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ACHIEVEMENTS IN HAPO RADIATION MONITORING, 1944 TO 1954

I. INTRODUCTION

At HAPO the protection of employees from nuclear radiations has paralleled or preceded the emphasis on atomic products production. The production of atomic products on the scale for which HAPO was designed presented voluminous problems in employee education, radiation detection, shielding, and indeed, fundamental research to determine working limits for the various types of radiation exposure which would necessarily be encountered, and to determine working limits for the deposition of radioactive isotopes and mixtures of isotopes in the human body. Since the time radioactive materials first arrived at HAPO and the start-up of the first HAPO reactor on February 23, 1944, there has been a fundamental philosophy that all employee exposure to nuclear radiations should be maintained at a minimum as opposed to just some level of exposure below the accepted maximum permissible limit. It was with this philosophy in mind that the many achievements and advances in the science of radiation protection at HAPO have been forthcoming.

II. GENERAL ACHIEVEMENTS IN RADIATION PROTECTION

A. Organizational

Radiation protection at HAPO was originally established as the Health Instrument Division (H.I.) of the Medical Department under the direction of Dr. S. T. Cantril. The Health Instrument Division was established as an independent department on February 1, 1948, with H. M. Parker as Superintendent. On September 1, 1951 the radiation monitoring responsibilities for HAPO were divided into four separate groups. Reactor facilities monitoring was performed by the Radiation Monitoring Sub-Section of the Reactor Section, Manufacturing Department, while the Separation facilities monitoring was performed by the Radiation Monitoring Sub-Section of the Separations Section, Manufacturing Department. Radiation Monitoring for the metal preparation operation is performed by the small radiation monitoring group of the Metal Preparation Section,

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Manufacturing Department. All other radiation monitoring responsibilities were given to the Radiation Monitoring Unit of the Radiological Records and Standards Section of the newly formed Radiological Sciences Department. Such a division of radiation monitoring responsibilities was made in an effort to expedite monitoring functions within the various sections and to promote between operating and radiation monitoring groups a better understanding and appreciation for each other's functions and responsibilities.

B. Radiation Education

To work safely with the tremendous quantities of radioactive material handled at HAPO an intensive program of radiation education was necessary. Such a program was greatly complicated by the highly classified nature of the production work and product being manufactured. Concurrently with the preparation of the first uranium slugs for irradiation, the first series of Health Hazard Lectures was conducted. This first Health Hazard Lecture Series was completed in March, 1944, the same month the first uranium slugs were canned.

Employee education talks were and are still being given to all employees working within the HAPO barricade. These talks are commonly referred to as Special Hazard Disclosures and are, in general, conducted by the Radiation Monitoring personnel responsible for radiation control at the facility.

Training programs for Radiation Monitoring personnel have been held periodically. Such training programs are conducted by various qualified personnel of the Radiological Sciences Department and speakers from other departments. These training programs lead to the issuance of the H.I. Lecture Series manuals in January of 1947. This series contains written abstracts of the radiation monitoring training program lectures. Several series of H. I. Lecture manuals were issued as classified material. Part I of this series recently was declassified, with deletions, to provide a more useful refe rence source.

In 1952 a formal training program for radiation monitoring personnel was set up by the Radiation Monitoring Unit of the Radiological Sciences Department. One Radiation Analyst was assigned full time to the training program function. Five sessions of 40 hours each were conducted for the Radiation Monitors. A total of 77 radiation monitors attended the training schools which were of the lecture and group-discussion type.

Two training schools of 80 hours duration each were also conducted for exempt Radiation Monitoring personnel. These schools were also of the lecture and group-discussion type. A total of 44 Radiation Monitoring exempt personnel attended these sessions. Since January, 1947, a total of 180 exempt role HAPO personnel have attended the various training schools sponsored by the Health Instrument Division (or the Radiological Sciences Department) and have been trained in the principles and practices of health physics and radiation monitoring.

In 1954, all training responsibilities within the Radiological Sciences Department were transferred to the Radiological Administration and Communications Section and consequently the training programs conducted by the Radiation Monitoring Unit have been discontinued.

