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To:	Dr. Donna Cragle	**From:**	Hap West Hap
Date:	June 15, 1993	**Copies To:**	Distribution
Subject:	ADDENDUM TO "BRIEF HISTORY OF THE Y-12 EXTERNAL MONITORING PROGRAM"		

Attached is information that I discovered after issuing the June 7 report, "Brief History Of The Y-12 External Monitoring Program." It is excerpted from Y-1186 as shown. This information does not invalidate any statements made in the referenced report, but it confirms the statements, gives additional information about the 1956-60 program, and serves as documentation of the program for that time period. Consequently, it should be attached to that report as an addendum.

CMW:jj

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Attachment

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Date Issued:

Report Number Y-1186

Subject Category: Health and Safety

UNION CARBIDE NUCLEAR COMPANY
Division of Union Carbide Corporation
Y-12 Plant
Contract No. W-7405-eng-26
with the U. S. Atomic Energy Commission

THE Y-12 HEALTH PHYSICS PROGRAM

Work done by:
Y-12 Health Physics Department

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Oak Ridge, Tennessee
November 1, 1957

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III. Plant Limits

It is the policy of the Y-12 plant to make every reasonable effort to protect plant personnel from injury by exposure to excessive amounts of ionizing radiation, radioactive materials, or other toxic materials or vapors. To facilitate the realization of this aim, the recommendations of certain recognized authorities are accepted as operating limits of concentration or exposure.

A. Maximum Permissible Limits for Exposure to External Radiation

The maximum permissible limits accepted at the Y-12 plant for chronic exposure to ionizing radiation are those recommended by the National Committee on Radiation Protection as published in the National Bureau of Standards Handbook 59, issued September 24, 1954. Notice has been taken of the recommendations of this committee for lowering the permissible limits for average annual dose and cumulative lifetime dose as outlined in their preliminary statement which was circulated by the National Bureau of Standards January 11, 1957. It is expected that these proposed limits will be put into effect at the Y-12 plant when they are adopted by the United States Atomic Energy Commission.

Table III.1

Maximum Permissible Limits for Exposure to External Radiation

Part of Body	Type of Radiation	Maximum Permissible Dose		
		Per Week	Per 13-Weeks	Per Year
Whole Body, Blood forming organs, Gonads, lens of eye	Gamma or X-ray	300 mr	3900 mr	15,000 mr
Skin at Basal layer of Epidermis	β or Total $\beta+\gamma+x$	600 mrem	7800 mrem	30,000mrem
Hands and forearms, feet and ankles, or head and neck (exclusive of lens of eye)	β or Total $\beta+\gamma+x$	1500 mrem	-----	------
Whole Body	Neutrons	300 mrem*	-----	------

* Sources of neutron radiation at Y-12 are Ra-Be or Po-Be sources. All neutrons detected by film are assumed to be fast neutrons. A one week maximum permissible neutron dose would be roughly the equivalent of 45 neutron tracts per fifty fields when the film is examined microscopically.

An employee whose personnel monitoring film indicates a dose in excess of 300 mr gamma or hard X-ray, or 600 mrem total beta plus gamma or X-ray in any one week is considered to have been "overexposed".

Table III.2

Control Points and Action Taken for Technical Overexposure to External Radiation

Control Point	Action Taken
*300 mr gamma or 600 mrem beta + gamma in any one week.	Written notice to supervisor of employee exceeding MPL advising (a) the amount of indicated dose, and (b) the cumulative dose for the most recent 13-weeks.
Nearing 6000 mrem beta + gamma for the most recent 13-weeks.	Written notice as above with recommendation that exposure be limited.
**Greater than 7800 mrem beta + gamma for the most recent 13-weeks.	Written notice as above with recommendation that exposure be restricted until the dose indicated for the most recent 13-weeks falls below 6000 mrem beta + gamma, the maximum permissible for 13-weeks when an overexposure has occurred any one week.

