

There was a quite lengthy delay in NIOSH initiating the study because DOE initially believed it would handle the evaluation themselves and because NIOSH staff had to obtain the proper security clearances. Once these issues were resolved, a two-part study was undertaken by NIOSH: 1) An industrial hygiene study was conducted to evaluate occupational exposure levels to radiation and other agents, and 2) an epidemiologic study was conducted to determine whether the workers at the plant have experienced any excess mortality, particularly from cancer, that could be associated with exposures at GAT.

Industrial Hygiene Survey. Because of the size of the plant, the industrial hygiene study was conducted in three phases.

1. A qualitative assessment was conducted of chemical and physical agents to which workers at GAT may potentially be exposed. This assessment was conducted in March 1982 to obtain information that would: 1) aid in future plans regarding quantitative evaluation of

chemical agents and ionizing radiation, and 2) form part of the industrial hygiene data base for the epidemiologic evaluation. The survey assessed exposures to chemical and physical agents for 24 job titles in approximately 50 departments. No environmental sampling was conducted as part of this assessment.

2. A quantitative assessment was conducted of surface radiation activity at selected sampling sites in six production related buildings. This survey, conducted June 27-July 1, 1983, was particularly important for its assessment of (removable) alpha activity (the activity detected on a 44mm filter wiped over 100cm² of the selected sample surface). Alpha radiation is the predominant radiation form emanating from the decay of uranium 238 and 235 nuclides. The surface alpha radiation is a particulate radiation form and can become airborne. This can pose a potential inhalation radiation hazard, or it can "rub" off on workers coming into contact with the contaminated surface, thus posing a potential ingestion hazard.

Levels of alpha surface activity measured in each of the selected buildings will be used to develop comparative indices of surface activity. It is hoped that these indices will provide a comparative indicator for the workers of quantitative potential exposure to internal radiation.

For the survey, approximately 1035 sample points were measured. Beside measurement of removable alpha surface activity level at each sample point, total alpha surface activity and beta and gamma radiation levels also were measured.

3. A statistical analysis is being conducted of environmental/bioassay data collected by GAT. GAT provided NIOSH with the following data: continuous air-monitoring, film badges, urinalysis, and whole-body radiation--also known as in-vivo data. Data analyses are focusing on the continuous air-monitoring, the urinalysis, and the whole-body radiation, since all of these provide indication of internal radiation exposure. These data bases are large: the air-monitoring data base has approximately 377,000 records, the urinalysis base has approximately 135,000 records, and the in-vivo base has approximately 6,700 records.

The purpose of analyzing the above data is threefold:

- a. To determine environmental radiation variability in production related buildings as an aid in planning statistically defensible, quantitative assessments of exposure. In particular, we determined data variability from the continuous air-monitoring data associated with airborne alpha activity levels in selected production buildings, for specified time periods. We then used the variability in the data to determine the required number of sample sites in the selected buildings for the alpha surface activity survey. The sample sizes allowed us to detect a 100% increase/decrease in average radiation levels from building to building with a 90% chance of finding statistical significance.

b. To obtain some indication of the radiation exposure and the absorbed dose that has occurred since plant began operation in 1952. The urinalysis and the in-vivo data tapes can shed light on these variables. These data (in-vivo, urinalysis) are being used to develop crude exposure/dose estimates for use in the epidemiologic evaluation.

c. To obtain an indication of historical exposure trends at GAT. Such trend data may reflect the efficacy of radiation protection and control efforts.

We are continuing with analyses of the industrial hygiene and radiation data. A final report summarizing the analyses along with more detailed observations/recommendations will be completed late in 1985.

Epidemiologic Study. The epidemiologic study at GAT is a retrospective cohort-mortality analysis. In this type of analysis, the number of deaths from a specific cause among the workers employed at the plant is compared with the number of deaths expected from this cause, assuming the workers would have died from this cause at the same rate as that for the U.S. population as a whole. In this study, we will attempt to address specific hypotheses based on the exposures at the plant. For example, is exposure to radiation from enriched uranium associated with excess mortality from lymphatic/hematopoietic cancer? The historical GAT urinalysis data and the data generated by the NIOSH industrial hygiene study will be used to examine whether the mortality results are associated with specific exposures or jobs at the plant.

Approximately 8000 workers have been employed at the plant since it opened. For the retrospective cohort mortality study, we have successfully traced the vital status of approximately 97% of these workers. There have been 607 deaths. We are currently analyzing the mortality data for the cohort. We anticipate that this analysis will be completed during the summer of 1985.

UPDATE OF NIOSH ACTIVITIES AT PNS

In May 1978, a Boston hematologist reported a five-fold increase in proportional mortality from leukemia and a two-fold increase from all cancer among workers employed in the maintenance of nuclear submarines at the Portsmouth Naval Shipyard (PNS) in Kittery, Maine. PNS built ten nuclear submarines between 1956 and 1971 and overhauled 60 nuclear powered submarines between 1959-1978.

After being alerted to the reports of the Boston hematologist by PNS union representatives, the predecessor of the Subcommittee on Health and the Environment of the Committee on Energy and Commerce, U.S. House of Representatives, requested that DEHS investigate this potential problem. NIOSH conducted this investigation by performing (1) an evaluation of the Radiological Control Program at the Shipyard; (2) a retrospective-cohort mortality study of all shipyard employees (radiation and non-radiation workers); and (3) case/control studies of deaths from leukemia and lung cancer.