C. Radiation Monitoring Records

The radiation monitoring personnel maintain complete records of their work on appropriate forms and logs. These records are the primary, legal record of radiation protection provided at HAPO and are maintained in a

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central file for future reference. Initially,forms used for recording radiation monitoring results were brief outlines for recording the necessary data. Many of these forms were classified material and,as such,required special handling. As experience in radiation work expanded, new revised forms for radiation records were forthcoming. As the secrecy of the HAPO product was relaxed, the use of unclassified forms and records for recording radiation monitoring work became justified. Today's forms for recording radiation monitoring data are designed to require a minimum of time to complete while assuring, if completely filled out, that all necessary data is adequately recorded and is readily available for future reference.

Hand score cards for recording check-out results when a four or five fold counter is used were initiated in February of 1945. All employees working with radioactive materials are required to take a four and/or five fold count or otherwise survey themselves for radioactive contamination before eating, smoking, or leaving the job.

Exposure record cards are now carried by employees receiving radiation exposure at several different places and at different times during the day. The exposure record card is filled in with the estimated exposure received on each job and gives a readily available record of the estimated exposure received at any time during the day. A new exposure record card is issued each month. These cards are especially valuable in reducing personnel overexposure , since if an employee's exposure record card shows an exposure approaching the maximum permissible radiation exposure for the day, he will not be assigned to another job involving significant radiation exposure during that day.

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In 1954 the exposure record card and the hand score card were combined into a single card. This card helps consolidate the radiation monitoring records.

D. <u>Field Development</u>

In January of 1953 a field development group consisting of a radiation analyst and a radiation monitor was established as a part of the Radiation Monitoring Unit of the Radiological Sciences Department. Similar assignments have been established in the Reactor and Separations Monitoring Sub-Sections.

The field development group devotes full time to research, development, and improvement of radiation monitoring methods and works in close contact with the radiation monitoring field offices. Some of the functions performed by the field development group are:

1. Test the radiometallurgy multicurie cells for radiation leaks or voids.
2. Standardize the air monitoring programs at the various HAPO facilities and provide standard sources for the calibration of air monitoring counting equipment.
3. Develop a method of using a by-product from a manufacturing facility as a raw material in a radiation monitoring urinalysis program.
4. Serve as chairman of the HAPO Protective Clothing Committee and investigate improved protective clothing.

E. <u>Design Consultation</u>

Radiation Monitoring personnel have assisted in design consultations for the expansion and improvement of the HAPO facilities. Many valuable

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recommendations were made for contamination control within buildings and facilities. Estimates on radiation shielding requirements and suggestions on radiation work arrangements within buildings were valuable in securing a reasonable balance between construction cost and radiation protection for the HAPO employees.

The required assistance from radiation monitoring personnel in design consultations reached a magnitude that justified the establishment of a "Sub-Section" called Radiological Engineering in December 1952. Radiological Engineering has taken over the major design consultations; however, many significant ideas and suggestions are still forthcoming from the radiation monitoring personnel in the field.

F. A.E.C. Emergency Monitoring Program

Pending establishment of civil defense organizations with definite assigned functions for radiological defense, the AEC acted in 1949 to establish emergency radiation monitoring teams in about 20 locations throughout the United States, to operate under the jurisdiction of 5 AEC operations offices. One of these teams was formed at HAPO. The team was composed of HAPO personnel experienced in radiation detection work and stood ready to monitor any radioactivity resulting from enemy attack or disaster.

In the period since establishing this emergency monitoring work, civil defense organization and training have made appreciable strides forward, with the result that on January 4, 1954, after consultation with the Federal Civil Defense Administration, the HAPO team was relieved of responsibility for civil defense radiological monitoring operations.

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G. Field Testing of New Monitoring Instruments

The radiation monitoring groups have shown an active interest in field testing the new and improved radiation monitoring instruments. Concientious evaluations of instrument performance in field use have prompted further developments and led to significant improvements in instrument characteristics and performance, and hence, rapidly improved the radiation protection provided HAPO employees by the radiation monitoring field offices.

