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RADIATION PROTECTION DEPARTMENT REPORT FOR FEBRUARY 1965

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RADIATION PROTECTION DEPARTMENT REPORT FOR FEBRUARY 1965

Organization

Betty B. Haller transferred to Metallurgy Research effective February 26. Sandra S. Young accepted a position as secretary with Dosimetry Studies and Evaluation Section effective February 23, 1965.

Laboratory Experience

There were two incidents involving four employees which required special bioassay sampling for plutonium analysis. In addition to the incidents involving plutonium, there were three incidents involving four persons that required evaluation for possible intake of other radioisotopes.

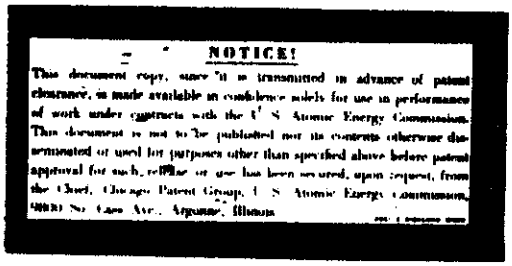
The badge film of a Coolant Systems Development employee working at the 1706-KE facility showed 1.8 R for January. A formal investigation of the handling of the employee's film badge dosimeter produced evidence that it was subjected to heat while at home. An experiment to verify the heat effect on the badge film while in the employee's home is in progress.

Environmental Evaluation

The average concentration of fallout materials in the air in the vicinity of the Hanford project during the four week period ending February 19, 1965 was 0.2 pCi β/m^3, the same as the average for the past two months.

The estimated dose to the GI tract due to drinking water from the Richland municipal water system was about 4.4 mrem during the months of January and February. This was slightly less than the dose estimated for similar months of 1964. The average concentration of P^{32} in the flesh of whitefish caught at Hanford was 46 pCi/gm. This was less than half that found during January 1964, but quite similar to 1963 experience. The rate of transport of P^{32} in the river as measured at Richland dropped from an average of 40 Ci/d during December to about 25 Ci/d during January. The decrease was not indicated by IPD-GE measurements of rate of release which did not change between December and January. If the value of 25 Ci/d is a true value, it represents a new low for this time of year.

The U. S. Testing Company began analyzing environmental samples on a limited basis on February 23. Samples which are being delivered to them are: air sample scrubbers and filters, water samples requiring total beta only, one large volume water sample per week for detailed isotopic analysis, beef thyroids,



milk, and oysters. This limited delivery will be continued for several more weeks until U. S. Testing has completed calibration. The Radiological Analysi group will continue to analyze other off-site samples so that our schedule may continue at the reduced level established in December.

Locations for new control plots outside of the 200 Area exclusion fences were investigated and laid out. Control plots on the Wahluke Slope were redefined with stakes and signs. Surveys at control plots showed no detectable contamination.

Aerial monitoring flights to Spokane and down the Columbia River to Astoria were made.

Nuclear Safeguards

With the assistance of Physics Laboratory and Programming personnel, a research proposal was prepared and submitted to the U. S. Army Electronics Command, Fort Monmouth, New Jersey. The objective of the proposed research is to develop an improved land fallout prediction system based on the dynamics of the fallout environment from time of burst to fallout deposition. The proposed project would require about 90 man-months.

New studies are underway of the effect of various postulated production reactor accidents on the Wahluke Slope, assuming that the entire area were developed for farming. The economic parameters have been determined, analyses based upon them have been made, and conclusions are being formulated.

Work is continuing on the high-power density core analyses for PRTR. Preliminary data and subsequent analysis indicate that a portion of the center of several fuel rods will be molten during operation. Studies are under way to determine the tolerable limit of fuel rod partial melting. It has been proposed that a boron chemical shim (boric acid dissolved in the moderator) replace or augment the present mechanical shims during high-power density core operation. Preliminary tests of relatively dilute boron shims are planned. In support of these tests an analysis was made of the nuclear effects of a hot primary coolant blowdown through a pressure tube rupture into the borated moderator (20 ppm boron shim), at initial moderator levels of 8 feet, 6.5 feet and 4 feet. In all cases the combined result of clean hot primary coolant entering the moderator, void formation, and rise in moderator level was a negative reactivity insertion.

Further improvements were made in the computer program for whole body dose from a radioactive cloud, permitting the extension of the exposure time interval from 8 hours to 24 hours. Whole body doses from a postulated ground level release of activity from PRTR were calculated. The computed results are being analyzed.

