Copy 12

OFFICIAL USE ONLY

Progress Report USNRDL-P-18

RADIOLOGICAL SAFETY AT USNRDL

ANNUAL PROGRESS REPORT 1958

OFFICIAL USE ONLY

OFFICIAL USE ONLY

RADIOLOGICAL SAFETY AT USNRDL -- 1958

Progress Report USNRDL-P-18

A.L. Baietti
T.G. Brough

Annual Progress Report
For Period 1 January to 31 December 19

Health Physics Division

Captain A.R. Behnke, (MC) USN
Radiological Medical Director

Captain J.H. McQuilkin, USN
Commanding Officer and Director

U. S. NAVAL RADIOLOGICAL DEFENSE LABORATORY
San Francisco 24, California

OFFICIAL USE ONLY

INTRODUCTION

The operation of the Health Physics Division during the year can be divided into three main programs.

Under Program 1 - Health Physics personnel supported the general Laboratory Operations which included Laboratory consultation and monitoring for the various divisions, dosimetry, radiological services (including waste disposal), environmental surveys, and Radiological Safety Instrumentation.

Under Program 2 - Radiological safety evaluations were made for various segments of the Laboratory, as well as outside agencies. Training in radiological safety regulations and procedures was also supplied under this program.

Under Program 3 - Health Physics personnel participated in support of various field operations such as HARDTACK, STONEMAN II, and Naval Ordnance Testing Station (NOTS) PROJECT 173, as well as training for PLUCON teams.

SUMMARY

The operation of the Health Physics Division during the year can be divided into three main programs: General Laboratory Radiological Support, Radiological Safety Evaluations, and Health Physics Support for Field Operations.

Program 1 - Health Physics Measures for Laboratory Operations

Health Physics Division continued its regular monitoring services for various scientific divisions of the laboratory. Well over two hundred routine monitoring surveys and some two hundred special monitoring surveys were performed in various laboratory work spaces. There were six minor contamination incidents during the year not involving laboratory personnel and one which contaminated the soles of some investigators. Three radiological accidents occurred during the year. Two of them resulted in radiation exposure exceeding the weekly maximum permissible exposure of 0.3 rem. The maximum dosage received was 0.69 r in one incident and 4.0 r in the other. In all cases of contamination the material and equipment was quickly and thoroughly decontaminated.

The Division continued its film badge dosimetry processing service for the Laboratory and various outside agencies. Only one exposure in excess of the monthly maximum permissible exposure (1.2 r) was detected by the film badge program for NRDL personnel and visitors during 1958. Health Physics personnel continued the accountability services for radioactive sources for the Laboratory and processed and serviced orders for cyclotron and reactor irradiated samples.

The radioactive disposal operation continued, discharging at sea, until mid-September, when the barge became damaged in heavy seas and was retired for repairs. The Environmental Survey continued. Analysis of the results indicated that there was no significant release of radioactive aerosols by NRDL operations during 1958. An air and water Effluent Monitoring System was designed and let out for bids.

The radiological Safety Instrumentation program proceeded with the establishment of an instrument calibration range and the making up of standard sources for such calibration. All monitoring instruments assigned to the Health Physics Division have been placed on a preventative maintenance schedule by the Central Instrument Branch.

Program 2 - Radiological Safety Evaluations

Various requests for radiological safety assistance by activities outside the Laboratory were honored. These usually involved monitoring or calibrating facilities or instruments and suggesting procedures for their use. Instructions and training guides were drafted and submitted

for approval. Radiological Safety Training courses were conducted by members of the Division both in the Laboratory and at various nearby activities.

Program 3 - Special Operations

The Health Physics Division continued its support of field operations. For Operation HARDTACK, the Division set up a training program to certify NRDL personnel as monitors and arranged for the training of naval personnel assigned to Task Group 7.3. For the Stoneman II project "Development of Reclamation Procedures for Land Targets", the Division provided rad-safe job training for Army Chemical Corps personnel, provided rad-safe support during the test operations, gathered data to document radiological conditions of the test area, and assisted in the roll-up. Radiological Safety support for six NOTS Project 173 Weapons Vulnerability Test series was furnished by the Division. A five day training program was presented for Explosive Ordnance Disposal Test Center (EODTC), Pearl Harbor Naval Shipyard (PHNS), and U.S. Naval Hospital, Bethesda, Md., personnel on PLUCON problems.

Program 1.0 Health Physics Measures for Laboratory Operations

This program is chiefly concerned with direct health physics support of Laboratory operations. An average of 75% of the available effort was expended on Program 1.0 assignments. This program is divided into five sub-groups to facilitate program planning and reporting.

Project 1.10 Laboratory Consultation and Monitoring

General

A formal routine monitoring program was instituted during the first quarter. Emphasis was placed on Chem-Tech and BioMed spaces, with a series of weekly and monthly surveys covering all spaces where radioisotopes are normally used. 244 monitoring surveys were made for general contamination control, control of liquid effluents from the Laboratory, controlled maintenance work, Program 3.0 training exercises, and the final release of areas. No evidence of significant amounts of uncontrolled radioactivity was disclosed. However, a number of minor discrepancies was observed. Among these were: unlabeled radioactive solutions on benches and in hoods, placement of radioactive solutions near bench edges, waste cans needing emptying, and minor floor contamination. Recommendations for correcting the above points were made to the personnel concerned.

A wall chart showing the location of all radiation sources in laboratory spaces was installed in Room 255. A calibration source for the Central Instruments Branch was installed in Room 2125. A monitoring survey indicated that the maximum dose rate in adjacent uncontrolled spaces, when the source was open, was 1 mr/hr.

A total of 176 samples were received from the Eniwetok Proving Grounds in 12 separate shipments during May and June.

In addition, about 2 dozen samples were received from Los Alamos Scientific Laboratory (LASL) and University of California Radiation Laboratory (UCRL). A few samples were shipped from NRDL to LASL and UCRL.

Monitoring surveys were made on all equipment returning from Operation HARDTACK. All equipment that met final clearance standards was released for return to the users. The amount of radioactivity detected on the major portion of contaminated equipment was quite low (less than 10,000 c/m). These items were segregated for decay, since there was no

immediate need for the equipment. A few items were segregated for future decontamination. 37 transportainers contaminated to 2,000 c/m were cleaned by vacuuming and then painted.

Monitoring surveys were made on a large quantity of equipment (formerly on the YAG-39 and 40) being moved to San Bruno storage. All items checked were below final clearance standards and contamination control measures were not required.

The decontamination of Bldg. 506 (used to process HARDTACK samples) was completed. The work space will be used for the Chem-Tech Division program involving plutonium and uranium sputtering operations.

In cooperation with the Engineering Division a decontamination facility was set up in Bldg. 364. A decontamination sink, cleaning materials, protective equipment, and liquid and solid waste collection containers are currently available in the facility. A small steam cleaning unit, complete with a detergent pick-up, is currently on order.

In cooperation with the Logistic Support Division, an emergency rad-safe equipment station was set up in Room 2179. The station is equipped with protective clothing and decontamination and delineation equipment to handle accidents involving liquid or unconfined radioactive material.

30 special work permits for controlled maintenance work were issued during the year.

Some progress was made toward the establishment of a routine urine-sampling program for the Laboratory. The names of 15 Chem-Tech personnel were submitted to the Radiological Health Officer for such sampling.

Chemical Technology Division

210 documented monitoring surveys through the year were made in Chem-Tech spaces in connection with processing MTR and cyclotron irradiated samples, experimental operations, incoming radioisotopes, spills, maintenance, and decontamination work. 145 air samples were taken during the year. No airborne contamination in excess of the established MPC's was detected.

A total of 18.5 curies of La^{140} and fission products (measured at the time of shipment) were received from the Materials Testing Reactor (MTR) for Chem-Tech experimental purposes. All samples were processed in glove boxes with external lead shielding or with local interior lead shielding. In general, the radiation levels in the working spaces in front of the box were approximately 100 mr/hr. Short exposures (less than 5 minutes) of 1 r/hr were experienced during material transfers and hand manipulations. No significant personnel exposures in excess of the MPE were noted.