III. ACHIEVEMENTS IN REACTOR RADIATION PROTECTION

A. Reactor Start-Ups

Charging of the first reactor at HAPO, the 305 test reactor, was begun on February 21, 1944, and the unit went critical on February 23, 1944. Although a reactor of a smaller size had been in operation at Chicago, the 305 test reactor was an important step in the "scaling up" of reactors to the much larger HAPO production reactors. Radiation monitoring personnel made extensive radiation surveys around this reactor and gained valuable experience in this type of monitoring before the large production reactors were ready for operation.

The first HAPO production reactor put into operation was the 105-B reactor which went critical on the evening of September 26, 1944. This event was a major accomplishment in the field of nuclear engineering. Extensive radiation monitoring accompanied the start up of 105-B. Complete radiation surveys over the faces of the reactor were made immediately to detect voids or faulty construction in the reactor shielding and to assure that adequate shielding had been provided.

Operation of the 105-B reactor was quite erradic during the next several months as operational and radiation monitoring personnel became rapidly acquainted with problems in reactor operation. Numerous shut-downs and scrams were encountered as additional reactor tubes were charged and the power level was stepwise increased to the design capacity of 250 megawatts (M.W.)

The 105-D and 105-F reactors became critical on December 17, 1944 and February 25, 1945, respectively. to complete the initial HAPO reactor compliment.

The operation of these first HAPO production reactors presented radiation monitoring personnel with tremendous sources of gamma, beta, alpha and neutron radiations for which dosimetries and permissible exposure limits were not well established. The fact that no HAPO employee has ever received an injurious body exposure to nuclear radiation is a highly meritorious achievement of radiation monitoring personnel.

B. Reactor Development and Maintenance Monitoring

Although radiation monitoring personnel were doing a thorough and conscientious job of reactor monitoring, it was readily recognized that a constant monitoring system was needed at strategic locations within each reactor building. By July, 1945 a system of Health Monitoring (H.M.) chambers had been installed at each reactor facility to perform this function. A schedule of routine surveys throughout each reactor facility was established.

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On May 5, 1945, the first Health Instrument report on the 100 Areas and 300 Area was issued. As set forth in the first of these weekly reports, their goal was:

1. To draw attention to any hazardous conditions which developed.
2. To disseminate knowledge gained through radiation work, monitoring, and control.
3. To show trends in radiation control.
4. To present proposed work.

These reports evolved to a monthly report for the 100 Areas and a separate monthly report for the 300 Area Metal Preparation Section.

The Special Work Permit was initiated to prescribe to operational and maintenance personnel the protective clothing required, time limits for work at each special job, and additional radiation control procedures.

Reactor maintenance has involved such jobs of replacing thimbles, process tubes, tip-offs, verticle safety rods, etc. Dosage rates for these jobs performed in 1946 were a few tens of mrep/hr with an occasional dosage rate of a few hundred mrep/hr. Increased power levels have increased these dosage rates by a factor of 100 to 1000 in 1954. These jobs involve the manipulating of highly contaminated equipment. Radiation monitoring personnel monitoring these jobs have become familiar with contaminants of widely varying natures and can make reasonable estimates of the dosage rates and contamination which may be encountered.

Radioactive argon and other gases are encountered around the top of the reactors. Assault mask protection is not adequate for gross amounts of these gases and Chemox or fresh air masks are now prescribed

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when necessary. Sulfur-35 and carbon-14 are ever present contaminants during reactor maintenance and the hazards due to these elements must be carefully evaluated. In recent years the mica window counting tube has received increased use for contamination detection and air sample counting in the reactor areas.

During 1947 the vertical safety rods were buffed with no undue exposure of personnel. The buffing operation reduced the surface dosage rate of the vertical rods by a factor of 10.

The reactor basins were given a complete renovation during the first half of 1953. The basins were drained, hosed down and washed with sulfuric acid in efforts to remove as much radioactive contamination as possible. Radiation Monitoring for this work was complicated by the large number of construction workers involved and the contaminated water present in the basin. A noteworthy job of radiation monitoring was performed during the basin renovation as not a single overexposure was received by construction personnel.

