Form AEC-313 (5-58)	ATOMIC ENERGY COMMISSION **APPLICATION FOR BYPRODUCT MATERIAL LICENSE**	Form approved. Budget Bureau No. 38-R027.4.

INSTRUCTIONS.–Complete Items 1 through 16 if this is an initial application. If application is for renewal of a license, complete only Items 1 through 7 and indicate new information or changes in the program as requested in Items 8 through 15. Use supplemental sheets where necessary. Item 16 must be completed on all applications. Mail three copies to: U. S. Atomic Energy Commission, Washington 25, D. C. Attention: Isotopes Branch, Division of Licensing and Regulation. Upon approval of this application, the applicant will receive an AEC Byproduct Material License. An AEC Byproduct Material License is issued in accordance with the general requirements contained in Title 10, Code of Federal Regulations, Part 30 and the Licensee is subject to Title 10, Code of Federal Regulations, Part 20.

1. (a) NAME AND STREET ADDRESS OF APPLICANT. *(Institution, firm, hospital, person, etc.)*

New York Shipbuilding Corporation
Broadway and Fairview Streets
Camden, New Jersey

(b) STREET ADDRESS(ES) AT WHICH BYPRODUCT MATERIAL WILL BE USED. *(If different from 1 (a).)*

Same as 1.(a)

2. DEPARTMENT TO USE BYPRODUCT MATERIAL

Department 22, Naval Nuclear
Radiological Control Department

3. PREVIOUS LICENSE NUMBER(S). *(If this is an application for renewal of a license, please indicate and give number.)*

Renewal of License No.
29-2204-3 (G64)

4. INDIVIDUAL USER(S). *(Name and title of individual(s) who will use or directly supervise use of byproduct material. Give training and experience in Items 8 and 9.)*

Bruce E. Eldredge - Sr. Monitor
Donald H. Reppert - Sr. Monitor
Thomas L. Mulleavy- Sr. Monitor
Arthur V. McKeon - Sr. Monitor

5. RADIATION PROTECTION OFFICER *(Name of person designated as radiation protection officer if other than individual user. Attach resume of his training and experience as in Items 8 and 9.)*

Arthur E. Schmidt

6. (a) BYPRODUCT MATERIAL. *(Elements and mass number of each.)*	(b) CHEMICAL AND/OR PHYSICAL FORM AND MAXIMUM NUMBER OF MILLICURIES OF EACH CHEMICAL AND/OR PHYSICAL FORM THAT YOU WILL POSSESS AT ANY ONE TIME. *(If sealed source(s), also state name of manufacturer, model number, number of sources and maximum activity per source.)*
(A) Cobalt-60	Sealed encapsulated source, Type RR-60, Nuclear Chicago Corp., one source not to exceed 235 mc.
(B) Cobalt-60	Sealed encapsulated source, Type RR-60, Nuclear Chicago Corp., one source not to exceed 30 mc.

7. DESCRIBE PURPOSE FOR WHICH BYPRODUCT MATERIAL WILL BE USED. *(If byproduct material is for "human use," supplement A (Form AEC-313a) must be completed in lieu of this item. If byproduct material is in the form of a sealed source, include the make and model number of the storage container and/or device in which the source will be stored and/or used.)*

All of the above sources are to be used for instrument calibration.

Storage Containers
(A) Nuclear Chicago source holder - Model SH-603 (3" lead)
(B) Nuclear Chicago source holder - Model SH-603 (1-5/8" lead)

ACKNOWLEDGED

(Continued on reverse side)

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TRAINING AND EXPERIENCE OF EACH INDIVIDUAL NAMED IN ITEM 4 *(Use supplemental sheets if necessary)*

8. TYPE OF TRAINING	WHERE TRAINED	DURATION OF TRAINING	ON THE JOB (Circle answer)	FORMAL COURSE (Circle answer)
No Change				
a. Principles and practices of radiation protection			Yes No	Yes No
b. Radioactivity measurement standardization and monitoring techniques and instruments			Yes No	Yes No
c. Mathematics and calculations basic to the use and measurement of radioactivity			Yes No	Yes No
d. Biological effects of radiation			Yes No	Yes No