* Sources of very penetrating radiation are used only to a very limited extent and under closely controlled conditions precluding any great likelihood of anyone exceeding the limits of 300 mr of gamma or equivalent neutron dose in any one week or 3900 mr in any 13-weeks.

** Because of the limited exposure potential in uranium handling at Y-12, there is little likelihood of anyone exceeding the limit of 7800 mrem beta + gamma during a period of 13-weeks.

IV. Program

That portion of the report which follows is a comprehensive outline of the program or methods by which the Health Physics Department discharges its responsibilities with regard to fulfilling the policies of the Y-12 plant.

A. Personnel Monitoring

The purpose of the personnel monitoring program at Y-12 is to measure and record the amount of ionizing radiation dose received by employees who may be exposed to such radiation in measurable quantities. The personnel monitoring program is intended to measure the dose received from external sources of radiation, and to detect the presence of and estimate the amount of dose contributed by radioactive materials inside the body.

1. External Radiation Monitoring - Radiation sensitive film is used as a personnel dosimeter to measure the doses of beta, gamma, X-ray or neutron radiation received by plant personnel. Films used for beta, gamma or X-ray dosimetry are processed once a week, and in some low exposure potential areas, once a month. Special emulsion films used for neutron dosimetry are processed every two weeks.

   The film badge presently being used at the Y-12 plant is AEC Cat. No. PF-1B, manufactured by the A. M. Samples Machine Company, Knoxville, Tennessee. This is a stainless steel case made in two pieces which slide apart or together easily for insertion or removal of the film. A rectangular hole is punched in both the front and back halves of the case for an open window portion to measure both beta + gamma radiation, and a 1 mm thick cadmium filter is in both the front and back halves of the case for a shielded portion to measure gamma radiation only. For identification purposes, the payroll badge number is pierced in the front filter of the badge.

   Table IV.1 shows the type of radiation to be expected and the kind of work performed in each of the areas in which persons presently are being badged.

Table IV.1

Types of Radiation to be Expected for Various Jobs

Area or Job	Buildings	Radiation Expected	Source of Radiation
Non-Destructive or Radiological Testing	9201-1 9980	X-ray, gamma	X-ray machines and Ra or Co^{60} sources
Instrument Mechanics or Electrical Repairmen	9737	X-ray, gamma	X-ray machines and Ra or Co^{60} sources
Firemen and Plant Shift Supervisors	Subject to go anywhere in plant	X-ray, gamma Beta	Potentially any source in plant area
Medical Technician	9706-2	X-ray	X-ray machine
Chip Handling Normal Machine Shop Normal Foundry	9206 9212 9998	Beta, gamma	Normal or depleted uranium metal
Chemical Production	9212	Gamma	Recovery of uranium, possibly fission product contaminated, contained in a closed system
Assay Instruments Development	9201-4, 9201-5, 9203, and 9205	Neutron, gamma	Ra-Be or Po-Be neutron sources, Cs^{137}, and others

a. Assignment to Film Program - Supervision, with the assistance of the Health Physics Department, decides which groups and which persons within a group shall be assigned to the routine film monitoring program, and keeps current the list of persons assigned.

The supervisor makes a request, either oral or written, for the Health Physics Department to add persons to or remove persons from the film badge program.

The Health Physics Department sends the request to the monitoring laboratory giving all the necessary data on a "Film Badge Assignment Request" form.

FILM BADGE ASSIGNMENT REQUEST

Date _____

Badge No.	Name	Dept.	Area Code	Add	Remove	Change From	Change To	N	Requested By

Revised 8-30-57 Health Physics Dept._____

Figure IV.1

The monitoring laboratory prepares the necessary badges, one with a black face and one with a white face for each person, to be worn on alternate weeks.