Paralleling the basin renovation, the third safety system on the reactors was changed to the "Ball Third System". No serious overexposures were encountered although this work involved a considerable construction force working in the contaminated area on top of the reactor.

C. Reactor Charging and Discharging

The un-irradiated uranium ready for charging into a reactor presents relatively few problems in handling; however, a single discharged slug is a formidable radiation source. Dosage rates from a single irradiated slug, shortly after discharging, may be 30 r/hr at 20 feet or even greater.

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Numerous incidents of irradiated uranium slugs improperly removed from a reactor have led to extremely high dosage rates both at the rear reactor face and the front reactor face. Radiation monitoring personnel have played an important role in suggesting ways to gain control over these irradiated slugs and yet keep personnel radiation exposure at a minimum.

D. Radiation Beams from the Reactors

Since the start-up of the first reactor, radiation monitoring personnel have recognized the hazards of radiation beams from the interior of the reactors and have been on guard to detect at the earliest possible time any such beams. On several occasions radiation beams from a reactor process tube that had been discharged but not recharged have been found and corrective action taken before any significant personnel overexposure resulted. Beams of 7.5 rems/hr including 1.5 rems/hr due to neutrons have been observed from uncharged process tubes.

Early in 1948 radiation beams were noted around the top edge of the reactors. These beams were traced to a displacement of the side and top reactor shielding due to expansion and warping of the graphite moderator caused by the effects of continued irradiation. Radiation monitoring personnel conducted film studies and took appropriate instrument readings to determine the exact location and intensity of the beams. All work in the vicinity of the beams was carefully controlled by the radiation monitoring personnel. The beams reached an intensity of 4 r/hr during July and August of 1949 at the 105-F reactor before effective corrective measures to reduce the beam intensities were developed.

E. Ruptured Slugs and Reactor Power Levels

Although a rigid program of slug testing and inspection is maintained, ruptured slugs present a serious problem to both operational and radiation monitoring personnel. Frequently, special tools must be fabricated for removing severe ruptures. The radiation exposure hazard from a ruptured slug is amplified by the contamination control problems of the powdery fission product, uranium, and plutonium material escaping from the slug through the rupture.

The wearing of water-proof plastic suits and full face masks for rupture removal has greatly reduced the personnel contamination hazard of this job. Radiation monitoring personnel lead the way in securing this type of protective clothing and in prescribing its use when necessary.

In July, 1945, the three reactors were operating at power levels of about 250 megawatts (MW) and continued at about this level with the exception of 105-B, until 1948 when the power levels were increased to 275 MW. The fourth HAPO production reactor, 105-H, was charged October 3 to 13, 1949, and went critical on October 21, 1949. By November the power level at 105-H had reached 275 MW. During the first part of 1950, the power levels were being slowly increased with extensive surveys by radiation monitoring personnel to assure that the increase would not result in a significant increase in personnel exposure. During September 1950, 105-DR reactor was started up. Radiation monitoring personn were quick to detect a void in the reactor shielding and recommend corrective measures. By January 1951, the power levels in MW were: 105-B - 345, 100-D - 330, 105-DR - 440, 105-F - 320, 105-H -475. These increased power levels were accompanied by increased dosage rates encountered during necessary reactor maintenance. / The significant increase in the number of slug ruptures increased the radiation control problems of the radiation monitoring personnel in two ways: 1. More ruptures to be removed from the reactors meant an increased amount of radiation work.

2. A high radiation dosage rate was, usually, associated with each rupture. Since September, 1951, the reactor power levels have been increased by about 40%.

In November, 1952, 105-C reactor was placed in operation and reached power levels in excess of 1000 MW by the end of the year. Many new features were incorporated in the 105-C design which greatly facilitated the radiation monitoring program at that reactor.