9. EXPERIENCE WITH RADIATION. *(Actual use of radioisotopes or equivalent experience.)* No Change

ISOTOPE	MAXIMUM AMOUNT	WHERE EXPERIENCE WAS GAINED	DURATION OF EXPERIENCE	TYPE OF USE

10. RADIATION DETECTION INSTRUMENTS. *(Use supplemental sheets if necessary.)* No Change

TYPE OF INSTRUMENTS *(Include make and model number of each)*	NUMBER AVAILABLE	RADIATION DETECTED	SENSITIVITY RANGE *(mr/hr)*	WINDOW THICKNESS *(mg/cm²)*	USE *(Monitoring, surveying, measuring)*

11. METHOD, FREQUENCY, AND STANDARDS USED IN CALIBRATING INSTRUMENTS LISTED ABOVE.

No Change

12. FILM BADGES, DOSIMETERS, AND BIO-ASSAY PROCEDURES USED. *(For film badges, specify method of calibrating and processing, or name of supplier.)*

No Change

INFORMATION TO BE SUBMITTED ON ADDITIONAL SHEETS

13. FACILITIES AND EQUIPMENT. Describe laboratory facilities and remote handling equipment, storage containers, shielding, fume hoods, etc. Explanatory sketch of facility is attached. *(Circle answer)* Yes No No Change

14. RADIATION PROTECTION PROGRAM. Describe the radiation protection program including control measures. If application covers sealed sources, submit leak testing procedures where applicable, name, training, and experience of person to perform leak tests, and arrangements for performing initial radiation survey, servicing, maintenance and repair of the source. Change "Preliminary Issue of NNEP-20, Radiological Control Manual, to "NNEP 20,Rev.B, Radiological Control Manual.

15. WASTE DISPOSAL. If a commercial waste disposal service is employed, specify name of company. Otherwise, submit detailed description of methods which will be used for disposing of radioactive wastes and estimates of the type and amount of activity involved. No Change

CERTIFICATE (This item must be completed by applicant)

16. THE APPLICANT AND ANY OFFICIAL EXECUTING THIS CERTIFICATE ON BEHALF OF THE APPLICANT NAMED IN ITEM 1, CERTIFY THAT THIS APPLICATION IS PREPARED IN CONFORMITY WITH TITLE 10, CODE OF FEDERAL REGULATIONS, PART 30, AND THAT ALL INFORMATION CONTAINED HEREIN, INCLUDING ANY SUPPLEMENTS ATTACHED HERETO, IS TRUE AND CORRECT TO THE BEST OF OUR KNOWLEDGE AND BELIEF.

Date July 15, 1964

New York Shipbuilding Corporation
Applicant named in item 1

By _____

Executive Vice President
Title of certifying official

WARNING.—18 U. S. C., Section 1001; Act of June 25, 1948; 62 Stat. 749; makes it a criminal offense to make a willfully false statement or representation to any department or agency of the United States as to any matter within its jurisdiction.

* U.S. GOVERNMENT PRINTING OFFICE : 1961 O—615983

NEW YORK SHIPBUILDING CORPORATION

NAVAL NUCLEAR ENGINEERING PROCEDURE

NNEP 20 REV. B

TITLE: Radiological Control Manual

APPLICABLE TO:

CONTRACT	SHIP	CONTRACT	SHIP
534	SS(N)603 Nuclear Submarine	541	SS(N)647 Nuclear Submarine
535	SS(N)604 Nuclear Submarine		
539	SS(N)612 Nuclear Submarine		

PREPARED BY: R. H. Nichols CHECKED BY: R. W. Heward

CONCURRENCE:

REACTOR ENGINEERING SECTION SUPERVISOR Heward 3-4-64
Date

NAVAL NUCLEAR QUALITY CONTROL MANAGER /s/J. E. Wahler 12/17/62
Date

APPROVED BY:

VICE PRESIDENT, NAVAL NUCLEAR /s/J. M. Dunford 7/17/62
Date

S.O.S. VALIDATION: /s/K. J. O'Toole 12/18/62
Date

ACTION DEPARTMENTS: All Departments Which Can Reasonably Expect To Have Personnel Enter "Controlled Access Areas" On Nuclear Powered Submarines As Defined Herein.