The kilocurie Co^{60} source was received from the MTR for the Applied Research Branch. The source cask was installed on the exposure chamber without incident (maximum dose rate in vicinity of personnel - 30 mr/hr). Because of loose Co^{60}, there was a minor contamination control problem. The shipping container closure plug was contaminated to 230 mr/hr at contact and low level (1000 c/m max.) floor and shoe contamination was observed. Decontamination reduced all levels to background. The source itself was decontaminated by remote operation such that the wipes were reduced from 100 mrad/hr to 20,000 c/m (apprx. a factor of 50). Since there was still some loose contamination at the source, it was necessary to establish contamination control checks during sample irradiation operations. From a radiation viewpoint, the source assembly did not meet operating standards. When the source was extented into the exposure chamber, dose rates of approximately 2 r/hr at the surface of the assembly and 10 mr/hr at the walls of the room were observed. Two inch lead blocks were fabricated to fit inside the existing exposure chamber. This increased shielding reduced the above dose rates by a factor of 20. The kilo curie Co^{60} source in Room 165 was placed in operation. No significant radiation or contamination problems have developed. A detailed operating procedure, including the rad-safe requirements, has been prepared and approved.

Special capsules that can be used for the MTR irradiation program and are approved by the Bureau of Explosives (to meet ICC specifications) were developed in conjunction with Chem-Tech personnel.

Arrangements have been made for the irradiation of gram quantities of source and special nuclear materials, during the 4th quarter of 1958, at the Berkeley 60" cyclotron and the NRDL Van de Graaff. Special film badges will be provided at the cyclotron for recording radiation dosages received by Chem-Tech personnel.

Recommendations have been made to the Analytical and Standards Branch on the rad-safe aspects of the procedures and equipment to be used in the uranium and plutonium sputtering operations to be performed in Bldg. 506.

In December, a trip was made (in conjunction with Chem-Tech personnel) to Vallecitos to inspect the new G.E. Test Reactor and to discuss use of the reactor to perform NRDL irradiations.

A small scale field experiment was conducted at Camp Stoneman in preparation for Operation HARDTACK. Fallout simulant (La^{140}) was applied to a coracle instrument platform in order to check out instrument response. Personnel exposures up to 600 mr gamma and 2 rep beta were received during the experiment. The equipment used was successfully decontaminated at the end of the experiment.

Project 1.30 Radiological Services for Laboratory Operations

Accountability

The following table summarizes the radioisotope orders processed and shipments received for each Division during the year.

Division	Orders Processed	Shipments Received
Bio-Med	57 orders - 1,208 mc	97 shipments - 2,160 mc
Chem-Tech	38 orders - 2,135 mc	43 shipments - 1,626 mc
Nucleonics	16 orders - 3,677 mc	20 shipments - 6,236 mc
Health Physics	3 orders - 6,920 mc	6 shipments - 7,020 mc
TOTALS	114 orders -13,940 mc	166 shipments -17,042 mc

Multicurie sources were received as follows:

Division	Radioisotope	Quantity
Chem-Tech	Co^{60}	1,000 curies
	La^{140}*	3,500 curies
Nucleonics	Ir^{192}	326.4 curies
	Cs^{137}	120 curies
	Cs^{137}	200 curies
	Co^{60}	3.8 curies
	Co^{60}	3.8 curies
	Pu-Be	5 curies(80 g Pu)
Health Physics	Co^{60}	5 curies

*Used in Stoneman II

Twenty-five cyclotron- and reactor-irradiated samples were processed and received during the year. An indeterminate quantity of activity was produced in these irradiations.

On the average about 100 items totaling 1.5 curies of radioactivity were in use by the Laboratory throughout the year. 25 items totaling 400 mc were stored in Room 1109.

The Ship Shielding program continued through the third quarter, using 200-curie Cs^{137}, 50-curie Co^{60}, and 350-curie Ir^{192} sources. Deck and side exposure studies were made on the USS COWPENS. Later, the Ir^{192} source was removed from the deck exposure container and replaced by the Cs^{137} source. This transfer was also accomplished in Bldg. 364 with a maximum dose rate from over-the-wall scattered radiation of 30 mr/hr. The dosage received by personnel involved was less than 50 mr. The handling wire for the 50-curie Co^{60} capsule was also replaced, using the Bldg. 364 remote handling facilities. A preoperational test was made with the 500-curie Co^{60} source. The source was suspended 60 feet above the deck of the USS COWPENS and the primary beam could be confined to the ship with dock side levels being less than 5 mr/hr. A trial exposure was made with the beam directed through the side of the ship (beamed from the dock toward the water), the scattered radiation producing levels no greater than 5 mr/hr outside the roped area.

The program has been using a 413-curie Co^{60} source during the last quarter. The source was so collimated that radiation levels external to the ship (USS COWPENS) were less than 200 mr/hr. The radiation levels outside of the restricted area (defined by rope barricades and signs) were less than 5 mr/hr. Another shielding experiment using the 413-curie Co^{60} source and the DD 592 is scheduled for February 1959. Berth 15 in the San Francisco Naval Shipyard (SFNS) will be used. During horizontal beam exposures, the 5 mr/hr line has been calculated to be 800' from the Pier. Monitoring arrangements will be coordinated with the SFNS Rad-Safe Officer when this experiment is carried out.

A series of shielding studies on ship compartments has been rescheduled to begin 1 April 1959. Tentatively, the area used will be outside the SFNS South gate. Discussions with the Ship Shielding Branch have been held on the safety aspects, and recommendations were made as to the source packaging methods and handling procedures. A 50-curie Co^{60} and a 100-curie Cs^{137} source will be ordered shortly for an irradiation apparatus which will be obtained on loan from the Technical Operations Corp., Mercury, Nevada. The nature of the experiments planned are such that a continuous radiation monitoring scheme must be established.

Early in the year a special monitoring survey was made of the 120-curie Cs^{137} source installed in the instrument trailer subsequently used at Operation HARDTACK. With the source beamed upward, the radiation level at head height at the exterior surface of the trailer was 30 mr/hr. At the control panel in the trailer (at the opposite end from the source) the dose rate was less than 6 mr/hr.

The use of moderate level Sr^{90} sources in plastic shields was recommended to the Instruments Branch in connection with their recycling dosimeter development. The use of intense beta point sources instead of their gamma equivalent produces the required dose rates without the danger of significant personnel exposure. A 50-mc and 25-mc Sr^{90} source was recommended.

139 μgrams of Pu were used as a source by the Instruments Branch for the development of scintillation crystals. The source was mounted in a lucite holder. A wipe test of the source indicated that there was 75 d/m removable alpha contamination.

A study was made on the use of: (1) 200-curie Co^{60} (2) 120-curie Cs^{137} and (3) 4-curie Co^{60} sources in the 4th floor increment. By limiting the beam size and controlling the placement of the sources, it was thought possible to keep the significant radiation levels inside the existing enclosure. A special monitoring survey was made during initial exposure runs using the 120-curie Cs^{137} beamed source. It was found that at the normal operating position of the source (20' from the East wall), the maximum radiation level outside the fenced enclosure was 15 mr/hr. A temporary rope barrier was erected at the 5 mr/hr contour to restrict entry of personnel into the radiation field outside the cage. Later, in the 4th quarter, the calibration facilities on the fourth floor were expanded. Two 100-curie Cs^{137} sources were located in Room 4121. Monitoring surveys were made and the radiation beams delineated.

The shielding integrity of a container for a 200-curie Co^{60} source is being checked by radiographs. A 3.8-curie Co^{60} source was installed in Room 187 for energy dependence studies. Monitoring surveys were made to delineate the radiation beam from the 3.8-curie Co^{60} source used in the climatic simulator. A new shielded container for the 459-mg radium source is being installed to replace the temporary lead brick enclosure. Handling procedures were recommended for a 1-curie Au^{198} source prepared for the Nuclear Radiation Branch. Handling procedures and equipment were also prepared for the 80-gram Pu-Be neutron source (7×10^6 n/sec).

Biological and Medical Sciences Division

During the 1st quarter arrangements were made to obtain 3 mc of K^{42} on a weekly basis from the U.C. Medical Center for use in the Biochemistry Branch. The material was specially processed and standardized there for biological studies. A special lead-shielded container was constructed for use in transporting the shipment to the Laboratory.

Routine and special monitoring surveys made in Bio-Med Division spaces during the year disclosed no significant area contamination resulting from isotope use. However, space reassignments among the Bio-Med Branches required a number of laboratory monitoring surveys. No significant space or equipment contamination was detected except in Room 538, which had been used as a contaminated animal room by the Internal Toxicity Branch. Contaminated equipment was disposed of either by decontamination and removal as waste, or by storage elsewhere for future decontamination. Radioisotopes formerly stored in Room 538 were transferred to Room 1109 (Isotope Storage Room).

A 10-mc Sr^{90} source, sealed in gold foil, was loaded in an ionization instrument used by the Bio-Chemistry Branch in Room 530. Wipe tests on the foil showed no removable activity. Periodic wipe tests will be made to detect the occurrence of any loose contamination.