IV. ACHIEVEMENT IN SEPARATIONS RADIATION PROTECTION

A. Radiochemical Laboratories

Before radioactive materials were processed in the chemical laboratories, many practice sessions in the methods of radiochemistry were held with the laboratory personnel. Procedures to minimize all chances of contamination spread to laboratories and laboratory personnel were developed through close cooperation between operational and radiation monitoring personnel. Emphasis was placed on standard operating procedures for the performance of the necessary routine analysis of the highly radioactive solutions and materials.

Special shielding and remote handling apparatus were developed with the assistance of radiation monitoring personnel. With further experience in radiation work, and with the increase in reactor power levels which increasedthe radioactivity of the laboratory samples, revised standard operating procedures were prepared.

Manifold vacuum air sampling systems were installed which allowed an increase in the air monitoring program and, hence, improved the radiation protection afforded these laboratories. The radiochemistry laboratories accelerated their schedule by making their personnel survey for contamination and radiation beginning in July, 1946. Routine surveys and monitoring

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of all work not covered by an approved standard operating procedure were still performed by the radiation monitoring personnel. The self-survey in these laboratories helped minimize the number of radiation monitoring personnel required for servicing these laboratories and also eliminated any time spent in waiting for a survey by radiation monitoring personnel.

During the past few years, an exposure study of laboratory analyses has evaluated the radiation hazards of each part of each analysis, thereby, showing the weakness in the operating procedures. Corrective action in the form of a changed analysis procedure or the addition of shielding and remote control equipment were soon to follow.

B. Separations Canyon Buildings

The canyon buildings are designed to process the large quantities of radioactive material generated in the reactors and effect a separation of the plutonium, from the uranium and fission products. Several years after start-up, monitoring was provide for changing the canyon separation process from a single line operation to a parallel system. This involved considerable remote work in the canyon cells where radiation intensities were prohibitive.

Early air sampling in the canyon required entry into the canyon to collect and change the air sampling filters. About 1950 a remote air sampling system was installed which allowed all necessary air samples to be taken without entering the canyon.

Late in 1951 and early 1952 the Redox Separation Facility and the Metal Waste Recovery Facility were activated. Difficulty in metal waste recovery

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from the Tank Farms led to a prolonged renovation of the Tank Farms which involved removing the dirt from the tops of the tanks, installing pumps, special lines and equipment in the tanks. The intense radiation fields at the top of the tanks, especially at any opening to the tanks, and the very great potential for the spread of gross amounts of radioactivity to personnel and the surrounding area presented a challenging problem to radiation monitoring personnel. Through the development of the "plastic bag" technique for controlling contamination in the field during the removal of large, highly contaminated equipment from the waste storage tanks , and through an aggressive performance of radiation monitoring, radiation monitoring personnel were able to maintain radiation control throughout the metal waste recovery conversions.

Redox Separation Facility operations led to serious problems in radiation control. Some of these were:

1. The canyon structural shielding was insufficient - 3 mr/hr in SWP lobby and 60 mr/hr outside the front entrance to the building when the cell blocks are removed from H cell.
2. The sample port shielding was insufficient - dosage rates as high as 13 r/hr at 2 inches necessitated additional lead shielding for the sample ports.
3. The Redox stack emission of radioactive particles has presented a continuing problem.
4. Inadequate canyon ventilation makes it difficult to clear highly contaminated air from the canyon.
5. Equipment burial dosage rates greater than 500 r/hr have been experienced - exposure rates in a locomotive during burial of an H-4 pot, with eleven intervening cars, was 250 mr/hr.

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C. Final Product Processing Buildings

A new final product processing building was initiated in June, 1949. Maintenance work in this building has been associated with very high levels of plutonium alpha activity. Activation of the remote maintenance, RM, line in March, 1952, and the gradual shutdown of the rubber glove line has resulted in a significant improvement in contamination control and personnel exposure within this building.

During the past two years an exposure study and a more accurate determination of the surface dosage rate of the product handled in this building have led to improved control and a more accurate evaluation of personnel exposure.

Monitoring has been performed for the installation of the first phases of the Recuplex project by Minor Construction forces beginning in May, 1953. Satisfactory control of the gross amount of contamination associated with the work was a notable accomplishment for radiation monitoring personnel. Latter phases of the Recuplex project are still in progress.