DISTRIBUTION:

4	4T	6	7	9	10	11	13	14	14N	16	17	19	21	22	23	24	29	42	20
25	3	3	1	3	3	3	1	2	2	1	25	3	1	16	3	2	2	4	3

46	47	55	58	59	64	66	67	68	69	71	73	74	75	76	79	80	
3	3		1	2	1	1	4	5	2		2	2	1	3	1	1	

Harvey (1) Brown (1) Lill (1) Bevan (1) Bradway (1) PNROR (2)
Teale (1) Bradshaw (1) Stout (1) G.Smith (1) S.O.S. (7) BREO (2)

61240

REV.	PREPARED BY	CHECKED BY	CONCURRENCE METHODS & MAT'LS SUPV.	CONCURRENCE QUALITY CONTROL MGR.	APPROVAL VICE PRES. NAVAL NUCL. POWER	APPROVAL PRESIDENT	TECHNICAL CONC.	VALIDATION S.O.S.
A	R.H. Nichols	[signature]	[signature]	[signature]	[signature] 12/17/62	[signature]	N.A.	[signature] 12/17/62

DESCRIPTION:

1.) Revised cover and revision sheets to suit standard format, 2.) Extended applicability to include N.Y.S.C. Contract 541, 3.) Revised section 2.10, Radiological Control Organization, redefined line of responsibility, 4.) Added new section 3.2.16, renumbered subsequent sections, 5.) Deleted "social security numbers" from 2nd line of section 3.4.3, 6.) Added new section 3.6.7, renumbered subsequent sections, 7.) Added section 3.6.12, 8.) Revised section 7.6.6 to include swiping of alpha sources once every three months, 9.) Revised section 10.3.6, changed "twelve (12) one hour lectures" to "five (5) two hour lectures", 10.) Revised section 10.6.1, deleted college requirement, referenced NNEP 20-3, 11.) Deleted section 10.6.2, information now contained in NNEP 20-3, 12.) Revised section 11.4.1, added details on film badge issue, clarified use of Radiation Work Permit, 13.) Revised section 11.4.2.10, film badges to be worn underneath Grade "A" and anti-contamination clothing, 14.) Revised section 11.5.1, added details on dosimeter issue, 15.) Revised section 11.5.2.3, dosimeters to be worn underneath Grade "A" and anti-contamination clothing, 16.) Added section 14.1, Index of Forms and Signs, 17.) Revised Department 22 Form RC-4, 18.) Added Department 22 Forms RC-16, through RC-25, 19.) Added sample Individual and Supervisor Certification Cards, 20.) Added References 15.11, 15.12.

B	H. Pattillo	[signature]	[signature]	[signature] 3-10-64	[signature] 3-1?-64	NA	NA	

DESCRIPTION:

1) Revised cover sheet to suit standard format; 2) Added Ref. 15.13; 3) Revised Sec. 3.3.2.5 to provide additional silt sampling as required by Ref. 15.13; 4) Revised Sec. 11.4.1 to provide general location of film badge shed; 5) Revised Sec. 11.4.2.4 to require that film badges be worn in areas where the radiation level is above 0.5 mr/hr to be consistent with actual practice; 6)*Revised Sec. 10.2, Program I, "Basic Course in Radiation Safety & Control" from 6 (1) hour lectures to 4 ($1\frac{1}{2}$) hr. lectures; 7)*Revised Sec. 10.3, Program II, "Comprehensive Course in Radiation Safety & Controls" for supervisors, Naval Nuclear Test Group Personnel and other personnel selected by D/4, from 5 (2) hour lectures to 2 (2) hour lectures; 8)*Revised Sec. 11.4.2.5 to require that film badges be worn by all persons who are likely to receive a dose in excess of 25 mrem/7 consecutive days.