Occupational exposure to ionizing radiation at PNS was limited to x-ray and to radionuclide sources used in industrial radiography. In July 1950, a photodosimetry program was begun, using film badges instead of pocket dosimeters as the primary device to measure occupational radiation exposure. In 1958, the Radiological Control Program was established in support of Naval nuclear propulsion work at PNS.

The first extensive radiological control work for occupational radiation exposure was that associated with the overhaul and refueling of the USS Nautilus, beginning June 3, 1959. This date is generally considered the start of nuclear work at PNS.

The basic functions of the Radiological Control Program at PNS can be divided into four general categories as follows:

1. Direct worksite surveillance
2. Technical planning and direction
3. Training of radiation workers and radiological control personnel
4. Radiological health and environmental health physics.

The Navy policy for ionizing radiation is, and has always been, to limit the radiation dose to the worker to a level as low as reasonably achievable (ALARA). In setting dose limits, the Navy has relied on the recommendations of national and international standards organizations for guidance.

The NIOSH evaluation addressed the following questions about the Radiologic Control Program:

1. Were the dose data the shipyard provided to NIOSH for the epidemiologic study adequate measure of the employee's dose?
2. Was the radiologic control program effective in protecting the worker from radiation hazards?
3. Did accidents or incidents occur which resulted in exposure of the worker to external or internal radiation sources?
4. Were there any unreported accidents or undocumented exposures?
5. Has the nuclear work at PNS had an effect on the surrounding environment?

Regarding these questions, the NIOSH evaluation showed that the radiation control program was effective in protecting the worker, the environment, and the general public.

Retrospective Cohort Mortality Study. The objectives of this study were: (1) to determine whether any excess cause-specific mortality exists at PNS, particularly for those causes previously reported by the Boston hematologist; (2) to determine whether a particular type of work (radiation, non-radiation) was associated with excess cause-specific mortality; and (3) to determine whether a dose-response relationship exists between radiation dose and specific mortality from any cause.

The study cohort consisted of 24,545 individuals who had worked at the Shipyard at least one day between January 1, 1952, and August 15, 1977. Of these, 7,615 had a cumulative, lifetime, radiation-exposure history of at least one millirem. Another 1,345 had been monitored for radiation exposures, but had a cumulative recorded dose of zero. The remaining 15,585 had no record of ever having been exposed to radiation.

Total mortality for radiation workers was well below that expected (833 deaths versus 1,065 expected), including cancer deaths, 201 versus 218 expected. Of the cancer deaths, seven were due to leukemia and aleukemia while 8.3 such deaths were expected. Total mortality for the non-radiation workers was approximately the number expected (3,733 deaths versus 3,801 expected), including 726 cancer deaths versus 723 expected. Of these cancer deaths, 33 were due to leukemia while 29 were expected. The results of the Boston hematologist were therefore not confirmed. Based on these analyses, we concluded that excess deaths due to malignant neoplasms and due specifically to neoplasms of the blood and blood-forming tissue were not evident in civilian workers at PNS. We informed the Navy and the union of these results and published our data in Lancet in 1981.

Since NIOSH found no evidence for radiation-induced deaths at the PNS, we commissioned an investigation into the differences between the original May 1978 report by the Boston hematologist and our subsequent NIOSH work. We found a spurious association created by a measurement bias in the original study which occurred when nuclear workers who had not died of cancer were misclassified as non-nuclear workers based on information

supplied by their next of kin. Also, misclassification of occupation in the original study and disagreements about the cause of death accounted for some of the reported excess deaths.

Case Control Analyses. We conducted two case-control studies to further evaluate our overall mortality results epidemiologically for leukemia and lung cancer. We conducted a matched case-control study on 53 leukemia deaths and 212 controls within the previously studied cohort to further ascertain whether there was an association between leukemia deaths and occupational exposure to either ionizing radiation or to organic solvents. We found no statistically significant associations between either ionizing radiation or presumed solvent exposure and either myelogenous or lymphatic leukemia. However, when we examined specific job categories and shops, two occupations, electrician and welder, were associated with leukemia, although this observation could have occurred by chance: the study was not designed to determine whether these two occupations were associated with increased risk.

It should be noted that the study was limited somewhat in its ability to detect an association between radiation and leukemia because cumulative lifetime radiation exposures from employment at PNS were very low. Only six cases had accumulated a lifetime radiation dose of at least 1 rem and only one of them had accumulated a lifetime radiation dose of more than 5 rem. This study is completed and has been submitted for publication. The Navy and the union have already been informed of the results of this study also.

The other matched case-control study involved 405 deaths from malignancies of the trachea, bronchus, or lung and 1,215 controls. Analysis for radiation exposures alone showed a statistically significant excess risk for workers whose cumulative lifetime exposure was at least 1.00 rem. Other known or suspected lung carcinogens at the shipyard included asbestos and welding by-products. Workers with exposure to these substances also showed elevated risk. Therefore, we analyzed for the effects of radiation exposure, while controlling for exposures to asbestos and welding by-products, and found, at all levels of the radiation exposure examined, lower estimates of radiation risk than in the uncontrolled analyses mentioned above. This reduction in risk implies that radiation workers also had a propensity for exposure to asbestos and/or welding by-products. Thus, the elevated risk of lung cancer cannot be attributed totally to radiation exposures, but is more likely due partially to concomitant exposures to asbestos and/or to welding by-products. We anticipate publishing the results of this case-control study soon.

Thank you for the opportunity to provide you with an overview of NIOSH activities regarding our studies of health and safety of workers employed at nuclear facilities. We will be happy to answer any questions.