D. Tritium Separation

The Tritium Extraction Facility at 108-B was put into operation on February 16, 1949. Monitoring for the detection of the very soft tritium beta particles was most difficult with the instruments then available. In May, 1949, the first significant internal deposition of tritium oxide was detected in a HAPO employee. Based on data supplied HAPO from another site, tritium oxide was not expected to be present in the Tritium Separation Facility. Experimental work soon disclosed significant amounts of tritium oxide were present. During September, 1949, a fresh air manifold system was installed at 108-B. This system allowed the use of fresh air masks anywhere in the separation processing rooms. An air sampling manifold system was also installed at this time and sampling of tritium oxide in the air was accomplished by passing the air through a drying agent.

On January 10, 1950, a tritium oxide urinalysis program was established at the Separation Facility and was operated by radiation monitoring personnel.

In February, 1950, a new survey instrument capable of detecting the tritium beta particles was first put into service. This instrument was later to be known as the "Pete". The "Pete" was a windowless counter requiring a flow of methane through the counting tube. This gas was changed to 90% argon - 10% methane in 1951, with greatly reduced potential for explosion or fire.

The Tritium Separation Facilities were shut down in May, 1952.

In June, 1953, renovation of the Tritium Separation Facilities was rapidly accelerated. Radiation testing of the can-opening cave and its associated cask was conducted in November and the first irradiated slugs again entered the process on December 14, 1953. During this operation of the Tritium Separation Facility, extensive investigations of tritium oxide air sampling procedures led to notable improvements in the air sampling accuracy. The use of calcium findings, instead of calcium turnings, greatly reduced the cost of the tritium oxide analysis. The calcium findings were a by-product of another HAPO operation and were previously being discarded. The facility was again shut down on August 4, 1954.

E. P-11 Project

Experimental work at this project involved large quantities of plutonium. During a critical mass study, the reactor suddenly went out of control on November 16, 1951. The primary and secondary safety circuits operated automatically, stopping the reaction. Six persons, at the remote operating position and the patrol gatehouse, were over-exposed to the gamma and neutron radiation produced. Air borne plutonium was spread throughout the building and a thorough cleaning was necessary.

On the night of December 4, 1951, a fire occurred in the 120 (test) building. The fire centered in the storage room, which contained several boxes of plutonium contaminated waste. Plutonium was spread throughout the inside and outside of the building. Some process equipment was salvaged. All significantly contaminated equipment and floors within the building were covered with concrete and permanently marked as "plutonium contaminated". The building was then completely sealed with concrete. All other buildings at this facility were carefully surveyed and unconditionally released.

F. Separations Stack Emission Problems

Since the start-up of the Separations Facilities, radiation monitoring personnel have watched for emission of radioactivity from the separation stacks. A survey during the last week of January, 1945, indicated no significant amounts of radioactive material had been discharged from the 291-T stack to that date.

The existence of a particle problem from the 200 Area stacks was first recognized in September, 1947. Ground contamination around B and T plants was first noted by an increase in shoe contamination. Deposition rates as high as one particle per square foot per day were observed in the prevailing wind direction. The particles had an activity of 0.1 /uc to 1 /uc and consisted of 60 - 90% Ce, 0 - 15% Y, 0 - 20% Sr. The following action was recommended to correct the particle problem.

1. Replace the black iron duct work with stainless steel.
2. Install filters on each cell exhaust system.
3. Pass dissolver off-gases through a scrubber.
4. Install sand filters just before the gases enter the stacks.

During the early part of 1948 the fans and associated duct work was replaced with stainless steel equipment. The sand filters were installed between the stack and certain canyon cells during the fall of 1948.

In January, 1954, emission of large quantities of ruthenium from the Redox stack were observed. In the following months deposition of radioactive particles in the Blaw-Knox, other construction areas, and the army camps reached a level which necessitated an emergency clean-up by radiation monitoring and minor construction personnel. The clean-up involved a thorough survey of 362.7 acres during a two-day period. Repeated Redox emission necessitated a second cleanup of the same area about 2 weeks later. Changes in the separation process and routings of the off-gases has helped to remedy the situation. Further work, to include the installation of ruthenium scrubbers in the off-gas stream, is now in progress. A total of 5600 man-hours were spent by radiation monitoring personnel in these two surveys.