Photodosimetry records of Bio-Med personnel who work at the University of California 60" cyclotron show no significant exposure. The average exposure for 8 people during April was 58 mr with a maximum of 140 mr. During May, the average was 53 mr with a maximum of 110 mr.

Warning signs, calling attention to radiation areas and limiting access under operating conditions, were placed in the control room and on the outside wall of Bldg. 510A (the 1 MEV X-ray facility).

Approval for the use of radioisotopes in humans by Bio-Chem Branch was received from SecNav and the AEC (AEC License No. 4-487-5 of 7 May 1958). The isotopes H^3, Br^{82}, and K^{42} in amounts well below MPC levels are being used in a study to measure total exchangeable potassium, chloride, and total body water in adult healthy humans. (Bio-assay studies were conducted to assure compliance with the provisions of the AEC license.) In the 4th quarter, one unit of tritium (as tritium-labeled water), seven units of K^{42} and three units of Br^{82} were received for continuation of the program.

Due to the recent availability of certain tritium-labeled compounds, a marked increase in the use of tritium has been realized in the Bio-Med Division. Quantities routinely handled are in the μc range. A maximum of 20 mc is stored in one location. No significant internal contamination of personnel has resulted from the use of these tracer quantities. Disposal of the tritium solutions has been a problem due to the hazard presented by the organic solvents (toxicity and flammability). Consultation with the SFNS Industrial Hygienist has provided a satisfactory solution to the disposal of small quantities of solvent (less than 5 gal/month). If larger quantities are to be generated, alternative disposal methods may be necessary.

A 3rd quarter radiation monitoring survey in Rm. 591 disclosed that there was a radiation leak (maximum 70 mr/hr) around the cable ports leading from Rm. 595 (X-ray room) into Rm. 591 (control room). A check of recent servicing records disclosed that the cables going through the wall had been removed and replaced. This action evidently disturbed the lead shielding near the cables. Arrangements were made to replace the shielding to its original position, thus eliminating a potential radiation overexposure condition. Special area monitoring films placed near the power cable ports for a 7-week period indicated no significant radiation hazard. The maximum dose rate observed was 230 mr/wk at the top of the left cable panel. The closest point of approach by operating personnel to this location is four feet and then at infrequent intervals.

The new decontamination facility in Bldg. 364 was used for the first time during the last quarter to decontaminate equipment used by the Bio-Med Division. Use of the facility has greatly reduced the decontamination time for contaminated equipment.

An investigation of the increased number of contaminated laboratory coats generated by personnel from the Pharmacology Branch indicated that new personnel should be more carefully indoctrinated in the rad-safe aspects of handling radioactive material and contaminated equipment. This has been a recurrent problem when new military personnel are rotated into technical assignments at frequent intervals. Recommendations have been made to supervisors to assure the proper rad-safe indoctrination of newly assigned technicians.

Two sets of special monitoring films were placed in Rm. 5149 at locations outside the collimated beam of the fluoroscopic X-ray machine for a one month period. No exposure in excess of 40 mr was observed. Use of lead-shielded gloves was recommended for routine use of this machine.

Accidents

Three radiological accidents occurred during the year.

USS COWPENS on 30 June. The wire holding the 350 curie Ir^{192} source was broken during the return of the source to the shielded container after an irradiation run. The source was picked up and placed in a special shielded container with handling tongs. The maximum dosage resulting from the incident was 0.620 r. The individual involved was restrained from work involving radiation exposure for two consecutive weeks, beginning 30 June. The plastic source positioning funnel was redesigned in order to prevent the source capsule from hanging up with subsequent wire breakage when the source is returned to the container. A new wire and method of suspending the source has been installed.

BLDG. 815 on 10 July. An individual was overexposed to 250 KV X-rays from the machine in Room 595. In order to take multiple field measurements, the door to Rm. 595 was held open and an ion chamber was held in place for measurements by the operator manipulating the chamber on the end of a pivoted boom. The total dose received was 4.0 r, representing an over-exposure of 3.7 r. In accordance with established regulations, the individual was restrained from further exposure to any source of ionizing radiation for 12.3 weeks (beginning 14 July and ending 7 October). Administrative steps were taken to prevent the repetition of such practices (over-riding interlocks on radiating machines).

USS COWPENS on 4 September. During the check-out of the 200-curie Cs^{137} installation, the source dropped to the deck when the closure plug was opened. The source was picked up and placed in a special

shielded container with handling tongs. The maximum dosage resulting from the incident was 0.070 r. A new, heavier wire was installed on the source and a complete pre-operational check-out of the source positioning mechanism was made in Bldg. 364. An inspection will be made of the control wire after each usage and the wire will be replaced if any fraying is observed.

Spills

Seven minor spills occurred during the year.

Early in the first quarter a spill occurred in Room 569 when a small flask containing less than 10 μc of H^3 in tritiated water broke on a bench top. No personnel contamination was involved and the area was easily decontaminated.

Two other spills, involving no personnel contamination, occurred during the first quarter: 1) Room 665, leaking waste drum (liquid), 25,000 c/m floor contamination; and 2) Room 683, sample containing 1000 c/m Ca^{45} spilled on hood, laboratory coat, and floor, approximately 100 c/m surface contamination detected. In both cases the required decontamination was accomplished quickly and routinely.

A minor spill occurred in Room 453 on 20 May. A Cs^{137} counting standard (μc range) was dropped causing floor contamination of about 5,000 c/m. It was necessary to replace some of the floor tile in order to effect complete decontamination.

Two minor spills, involving clothing and work space contamination, occurred as follows:

In the hallway outside of Room 672 on 22 May: A small residue of fission product solution was spilled on the floor and on the side of a waste collection drum. Maximum floor contamination was 5,000 c/m. Decontamination was accomplished quickly and routinely.

Room 633 on 23 June: 250 ml of a field sample solution spilled on the floor. Shoe soles of scientific investigators became contaminated to a maximum of 5,000 c/m. Floor contamination of the order of 40,000 c/m was found. The floor was decontaminated to $<$ 500 c/m and the shoe soles to 3,000 c/m. Masking tape was placed on the shoe soles until decay reduced the contamination to an insignificant level.

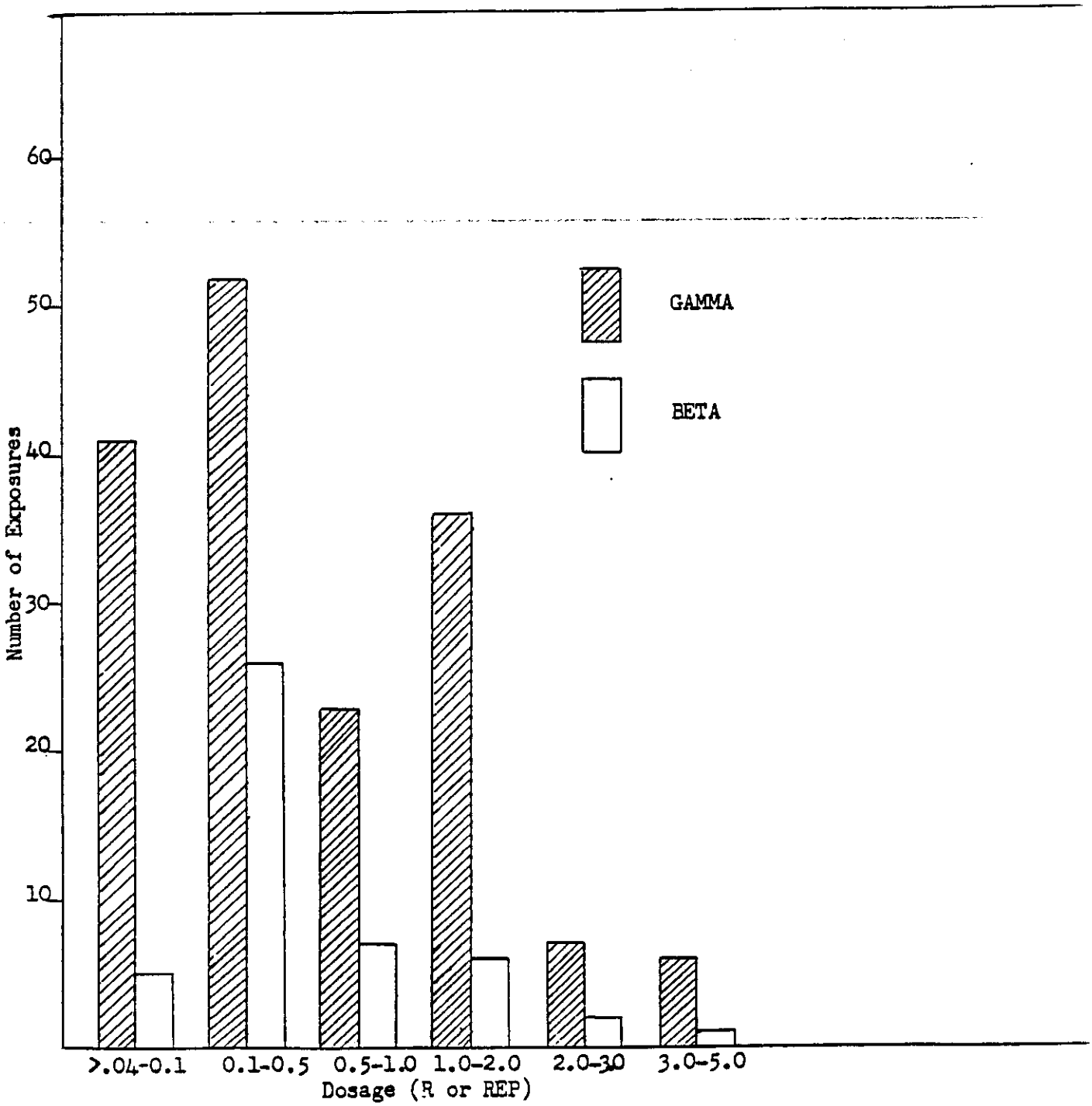
During the third quarter, a small radium source was dropped in the first floor hallway. The source did not fracture and no contamination resulted from the incident.