The laboratory also notifies the Tabulating Services Department of changes in the list of participants so that corrections can be made on the "Film Badge Exposure Worksheet" IBM forms before they are sent to the laboratory.

b. Distribution and Processing - Each Friday afternoon a Health Physics representative picks up from the laboratory all of the film badges of the proper color, which are loaded with film and ready for use. The Health Physics representative delivers the badges to the distribution point in each area. On Monday or Tuesday of each week the Health Physics representative collects from each area the badges which have been worn the previous week and delivers them to the monitoring laboratory for processing. Badges which are not in the racks or which are not turned in to the laboratory by Tuesday of each week are reported as "not available" for processing.

The monitoring laboratory removes the film from the badges, develops the exposed films, inspects the films for irregularities or abnormal indications, estimates the radiation dose from the amount of film blackening and records the results on the prepared film badge exposure IBM worksheets. The film badges are reloaded with film and X-rayed to imprint the badge identification numbers on the film. They are now ready for distribution on Friday. Film is developed out of routine whenever there is reason to suspect that an accidental overexposure has occurred.

c. Reporting and Recording

1) The laboratory sends the film badge exposure worksheets with exposure information recorded to the Health Physics Department. In cases of abnormal film indications or indicated extreme overexposures, the laboratory may notify the Health Physics Department by telephone in advance of sending the worksheets.

The Health Physics Department checks the worksheets for exposures which exceed the MPL. (See Table III.1, for maximum permissible exposure limits, and Table III.2 for levels at which action is taken). The worksheets are then sent to the Tabulating Services Department. Exposure summary reports are submitted to operating area supervision once a month and/or once a quarter.

The Tabulating Services Department transfers the exposure data to IBM cards which are the final record. Once a month the information on these cards is compiled for the most recent thirteen weeks period, giving a breakdown of exposures recorded for each individual within each department. Once a year a tabulation of all exposures reported for each individual is made and filed by badge number. The annual exposure record, the weekly IBM card and the developed films are retained as a permanent personnel exposure record.

2) In case the developed film indicates a valid exposure in excess of the weekly maximum permissible limit,

the supervisor of the employee is notified orally and/ or in writing. If the indicated overexposure is significantly higher than the accepted limit, is repetitive for an employee, or involves a group of employees, the incident is investigated to determine cause and measures which can be taken to minimize recurrence. If the 13-week cumulative exposure for any individual is nearing the accepted limit, his supervisor is requested to limit his exposure. If, in a very rare case, the employee's 13-week cumulative exposure exceeds the accepted limit he may be removed from areas of potential exposure until his cumulative exposure reaches accepted levels.

3) Temporary film badges are issued whenever required to visitors and Y-12 employees normally not assigned to radiation work. These badges are processed and the results handled in much the same fashion as are the routine badges and results. Film rings and pocket chambers are available for special jobs if required.

d. Control Program - A continuing program is carried on to determine the precision of laboratory interpretation of radiation exposure. Film badges which have been exposed to known amounts of radiation are given fictitious names and numbers and included in the regular film processing each week. The laboratory interpretations are checked against the known exposures and limits of error are calculated.

1) Method - The Health Physics Department assigns a few badges having fictitious names and inactive numbers to each of several departments. The Health Physics representative removes these control badges from the rack when he distributes the badges each Friday, and delivers them to the Quality Control Department. These control badges are exposed to known doses of beta and mixed beta and gamma radiation, and returned to the laboratory along with the regular badges on Tuesday.

2) Reporting and Recording - When the film badge exposure worksheets are received from the laboratory each week, the doses indicated for the control badges are transcribed to a "Film Badge Controls" form.

Information for the other columns of the form has been supplied by the Quality Control Department. One copy of the form is retained by the Health Physics Department and one copy is sent to the Statistical Services Department for calculating the bias and limits of error of laboratory determinations. Exposure data for the control badges are stricken from the worksheets before the sheets are sent to Tabulating Services for transcription to IBM cards. This prevents data from control badges being included in total and average exposure data for any of the departments. Averages for the precision of film badge interpretation are reported once a quarter in a quality control report for all analytical procedures.

FILM BADGE CONTROLS

Date _____

Name	Badge Number	Type Exposure	Exposure Level Mrep	Lab. Results Mrep	Remarks

Figure IV.2