V. ACHIEVEMENTS IN RADIATION MONITORING FOR BIOLOGICAL AND TECHNICAL RESEARCH

A. Radiobiology Laboratories and Animal Farms

Experimental work with fish and other aquatic forms of Columbia River life began in the fall of 1945. In conducting these experiments, monitoring of the reactor effluent water is required. This monitoring

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involves dosage rate determinations and contamination detection of many short half-life radioisotopes. Frequently, radioactive effluent vapors are also encountered and the biological hazards of these highly active, but short half-life radioisotopes require careful evaluation.

In the fall of 1949 the animal farms were established to determine experimentally many of the hazards of certain internally deposited radioisotopes. The operation of the animal farm presented to radiation monitoring personnel problems in monitoring for the preparation of radioactive foods for the animals, monitoring for special injections of radioactive solutions and methods for control and deposition of the animal waste.

Autopsies of animals containing radioactive materials requires careful monitoring due to the fact that certain radioactive materials may be concentrated in small animal organs and consequently may give rise to high dosage rates. Evaporation of the animal fluids as the autopsies proceed may give rise to rapidly changing dosage rates and radiation monitoring personnel must be constantly on guard to detect such dosage rate changes as the work proceeds.

B. Technical Research and Development Laboratories

Technical research and development of HAPO has steadily increased during the past few years. A new research center, the Works Laboratory Area, has been constructed within the 300 Area and was opened between the spring of 1953 and the spring of 1954.

Radiation Monitoring work for Technical Facilities presents a wide variety of challenges to the monitoring personnel. The experimental

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work with its rapidly changing conditions complicates the establishment of many routine radiation surveys. Radiation work with many isotopes, seldom encountered in production monitoring, is required. Special irradiations may give rise to new and previously unknown radioisotopes. The radiation detection and hazard evaluation of these isotopes must be developed as rapidly as possible.

Technical laboratory experiments and experimental work with small test reactors are performed with a minimum of radiation shielding to allow quick access to make the necessary changes in the experimental apparatus. This type of work has required radiation monitoring work of the highest quality to control contamination and over-exposure of technical personnel.

The potential hazards of over-exposure and loss of contamination control are ever present at the Radiometallurgy building where irradiated uranium slugs are sawed, ground, polished and inspected. Photographing and inspecting of irradiated ruptured slugs has required special equipment and handling techniques. Radiation monitoring personnel have performed well in monitoring the high dosage rates associated with the technical work in this building.

Radiation monitoring personnel have conducted radiation surveys about the various X-ray units operated at HAPO and have recommended changes in the shielding requirements when necessary. Radiation monitoring about the 2 Mev Van de Graaff generator, while it was in operation, led to the placement of additional shielding in the generator building.

VI. GRAPHS

Graph number I shows the average number of General Electric employees working within the HAPO production areas from 1944 to July of 1954.

No Graphs attached
to this report.
C. Unruh

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Graph number II shows the average number of radiation monitoring employees from 1944 to July of 1954.

Graphs number III, IV, and V show the number of Special Work Permits, Routine and Special Surveys, and Air Monitoring Samples respectively for the years 1945 to July 1954. The marked decrease in the number of Special Work Permits for 1953 is the direct result of a concentrated effort, on the part of the radiation monitoring groups, to reduce the amount of paper work involved in radiation work. The increased use of the Extended Special Work Permit and Standard Operating Procedure for radiation work of a repetiti.e nature has accounted for this decrease. The decrease in the number of air monitoring samples taken in 1953 is the result of reduced sampling frequencies in location of static or nearly static air conditions.

Graph number VI shows the total number of ruptured slugs removed from the reactors for the periods indicated. Radiation monitoring work in the Reactor Areas necessarily increases rapidly as the number of ruptured slugs increases.

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