Project 1.20 - Dosimetry

Film was processed for NRDL and Outside Activities as follows:

NRDL	Film Processed	
Laboratory personnel	9,328	
Laboratory visitors	1,214	
Environmental Monitoring	294	
Calibrations	544	
Special (wrist badges, etc.)	344	
Ship Shielding Program		
Personnel	846	
Environmental	51	
Stoneman II - Program		
Personnel	480	
Environmental Monitoring	73	
Personal Contamination Study	2.095	
Sub-Total		15,269
OUTSIDE ACTIVITIES		
SFNS	1,499	
Treasure Island:		
Schools Command & Dispensary	2,526	
Inspector of Naval Material, TI	246	
Marine Corps, FWD Supply Annex	57	
NAS, Moffett Field	50	
Port Chicago	116	
McClellan Air Force Base	10	
USS BRYCE CANYON (AD-36)	3	
NSC, Oakland	4	
Navy Ordnance Plant, Pocatello	17	
Sub-Total		4,528
Grand-Total		19,797

Only one exposure in excess of the MPE was detected by the film badge program for NRDL personnel and visitors during the year. The dose observed was 4.0 r. This is 2.8 r in excess of the monthly MPE of 1.2 r. The individual concerned was overexposed on 10 July 1958, as described in accident section above. The details of this exposure were presented in a special photodosimetry report to BuMed in accordance with established directives. Since the 10 neutron films used for personnel and area monitoring in Bldg. 816 had shown no significant readings during the first quarter, the film change interval was set at 4-week intervals instead of two weeks. In the second quarter, a card file system for urinalysis data of NRDL personnel dating back to 1954 was established.



Distribution of Film Badge Totals, NRDL 1958

Project 1.30 Radiological Services for Laboratory Operations

Accountability

The following table summarizes the radioisotope orders processed and shipments received for each Division during the year.

Division	Orders Processed	Shipments Received
Bio-Med	57 orders - 1,208 mc	97 shipments - 2,160 mc
Chem-Tech	38 orders - 2,135 mc	43 shipments - 1,626 mc
Nucleonics	16 orders - 3,677 mc	20 shipments - 6,236 mc
Health Physics	3 orders - 6,920 mc	6 shipments - 7,020 mc
TOTALS	114 orders -13,940 mc	166 shipments -17,042 mc

Multicurie sources were received as follows:

Division	Radioisotope	Quantity
Chem-Tech	Co^{60}	1,000 curies
	La^{140}*	3,500 curies
Nucleonics	Ir^{192}	326.4 curies
	Cs^{137}	120 curies
	Cs^{137}	200 curies
	Co^{60}	3.8 curies
	Co^{60}	3.8 curies
	Pu-Be	5 curies(80 g Pu)
Health Physics	Co^{60}	5 curies

*Used in Stoneman II

Twenty-five cyclotron- and reactor-irradiated samples were processed and received during the year. An indeterminate quantity of activity was produced in these irradiations.

On the average about 100 items totaling 1.5 curies of radioactivity were in use by the Laboratory throughout the year. 25 items totaling 400 mc were stored in Room 1109.

The following table summarizes the radioactive sources currently available in the Laboratory:

Isotope	Number	Total Quantity
Co^{60}	47	1710 curie (0.9 mc to 906 c)
Cs^{137}	6	450 curie (1 mc to 200 c)
Ra	11	1119 mg (0.1 mg to 500 mg)
Ir^{192}	1	39 curie
Sr^{90}	46	3.3 curie (1 mc to 2 c)
Ra-Be	5	138 mg Ra (2 mg to 100 mg)
Pu-Be	2	82 g Pu (2 g and 80 mg)
H^3-Zr	3	5 curie (150 mc to 2.6 c)

Eight Co^{60} sources totaling 164 mc (1 mc to 89 mc) and a 100-mc Sr^{90} source were processed and shipped to the Eniwetok Proving Grounds (EPG) for the field use of Project 2.3, Operation HARDTACK.

25-mc and 50-mc Sr^{90} sources were prepared for the Instruments Branch; a 10-mc Co^{60} point source for the Accelerator Branch; and a one-curie Au^{198} point source and seven point sources ranging in activity from 5 mc to 500 mc were prepared for the Nuclear Radiation Branch. The isotopes involved in the point sources were: Co^{60}, Cs^{137}, Au^{198}, Ce^{141}, W^{185}, Hg^{203} and Tl^{204}.

NRDL received Byproduct Material License No. 4-487-5 dated 4 August 1958 (expires 31 Dec 1958) which authorized the possession of 500 curies of La^{140} and was the formal AEC approval for the conduct of the experimental program for Stoneman II. (See pg 31 Project 3.30.)

In view of the questions raised by the MTR in connection with conditions 14 and 21 of NRDL's Byproduct Material License No. 4-487-3, the AEC was asked to clarify the interpretation of "sealed sources", which they did, supporting NRDL's position that materials shipped for irradiation purposes are not to be considered as sealed sources.

NRDL's License No. SNM-35 was amended on 23 July 1958. Possession limits for source, byproduct and special nuclear materials are now:

(1)

U^{235}	110 grams
U^{233}	6 grams
U^{236}	0.1 grams
Pu^{239}	263 grams
Tritium	0.001 grams
Uranium (depleted)	0.05 kilograms
Uranium (normal)	20 kilograms
Thorium	1 kilogram

(2) That special nuclear and byproduct material which will be produced during the in-pile irradiation of approximately one kilogram of source material and two hundred and sixteen (216) grams of special nuclear material.

Isotopic uranium foils available for irradiation:

Isotope	Quantity
U (depleted)	0.485 g
U (normal)	119.600 g
U-233	4.811 g
U-235	6.109 g
TOTAL	131.065 g

In December, an application for the renewal of NRDL's Byproduct Material License No. 4-487-3 was submitted to the AEC via BuShips. 30 grams of depleted uranium, 50 grams of enriched uranium and 22 grams of plutonium were received in the fourth quarter under NRDL License No. SNM-35.

NRDL Radioisotope Catalogue No. 6 was completed and distributed to all interested personnel. All available isotopes as of 1 April 1958 were listed.

Waste Disposal

Sixteen barge loads of radioactive waste were discharged at sea during 1958. Load type and quantities were as follows:

Date	Source	Total Curies	Type and Quantity
30 Dec 1957	Lathrup AFB	0.7	72 drums
	NRDL	2.12	212 drums
13 Feb 1958	McClellan AFB	0.74	148 drums
		2	1 concrete block (approx. 5 tons)
	UCRL(Berkeley)	0.5	60 drums
	MINS	0.05	5 drums
		0.07	14 drums (20 gal.ea.)
	NRDL	0.15	30 drums
26 Feb 1958	UCRL(Livermore)	2.4	240 drums
	UCRL(Berkeley)	2.3	240 drums
		2	1 concrete block - (approx. 5 tons)
		-	3 tons of scrap iron
25 Mar 1958	UCRL(Livermore)	2.4	240 drums
3 Jun 1958	UCRL(Livermore)	1.2	120 drums
		3	6 concrete blocks (approx. 48 tons)

Waste Disposal Trips (Con't.)