A brief survey was made of the nuclear safety of the Dynapak operation in the 308 Building. This is the first processing operation which has come to our attention which could possibly cause a nuclear detonation. The equipment as presently set up is nuclearly safe, since it cannot contain a critical mass at maximum density and with optimum conditions of fast neutron reflection by the metal parts of the machine.

Dosimetry Studies

A program was initiated to calibrate the whole body counters for lung burdens of various radionuclides using a REMCAL phantom. It is planned that the calibration will include Pu^{239}, Co^{60}, Fe^{59}, Sc^{46}, Ru^{103} and Zr^{95}-Nb^{95}. These radionuclides were chosen since they are the ones most commonly found in radiation incident related measurements.

Calibration of the Co^{60} radiation facility for the Biology Department was begun. Standard R-meter chambers related directly to the U. S. Bureau of Standards calibrated R-meters are being used for the study which was about 80 percent completed in February.

The Van de Graaff electron accelerator was used to provide a high beta dose to study pasteurization of specially packaged peeled potatoes for General Electric's Irradiation Processing Department.

A special dosimetry problem requiring the measurement of Co^{60} gamma radiations at a wide variety of positions within a flour beetle population was solved for the Biology Department. Seventy lithium phosphate glass rod dosimeters were provided, calibrated and evaluated to give the needed dosimetry information.

Environmental Studies

A study was made to examine dietary correlations that may be made using results of the Hanford Whole Body Counter and diet questionnaires. The example chosen was the Cs^{137} body burden resulting from milk consumption. The data taken during nine random months were chosen as a sample. A small but highly significant correlation was found between milk consumption and Cs^{137} body burden for the 979 sets of results examined. It was found that an average of 26.3% of the Cs^{137} body burden was obtained from milk. The effective half-life of Cs^{137} in the total body calculated from these data is 67.3 ± 22.3 days, which agrees well with the ICRP value of 70 days.

The RLOO-AEC requested comments on a proposal by GE-NRD to dispose of chemical decontamination wastes directly to the river following a forthcoming primary heat exchanger decontamination. In reply it was stated that, although no

applicable radiological or chemical limits for the river would be expected to be exceeded with the proposed disposal, river disposal of wastes from this routine, if infrequent, job represented an undesirable waste disposal practice. Disposal to a temporary crib was recommended.

Efforts in the development of the "Nuclear Facilities Monitoring Guide" were directed toward completing a section which quantitatively describes the significance of gaseous iodine release and the basis for calculating permissible stack releases. More time has been spent on this one aspect of monitoring than any other because iodine releases cause the major problems in routine power reactor operation. This is one of the areas in which the Guide can make an obvious contribution.

A study is in progress of the effects of reactor effluents on Columbia River water quality. Compilation and reduction of routine operating and meteorological data continued. One dye test for travel time measurement was made from N Area to 300 Area during the month. Additional temperature measurements were made in reactor effluent plumes and near the shoreline below K and F Areas where warm water seepage is occurring.

Applied Reactor Engineering, GE-IPD, has undertaken a study of inlet water temperatures at 181-D. During recent low river flow periods with N Reactor in operation, temperature increases in the raw water level exceeded any previously experienced on plant. A letter has been received requesting the assistance of J. P. Corley in this evaluation. A consultation with the IPD representative was held; the extent of future assistance is uncertain

A special study of inlet water temperature at the 181-N river pumphouse has been in progress. An additional dye test for B Reactor effluent intake at 181-N was made at an intermediate river flow rate. The results confirmed an estimate based on earlier data.

Radiological Development

Design of a new thermoluminescent reader was completed. The design provides for improved stability within the heating and light integrated circuits Also, larger quantities of thermoluminescent materials may be read with the new equipment. This results in a simple means to increase the sensitivity and lower the detection limit of the thermoluminescent dosimeters Ample space and design considerations will permit installation of an optical system so that specific light wave lengths may be examined independent of the total luminescent glow. Specific wave length study may provide a lower background for the system by eliminating non-radiation caused transitions.