Date	Source	Total Curies	Type and Quantity
23 Jun 1958	UCRL(Berkeley)	2	165 drums
		4.5	3 concrete blocks (approx. 10 tons)
	SFNS	--	3 acid bottles in concrete drums
1 July 1958	UCRL(Livermore)	0.6	120 drums
		7	6 concrete blocks (apprx. 48 tons)
3 July 1958	UCRL(Livermore)	1	192 drums
		12.5	5 concrete blocks (apprx.40 tons)
8 July 1958	UCRL(Livermore)	0.6	120 drums
		13.5	6 concrete blocks (apprx.48 tons)
10 July 1958	UCRL(Livermore)	0.4	68 drums
		12	6 concrete blocks (apprx.48 tons)
	UCRL(Berkeley)	0.4	40 drums
	McClellan AFB	0.2	16 drums
14 July 1958	UCRL(Livermore)	0.6	120 drums
		8	6 concrete blocks (apprx.48 tons)
16 July 1958	UCRL(Livermore)	0.4	124 drums
		8	6 concrete blocks (apprx.48 tons)
	McClellan AFB	0.2	16 drums
18 July 1958	UCRL(Livermore)	0.3	92 drums
		4	6 concrete blocks (apprx.50 tons)
7 Aug 1958	UCRL(Livermore)	0.9	264 drums
	McClellan AFB	0.3	2 concrete blocks (apprx.10 tons)
10 Sep 1958	McClellan AFB	0.5	126 drums
	NSC, Oakland	--	8 drums
	UCRL(Livermore)	0.1	36 drums
		7	5 concrete blocks (apprx.48 tons)
	QM Depot, USMC	--	1 drum
17 Sep 1958	UCRL(Livermore)	0.1	36 drums
		4	5 concrete blocks (apprx. 50 tons)
	UCRL(Berkeley)	1	96 drums
	McClellan AFB	0.001	18 drums
17 Sep 1958	UCRL(Livermore)	4	5 concrete blocks (apprx.9 tons)
		0.5	36 drums
	McClellan AFB	0.7	18 drums

Waste Disposal Trips (Con't.)

The total amount of radioactivity discharged during the year was 112.7 curies, distributed as follows:

Container	Total Curies
3093 drums	21.2
69 concrete blocks (520 tons)	91.5

Incidents During Waste Disposal Operations

On 30 December 1957, the USS CAHOKIA reported that the 4" manila line parted on the bridle and the bolt was carried away on the forward bin jacking device. On 13 February 1958 it was reported that the jacking devices were very stiff and required greasing. It was also recommended that a 4" manila retrieving line (400 ft. long) be attached to the towing bridle founder's plate to facilitate bridle recovery.

On 23 June it was recommended that batteries for side lights be renewed, that straps for securing bridle on deck be renewed, and retrieving line be renewed. On 1 July a recommendation was made to lubricate moving parts on Barge bay doors to facilitate closing. On 3 July it was reported that four cylinder type containers (presumably drums) floated, but after a recheck of the area they were no longer observed. It was decided that they sank after being sighted. On 7 Aug a recommendation was made to repair the mechanism for closing the doors on #3 bay.

On 17 September the CAHOKIA reported that heavy seas during the return trip made it impossible to close the bin doors. The return trip was made with all five doors open, with possible damage resulting to doors on one bin. Following this the barge, YNG-73 was inactivated for decontamination and repairs in September, hence no loads of radioactive waste were discharged at sea during the fourth quarter. Monitoring assistance and consultation services were supplied to the SFNS in connection with alpha contamination found on the barge.

A visit was made to the USS CAHOKIA at Treasure Island to discuss rad-safe procedures for the crew members stationed aboard the YNG-73 during waste disposal trips to sea. Recommendations were made to the CO of the CAHOKIA on measures necessary to maintain radiological safety, based on the monitoring capability and equipment allowance of the ship. An offer was extended to help develop an alpha monitoring capability. Interaction is planned between NRDL and SFNS to provide the CAHOKIA with a radiation and contamination monitoring report after each loading of the YNG-73 for sea.

Policy on Future Waste Disposal

On 7 May 1958, NRDL was advised by BuShips to terminate radioactive waste disposal services performed for UCRL no later than 30 June 1958. NRDL requested clarification on the Laboratory's future policy in handling such waste disposal. In a letter dated 7 July, BuShips indicated that NRDL continue waste disposal services performed for UCRL until such time as a qualified commercial concern became available provided "sellers liability" shall not be incurred by the Laboratory. On 21 July NRDL advised BuShips that arrangements had been made to carry out the UCRL waste disposal services by an order issued by the San Francisco Operations Office of the AEC. This procedure will be followed until the services of a qualified commercial firm can be obtained. BuShips NOTICE 5100, Ser.372-150 dated 28 July provided information that, as of 1 July 1959, Military Sea Transport Service (MSTS) will assume responsibility within the Department of the Navy for disposal of radioactive waste material at sea. Each addressee was requested to estimate the tonnage of radioactive waste which may be available for sea disposal by MSTS during FY60. The Notice indicated that commercial disposal outlets can be used if they are found to be more economical and/or more advantageous. On 25 Aug NRDL advised BuShips that NRDL will have approximately 170 gross tons of packaged waste for disposal during FY60. It has not yet been determined whether the Laboratory will have MSTS or a commercial firm dispose of the radioactive waste generated by NRDL.

An inspection visit was made by representatives of the San Francisco Operations Office, AEC, in December in connection with NRDL's radioactive waste disposal operations. Waste disposal records were reviewed, waste handling and packaging discussed, and an inspection made of the processing and storage areas.

Decontamination Laundry and Protective Equipment Issue

Contaminated Laboratory Coats

Quarter	Contamination Level			No. by Division		
	Min.	Max.	Av.	BioMed	Chem-Tech	Other
1st	11,000 c/m	--	--	7	5	2(H.Phys.)
2nd	1,000 c/m	50,000	10,000	8	5	2(Unknown)
3rd	600 c/m	50,000	10,000	7	10	--
4th	1,000 c/m	50,000	9,000	5	2	2(Unknown) 6(H.Phys.)

Laundry washing operations were studied to determine the specific activity of the liquid wastes produced. It was found that clothing contaminated to levels of less than 1,000 c/m produced no wash water in excess of 10^{-5} μc/cc. Clothing contaminated to levels greater than 1,000 c/m produced, for the wash and first rinse cycles, water contaminated to levels up to 10^{-4} μc/cc. All later rinses were less than 10^{-5} μc/cc. Further laundry waste sampling will be done in order to supply operating personnel with more complete operating procedures.

Project 1.40 Environmental Survey

The data in the accompanying chart, although showing rises both inside and outside Bldg. 815 during the same time intervals, were less in specific activity inside as compared to the environmental air sample outside. This lower specific activity is attributed to the filtration offered by the building air filtration system. This would indicate that there was no significant release of radioactive aerosols by NRDL operations during 1958.

A specific activity level alarm system to be installed on the 6th floor air exhaust is being fabricated. The unit will consist of an air duct probe coupled to an air filter and end-window beta particle counter. The particulate material filtered from the air will be continuously monitored during the 56-hour collection period. An alarm will sound if a preset activity level on the filter is exceeded. The sample will be changed once a week and counted as before. (See discussion of Air Effluent Monitoring System in a later section.)

Liquid and Soil Sampling Operations. The following liquid and soil samples were collected and counted for gross beta-gamma activity.

a. Two liquid samples taken from the waste storage tanks on the XFN-16 measured 10^{-4} and 10^{-8} μc/cc. The tanks were not dumped due to other experimental operations involving La^{140}. Additional samples were taken to confirm that the specific activity is below the MPC for sewer disposal.

b. One gallon of rain water collected during the period of December 1957 through February 1958 from the rainfall recorder on the roof of Bldg. 815 was analyzed as follows:

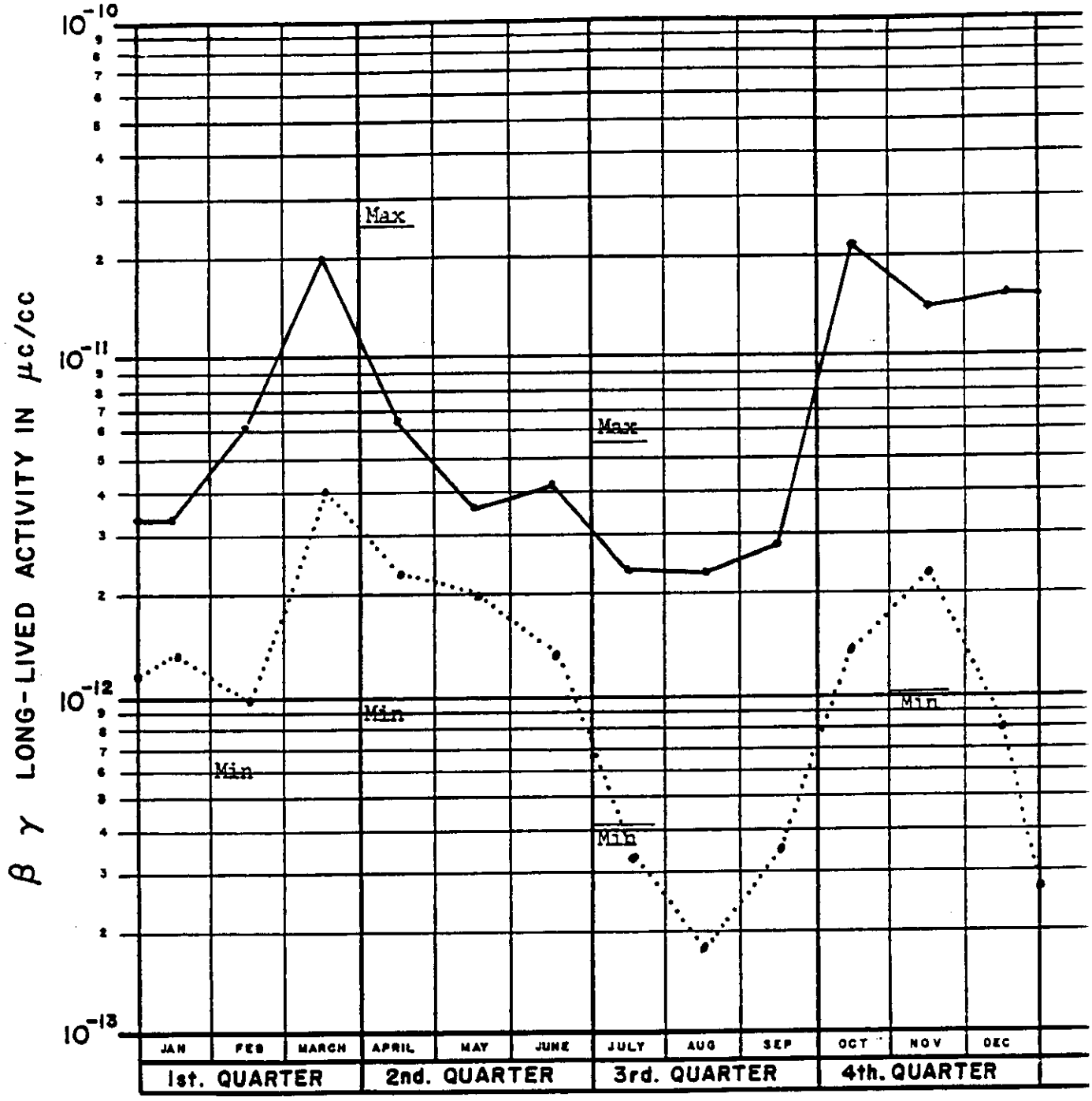
Sr^{89}	96 ± 3 d/m per liter
Sr^{90}	No Detectability Activity
Cs^{137}	6 ± 4 d/m per liter

This procedure was continued during the months when precipitation was prevalent.

2.7×10^{-10} ⟶ Max

1.6×10^{-10} ⟶ Max

U.S.N.R.D.L. ENVIRONMENTAL AEROSOL DATA FOR 1958



LEGEND

——— OUTSIDE BLDG. 815

..... INSIDE BLDG. 815

The Maxima and the Minima are listed for the outside samples during the month of the quarter in which they occurred.

c. A sample taken of the water collected in the Bldg. 364 sump showed a specific activity of 1×10^{-5} μc/cc and the water was pumped into the sewer (First quarter).

d. Two samples, Gun Mole tanks - 10 April. Specific activity - 10^{-6} μc/cc. Tank contents to sewer.

e. Two samples, barge tanks - 23 April. Specific activity - 4×10^{-5} μc/cc and 7×10^{-4} μc/cc. Tank contents barreled.

f. 15 laundry waste samples - 8 May. Specific activity - 5×10^{-5} μc/cc max. Waste greater than 10^{-5} μc/cc barreled.

g. Two samples from the waste collection drums at the NW corner of Bldg. 815 - 3 June. Specific activity - 1×10^{-3} μc/cc. Waste barreled.

h. Six laundry waste samples - 18 June. Scientific activity - 1×10^{-4} μc/cc max. Waste greater than 10^{-5} μc/cc barreled.

i. Barge tank, one sample - 19 June. Activity content: 1×10^{-6} μc/cc. Tank contents to sewer.

j. Gun Mole tanks, two samples - 23 June. Activity content: 2×10^{-6} μc/cc and 5×10^{-7} μc/cc. Tank contents to sewer.

k. Bldg. 529 sump, one sample - 23 September. Activity content: 4×10^{-6} μc/cc. Contents to sewer.

l. Bldg. 364 waste tanks - 2 October. Activity content: 7×10^{-5} μc/cc - 5×10^{-3} μc/cc. Tank contents to sewer.

m. 707 Waste Processing Area - 7 October. (Soil samples).
Activity content: Inside area: 5×10^{-4} μc/g
Outside area: 2.5×10^{-5} μc/g

n. Waste from underwater GITR experiment - 6 November. (25 mc Cs^{137} in 1500 gal. of water). Activity content: 5.5×10^{-3} μc/cc. Tank contents to sewer, after precipitation and filtration.

Radiation Intensity Monitoring

The uncontrolled spaces in Bldg. 815 that were monitored and the average accumulated dose per 24 hours by quarters, was as follows:

Location	Avg. Daily Dose (mr/day)			
	1st Quarter	2nd Quarter	3rd quarter	4th quarter
Room 665	1	1	--	--
666	4	4	--	--
667	2	1	--	--
595	1	4	--	--
5153	1	7	--	--
591	2	7	--	--
E wall	--	--	20	4
W wall	--	--	6	3
Room 5153	--	--	2	4
597	--	--	5	15
579	20	20	--	--
Room 480				
N wall	50	30	4	6
E wall	1	1	--	--
S wall	1	1	2	1
W wall	20	20	--	--
Room 448	--	--	2	1
Room 2129	1	1	--	--
2117	10	6	--	--
2177	2	3	--	--
2181	1	5	--	--

The controlled spaces in Bldg. 815 that were monitored and the average accumulated dose per 24 hours by quarters was as follows:

Location	Avg. Daily Dose (mr/day)			
	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
4th fl. 2nd increment				
Room 4121E				
N wall	10	Missing	10	1
E wall	50	50	8	12
S wall	10	12	8	4
W wall	10	15	10	10
Room 110	5	7	6	1
197	5	70	60	80

Dosage-Controlled Spaces(Con't.)

Location	Avg. Daily Dose (mr/day)			
	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Room 1109				
N wall	20	30	30	--
E wall	200	100	60	--
S wall	100	80	60	--
W wall	20	40	--	--
Room 2125				
N wall	2	Missing	--	--
E wall	5	6	--	--
S wall	30	2	--	--
W wall	5	4	--	--
Bldg. 816:				
Target Room	--	--	4	6

Air and Water Effluent Monitoring System. The Kaiser Engineering Company design contract was completed during the second quarter and the 12ND Public Works Office submitted the project for bids. One bid for $73,666 was received. This was in excess of the $35,880 available. The liquid effluent collection and monitoring system location was later changed, tentatively, to the west side of Bldg. 815. The tanks and piping layout have been redesigned by 12ND Public Works and Kaiser Engineers, and have been resubmitted for bid. It is estimated that construction might begin sometime during 1959. All components of the air-detector system have been procured and assembly will begin in the first quarter of 1959.

The water monitoring system design provides for two 15,000-gallon, below-ground collection tanks for hold up of all non-sanitary Laboratory waste. Pumps and piping are provided for sampling, recirculation, interchange, discharge to sewer,and barreling (if necessary) of the contents. The air monitoring system design provides for continuous sampling and monitoring of the exhaust ducts.

Project 1.50 Rad-Safe Instrumentation

The six-channel remote area monitor ordered for Bldg. 510A was rebuilt by the contractor to conform to the original specifications set by NRDL. It was necessary for the contractor to provide detection chambers made of a different wall material. Arrangements were made by the Engineering Division for the installation of the system. The detection chambers

for the Bldg. 510A monitoring system were later returned to the manufacturer (for a third time) because of chamber response discrepancies.

A Technical Associates hand and shoe counter with a side-window G.M. scanning probe was received and placed into service. The device is now undergoing service evaluation tests. Modifications will be made as indicated by the tests. An external speaker has been added, as per a request from the Health Physics Division.

Four Staplex air samplers were procured for use in the Laboratory spot air sampling program.

One Universal Atomics Model 700, side-window G.M. was procured for evaluation in connection with the Laboratory monitoring program.

One Eberline PAC-3G alpha monitoring instrument and three Eberline E-112B side-window G.M. radiacs were procured for use in the Laboratory's monitoring program.

All monitoring instruments assigned to the Health Physics Division have been placed on a preventive maintenance schedule by the Central Instruments Branch. These instruments will receive a weekly operating check and repairs will be made as necessary.

All environmental monitoring equipment has been located in the 6th floor, 2nd increment. An additional counter has been installed to reduce the possibility of losing data in the event of counting equipment failure. Procedures for switching the air collection pumps have been documented so that a person unfamiliar with the equipment can make the necessary changes in an emergency situation.

Program 2.0 - Rad-Safe Evaluation.

This program is chiefly concerned with the evaluation of special radiological problems within the Laboratory and from outside activities. Ten percent of the total available effort was devoted to these evaluations. The program is divided into two sub-groups to facilitate program planning and reporting.

Project 2.1 Radiological Evaluation and Procedural Development.

U.S. Naval Schools Command, T.I. A four-hour lecture on various aspects of rad-safe for medical officers was prepared and presented as part of a four-week training course for medical officers, "Medical Aspects of Modern Warfare."

U.S. Naval Ordnance Plant, Pocatello, Idaho. Information on exposures from diagnostic X-ray machines was forwarded to the Medical Officer.

Naval Supply Center (NSC), Oakland. An evaluation of the X-ray protective booth was made. The results of the evaluation were forwarded to the Medical Officer.

San Francisco Naval Shipyard (SFNS), San Francisco. Consultations were held with the industrial hygienist in connection with photodosimetry, air monitoring and the 120-curie Cs^{137} radiac calibration source installation.

Naval Advance Base Personnel Depot (San Bruno). At the request of the San Bruno Security Officer, a monitoring survey was made of Warehouses C-500 and E-200 (NRDL storage spaces). In C-500, low-level contamination was found on equipment and on the floor. Several Co^{60} sources (mc range) were in storage. The sources were removed to NRDL and the equipment and floor were decontaminated to final clearance levels. No contamination or radioactive materials were found in E-200. All radiation signs and tags were removed from NRDL occupied spaces and the Security Officer was notified of the final clearance status.

BuShips (Code 565H). In May a letter report on the evaluation of the radiological hazard of three underwater wrist compasses that had been treated with a special sealing compound was forwarded to BuShips. The protective coating reduced the amount of removable radioactive material but did not eliminate the problem.

BuShips (Code 423). At the request of BuShips (Code 423) health physics services were provided at the San Diego plant of the Solar Aircraft Company during the disassembly, inspection and partial decontamination of 6 turbine driven pumps used in washdown systems of ships participating in Operation HARDTACK. No significant radiation levels were encountered. The rad-safe aspects were concerned with contamination control measures. A summary letter report was sent to BuShips.

BuPers. A proposed ABC course curriculum was reviewed in part. Comments were transmitted to Countermeasures Evaluation Branch, Coordinator of the Laboratory review.

Puget Sound Naval Shipyard. In answer to a request, a procedure for air sample collection and evaluation of aerosol concentrations of radon plus daughter products in shipyard areas where radium-bearing markers are handled was forwarded to Code 725 of Puget Sound Naval Shipyard. Information concerning urine analysis for radium and breath analysis for radon, as documented by the Analytical and Standards Branch, was included.

U.S. Bureau of Mines, Albany, Oregon. Discussions were held with a representative of the Bureau of Mines on the health physics aspects of reactor operations and the processing of radioactive metals. Recommendations were made regarding air sampling and monitoring procedures.

USA Engineers Research and Development Laboratory, Fort Belvoir, Va. Discussions were held on the problems associated with the decontamination of buildings used for storage of large quantities of radium-bearing luminous markers.

McClellan Air Force Base. Consultation was provided for monitoring radiation fields from magnetrons. Film badges were supplied, processed and interpreted. Films exposed to radium activated luminescent key chain devices were evaluated and consultations were held in connection with the degree of hazard involved.

U.S. Geological Survey Dept., Menlo Park. Three diffraction and spectrographic X-ray installations were monitored for possible radiation hazards. Recommendations for minimizing radiation exposure of operating personnel were forwarded.

U.S. Customs Bureau and Post Office. Upon request of the Customs Bureau, a package labeled as containing radioactive material was investigated. The radioactive material was being shipped as personal property and since the radiation levels exceeded those stated in the post office shipping regulations, the material was taken from the package and disposed of by NRDL as radioactive waste.

Upon requests of the Fleet Post Office, a package labeled as containing radioactive material was checked. It was found that the labels were unnecessary and were removed.

Principles of Radiation and Contamination Control (PORACC). Additional effort was expended in editing the fall 1957 Review Draft with Dr. R.R. Newell. The revisions to all three volumes of PORACC were completed and formally approved by the Laboratory. Copies were transmitted to BuShips, BuPers, and BuMed for final review and approval.

NRDL INSTRUCTION 5100.1A - Rad-Safe Regulations and Procedures. An early draft instruction was reviewed and approved by the Radiological Policy Committee. The draft was then forwarded to the Commanding Officer and Director for his review. On the basis of comments received from the Commanding Officer and Director and the Scientific Director, the draft was reexamined by the Radiological Policy Committee and additional modifications were made. The revised draft was then reviewed by the Comptroller and Management Engineer and others and returned to the Radiological Policy Committee for final review. The most recent draft of the instruction, as approved by the majority of the Radiological Policy Committee, has been submitted to the Commanding Officer and Director for final review and approval.

PLUCON Program. Comments were prepared on the report USNRDL-TR-273, "Rad-Safety in Special Weapons Accidents." A draft of a report, "Contamination Control Procedures for Special Weapons Accidents" has been completed and received a technical review. The report will be formally submitted to the Reports Review Board early in the first quarter of 1959.

Calibration of Project 2.3 Dosimeters. The film dosimeters used by Project 2.3, Operation HARDTACK, were calibrated with a Co^{60} source, covering the γ-dosage range from 100 mr to 50,000 r. A 100-mc Sr^{90} exposure chamber for obtaining film densities equivalent to Co^{60} gamma fluxes was prepared for field use. The calibration procedures and curves were submitted to Radiological Capabilities Branch.

Photodosimetry Calibration. A Standard Operating Procedure was established for running Co^{60} film standards using the Co^{60} range on the second floor. Calibration curves were obtained for Co^{60} and Cs^{137}, as well as gamma and beta calibration curves for La^{140}. A La^{140} gamma dose vs film density curve was prepared for the Technical Developments Branch for the film packets used in the personnel contamination studies made at Stoneman II. A rough draft of the detailed procedures used in NRDL photodosimetry operations has been prepared. A final draft should be completed during the first Quarter of 1959.

Project 2.2 Rad-Safe Training.

A 4-hour and a 2½-day monitor's course to certify NRDL personnel as rad-safe monitors for Operation HARDTACK was prepared and presented during the first quarter. 24 personnel, including 6 from the AEC San Francisco office, attended the 4-hour course (Course I). Course I was designed for personnel with previous field experience. 21 personnel attended the 2½-day course (Course II), designed for personnel with no previous field experience. 18 (or 100%) of the NRDL personnel attending Course I and 18 (or 86%) of the personnel attending Course II, were certified.

A conference was held at Treasure Island Naval Schools Command on 22-23 September. Representatives from TraPac: FTC (San Diego); FTG (San Diego); BuShips; Schools Command, T.I.; MSTS; TG 7.3.1.5 and TG 7.3;and NRDL were present. The original purpose of the conference was to evaluate the special training given to TG 7.3.1.5 on rad-safe and decontamination (see page 31). At the request of BuPers, the purpose of the conference was expanded to include a review of all ABC training currently in existence within the Navy. A summary report and recommendations of the conferees was forwarded to Chief, Naval Personnel.

Program 3.0 Special Operations

Fifteen percent of the total Health Physics Division effort was expended on Program 3.0. The 3.0 program is divided into four sub-groups to facilitate program planning and reporting.

Project 3.20 Operation HARDTACK Support.