Radiological Engineering consultation was provided for the design of a 10,000

square foot addition to the Fuels Recycle Pilot Plant (FRPP). This addition would include facilities for a plutonium laboratory, reactor fuels rupture and decontamination laboratory and a high-level analytical chemistry cell. The design is proceeding on the basis that absolute separation of the currently designed functional areas of the facility and the proposed facilities is to be maintained. In addition, Radiological Engineering assistance in the design of gas decontamination equipment for the FRPP metallurgical cells was begun. The major problem is to devise a system for the collection of the volatile fission products that may escape from a ruptured fuel element. A vacuum chamber of a relatively few liters in volume may prove adequate for the collection and storage of these materials at reasonable cost.

An improved and wider time range system for pulsing the electron Van de Graaff for special dosimetry physics and chemistry studies is being designed and installed. The addition of this system to the Van de Graaff accelerator when coupled with the capabilities of the flash x-ray equipment will provide a precisely controlled irradiation capability from about 0.1 μsec to many hours.

A new 1000 gram plutonium fluoride neutron source was obtained. Calibration equipment modifications to accomodate the use of this source were provided. The new source is doubly contained with an inner can of monel material and an outer can of aluminum. The monel inner container was chosen to provide maximum inertness to fluorine. An air space of approximately 1/8 inch is provided between the two containers so that x-ray examination can be used to detect any possible source swelling of the inner container. The higher density monel metal has significantly reduced the gamma radiation dose rate from this source. Also, the recent purification of the plutonium used has resulted in a source with a minimum of Am^{241}. Gamma radiation dose rates from this source will increase as the Am^{241} content increases.

The use of silver phosphate glass rod gamma dosimeters for in-reactor gamma dose measurements at levels to about 10^6 R/hr was discussed with Nucleonics Instrumentation. An interference of 10^{12} n/cm^2-sec would necessitate shielding the neutron flux or use of a glass dosimeter with relatively low neutron sensitivity. Some 23 w/o boron shielding was provided for testing. The use of quartz glass dosimeters was recommended as an alternate.

Outside Consultations

Several meetings were held with Dr. Mancuso, Research Professor, University of Pittsburg, concerning the availability of exposure records for use in the AEC epidemiological feasibility study being conducted by him. At the request of Dr. Mancuso, occupational exposure histories were prepared for 75 individuals for use with certain medical statistics derived from occupational health records.

The RLOO-AEC requested that they be supplied with (1) estimates of increased environmental survey costs and (2) the cost of evaluating radiation exposure to people if a contamination event occurred in the Wahluke Slope area, if the assumption were made that the Wahluke Slope area were extensively farmed. It appears that adequate surveillance could be accomplished for within $10,000 per year. The cost of evaluating radiation exposure to people from a contaminating event is estimated to be within $5000. This estimate includes those incidents where it is necessary to define only the magnitude of the exposure and extent of area involved.

Hal Bernard and William Regan from the Environmental and Sanitary Engineering Branch, DRD, AEC Headquarters, met with Environmental Studies & Evaluation Section personnel several times during the period February 1 to 3, to discuss work in progress on the "Nuclear Facilities Monitoring Guide."

Consultation service was supplied to GE-CPD personnel concerning open pond aqueous waste disposal practices and radiation problems associated with planned excavations in the immediate area surrounding the old production buildings, 221-B and 224-B.

Approximately two days were spent at the U. S. Testing Company facilities tuning up the badge processing equipment, the film x-ray identification coder and the mechanized film densitometer. Essentially all difficulties encountered originated from dust or dirt in the equipment and the fluctuating voltage in the electrical power supply to the U. S. Testing building. Neither of these conditions was encountered in the 300 Area facilities.

Staff Activities

R. F. Foster and R. B. Hall visited the Division of Water Quality and Pollution Control, U. S. Public Health Service, Department of Health, Education and Welfare, Cincinnati, Ohio, February 16 and 17. The purpose was to discuss the methods used and results obtained in describing the effect of the Hanford Project on the content of radioactive materials in the Columbia River.

H. E. Hanthorn and L. J. Nitteberg presented an oral report on the status and problems of the high-power density core safeguards analysis at an information meeting for R. Grube of Washington-AEC.

J. K. Soldat presented a two-hour lecture entitled "Evaluation of Radiological Conditions Through Environmental Analysis" to about one dozen personnel of the Special Analysis group of the analytical laboratory of Battelle-Northwest.

J. P. Corley was assigned to the Industrial Wastes Committee of the Pacific Northwest Pollution Control Association.

R. O. Budd, J. P. Corley and R. B. Hall received notice from the American Board of Health Physics of certification as Health Physicists.

Manager
RADIATION PROTECTION DEPARTMENT

AR Keene:np

END