A four-week course in decontamination and radiological safety was prepared and presented in cooperation with the Radiac School of the Naval Schools Command, T.I. for 29 personnel from TG 7.3. The objective of the course was to train the leading Petty Officers of TG 7.3.1.5 who, in turn, would train all other personnel assigned to TG 7.3.1.5. The course covered the various phases of field rad-safe and shipboard decontamination. ($1\frac{1}{2}$ weeks devoted to lectures, $1\frac{1}{2}$ weeks devoted to practical exercises and 1 week of instructor training). The USS-PCDC-1, a land-locked training ship, was contaminated with Au^{198} (3-day $T_{\frac{1}{2}}$) and Br^{82} ($1\frac{1}{2}$-day $T_{\frac{1}{2}}$) to simulate shipboard contamination exercises. The average radiation exposure of the 29 personnel at the completion of the course was 75 mr, with a maximum of 125 mr and a minimum of 40 mr. The course was conducted from 13 January through 7 February 1958. On 6 March 1958 a detailed monitoring survey indicated no detectable contamination on the USS-PCDC-1.

A critique of the course was held when the Petty Officers and the Officers in Charge returned from Operation HARDTACK, to evaluate the training in light of field experiences. Recommendations were made on how to improve the course. It is anticipated that this course may serve as a prototype for a BuPers curriculum on Shipboard Rad-Safe and Decontamination.

Project 3.30 Stoneman II Rad-Safe Support.

A review was made of the Plan of Attack for Development of Reclamation Procedures for Land Targets with particular attention to rad-safe requirements. Lists of instruments, rad-safe clothing and other supplies were submitted to the Planning Coordinator for procurement. Plans were made to convert the building to be used as a change house during the month of July. An inspection was made of the Camp Stoneman facilities to aid in planning.

Plans for the laboratory and field phases of the proposed experiment for use of soil tagged with La^{140} on skin and clothes of volunteers were reviewed. Assistance was given to the Technical Developments Branch in requesting the necessary approval from SecNav and the AEC.

When Stoneman II was in progress, Health Physics personnel carried out the following phases:

Provided on the job training of rad-safe personnel to the Army Chemical Corps.

Provided rad-safe support during test operations.

Gathered necessary data to document radiological conditions of the test area and surrounding environment.

Assisted in the roll up.

The effort in the fourth quarter was used to complete the roll-up operations at Camp Stoneman, perform a monitoring survey of the test area to establish final clearance certification, and complete the first draft of a report detailing rad-safe aspects of the operation.

This report is being prepared for the project officer and the AEC (as part of NRDL License No. 4-487-5). The final draft of the report is scheduled for completion early in the first quarter of 1959.

A report combining the rad-safe data from Stoneman I and II will be compiled for issuing as a technical report or memorandum. This will be scheduled during 1959.

Project 3.40 Rad-Safe Support for Naval Ordnance Testing Station (NOTS), Project 173.

The rad-safe report for the second NOTS test series was completed and transmitted to NOTS in February. No significant contamination was detected. The rad-safe report for the third and fourth test series supported by NRDL personnel was transmitted to NOTS in June. No significant contamination was detected. The reports covering the rad-safe aspects of the fifth and sixth test series were completed and transmitted in August. At the request of NOTS, a special monitoring survey was conducted in certain ranges at NOTS used for Operational Suitability Tests. As a result of this study, NOTS requested BuOrd to request that NRDL instrument and monitor the NOTS range during at least three air bursts of retired war reserve weapons. A NOTS representative visited the Laboratory on 25 and 26 September to discuss the requested study in more detail.

On the basis of information received from NOTS and BuOrd, some effort will be carried out during the early part of 1959.

Project 3.50 Rad-Safe Support for PLUCON.

A five-day training program, starting 21 April, was conducted for Explosive Ordnance Disposal Test Center (EODTC), Pearl Harbor Naval Shipyard(PHNS), and U.S.Naval Hospital, Bethesda, Md., personnel on PLUCON problems. The following topics were presented:

Orientation
Basic Physics
Biological Effects
Radiac Instruments
Dosage Control
Possible Accident Situations
Air, Water and Urine Sampling
Contamination Control
Laboratory Counting Equipment
Care and Calibration of Radiac Equipment
Laboratory Demonstration
Introduction to Recovery Aspects
Contamination Characteristics
Texas Incident Movie
Project 57
Mechanics of Recovery
Ship Recovery Problem
Examination
General Discussion

The course was well received and the group discussions were mutually beneficial.

General.

Draft proposals for a contamination mobility program were formulated. Additional effort in defining and determining the scope of this program is scheduled for the first quarter, 1959.

INTERNAL DISTRIBUTION

100	905
120	910
140	920
200	920 A
202	930
205	930 A
220	933
224	934
240	935
250	940
700	940 A
720	941
730(10)	942
800	944
900	945
901	
902	

EXTERNAL DISTRIBUTION

Chief, Bureau of Medicine and Surgery
Special Weapons Defense Division
Washington 25, D.C.

Mr. E. E. Barnes, Manager
Industrial Hygiene
Westinghouse Atomic Power Laboratory
P. O. Box 1468
Pittsburgh 30, Pa.

Mr. Gene A. Blanc
U. S. Atomic Energy Commission
San Francisco Operations Office
518 - 17th Street
Oakland 12, California

Mr. L. J. Cherubin, Manager
Health Physics
Knolls Atomic Power Laboratory
General Electric Company
Schenectady, New York

Dr. Frederick P. Cowan
Brookhaven National Laboratory
Associated Universities, Inc.
Upton, Long Island, New York

Mr. Herbert S. Dankman
Department Chief
Sanitary and Industrial Hygiene
Engineering Section
McClellan Air Force Base, California

CO, Air Force Special Weapons Center
Kirtland Air Force Base
Albuquerque, New Mexico

Mr. J. F. Ege, Director
Industrial Hygiene & Safety Division
Radiological Physics Division
Argonne National Laboratory
P.O. Box 299
Lemont, Illinois

Mr. Merrill Eisenbud
New York Operations Office
U.S. Atomic Energy Commission
70 Columbia Avenue
New York 23, N.Y.

Mr. Steve Farkas
SIW Industrial Hygiene Group
Westinghouse Electric Corporation
Atomic Power Division
P.O. Box 376
Idaho Falls, Idaho

Mr. Louis Garcia
Naval Research Laboratory
Washington, D. C.

Mr. N. B. Garden
Head, Health Chemistry
University of California
Radiation Laboratory
Berkeley 4, California

Mr. Reynold L. Hoover
Combustion Engineering Company
Reactor Development Division
Windsor, Connecticut

Mr. J.R. Horan
Director, Health and Safety
Atomic Energy Commission
Idaho Operations Office
Idaho Falls, Idaho

Dr. Simon Kinsman
U.S. Public Health Service
47 Federal Office Building
San Francisco, California

Mr. J.W. McCaslin
Health and Safety Branch Manager
Atomic Energy Division
Phillips Petroleum Company
Idaho Falls, Idaho

Dr. Malcolm H. Merrill, M.D.
Director of Public Health
State of California
Department of Public Health
2151 Berkeley Way
Berkeley 4, California

Mr. H.E. Meyer
Health Physics and Safety Supervisor
Mound Laboratory
Miamisburg, Ohio

Mr. M.L. Mickelson
Hanford Atomic Products Operation
General Electric Company
Richland, Washington

Dr. K.Z. Morgan
Director, Health Physics Division
Oak Ridge National Laboratory
P.O. Box P
Oak Ridge, Tennessee

Mr. R.B. O'Brien
Supervisor, Health and Safety
General Electric Company
Aircraft Nuclear Propulsion Dept.
P.O. Box 535
Idaho Falls, Idaho

Mr. F.L. Paschal, Jr.
Administrator, Health Physics
CONVAIR
Fort Worth, Texas

Mr. C.M. Patterson
Health Physics Division
Savannah River Project
duPont
Augusta, Georgia

Mr. Harold L. Price
Director, Division of Licensing and Regulation
U.S. Atomic Energy Commission
1717 H Street, N.W.
Washington 25, D. C.

CO, Mare Island Naval Shipyard
Attn: Mr. G. Rosatti, Code 732
Vallejo, California

Mr. E. A. Sadowski
General Electric Vallecitos Atomic Laboratory
P.O. Box 846
Pleasanton, California

Chief, Bureau of Ships
Attn: Code 372
Washington 25, D.C.

Mr. James Sheehan (Code 722)
Industrial Hygienist
San Francisco Naval Shipyard
San Francisco, California

Dr. Thomas L. Shipman
Health Division
Los Alamos Scientific Laboratory
P.O. Box 1663
Los Alamos, New Mexico

Dr. James G. Terrill, Jr.
Chief, Radiological Health Program
Public Health Service
Health, Education and Welfare Bldg.
Washington 25, D. C.

Mr. R. C. Thorburn
General Electric Company
Atomic Power Equipment Department
2151 South First Street
San Jose, California