* Changes 6, 7 & 8 were previously distributed to holders of the Radiological Control Manual by NYS Ltr. 4-97-63 dated 1 March 1963.

NEW YORK SHIPBUILDING CORPORATION

CAMDEN, NEW JERSEY

N O T I C E

SUBJECT: Naval Nuclear Engineering Procedure No. 20, "Radiological Control Manual".

This manual provides the strict controls necessary whenever radiation from nuclear sources is involved in our work. Employees doing this work will be trained in the proper procedures, which are contained in this manual, and will be required to follow them exactly.

Department 22 has the authority to enforce these rules and to stop work where unsafe conditions exist.

Deviations from the manual require written authority from Department 4; such deviations must be recorded and serially numbered. Department 4 must conduct periodic audits to insure compliance with this procedure and to keep its provisions up to date. Bureau of Ships (Code 1500) must be notified of all such changes at the time they are made.

E. L. Teale
President

July 31, 1962

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1. SCOPE

1.1 This manual details the radiological controls to be applied during the construction and testing of all Naval Nuclear Powered Ships at New York Shipbuilding Corporation. Instructions are provided to control external and internal exposure to personnel (through the use of anti-contamination clothing, respirators and controlled access areas); control decontamination; and control receiving, transferring, installation, removal and shipping of radioactive materials.

2. GENERAL INFORMATION

2.1 The use of nuclear power for ship propulsion requires consideration of its radiological health aspects. The ionizing radiation given off during nuclear fission, by the fission products, or by induced radioactivity is harmful to the human body. Exposure to any ionizing radiation should be kept to the absolute minimum required to accomplish necessary work.

2.2 Hazard may occur from exposure to the ionizing radiation itself, or from radioactive materials which may enter the body from air, water, or contamination of surfaces. Careful observation of the instructions contained in this manual will insure that all operations involving radioactivity are conducted in a safe and effective manner.

2.3 The damage to the human body caused by radiation is measured by the amount of energy absorbed, and is termed "radiation dose". Radiation dose is measured in rem (adapted for use in the Naval Nuclear Program) where:

Rem (rad equivalent man) - the quantity of radiation of any type that will produce the equivalent biological effect in a man as that resulting from the absorption of 100 ergs of x-rays or gamma rays per gram of body tissue. = Rad x RBE. (1000 mrem = 1 Rem)

Rad (radiation absorbed dose) - a unit of radiation dose, from either particulate or electromagnetic radiation, which will impart an energy of 100 ergs to each gram of material exposed.

RBE (relative biological effectiveness) - a numerical factor used to correlate a fixed amount of physical damage to radiation of various types and energies.

2.3 (Continued)

Two other commonly used units of radiation dose are the:

Roentgen - that amount of gamma or x radiation which will release approximately 83 ergs of energy in a gram of air.

Rep - (roentgen equivalent physical) - a unit of radiation, from either particulate or electromagnetic radiation, which will impart an energy of about 93 ergs to each gram of soft body tissue exposed.

2.4 The biological effect of radiation varies with the amount of exposure, the rate at which exposure takes place, and the type of radiation. Table I provides the probable effect upon individuals exposed to short time, high doses of radiation. Table II provides a useful guide for converting RAD to REM. (defines the RBE for various types of radiation).

TABLE I	EFFECTS OF SINGLE WHOLE-BODY DOSES
Acute Dose to Whole Body (rem)	Probable Effect on Individuals
0-25	No clinically detectable effects.
25-50	Possible transient blood changes but no other clinically detectable effects.
50-100	Nausea and fatigue possible, blood cell changes with delayed recovery but no disability.
100-200	Reduced vitality, nausea and fatigue, depression of nearly all blood elements possible (recovery in nearly all cases within 3 to 6 months).
200-450	Same as for 100 to 200 rem, with immediate disability; some deaths possible within 2 to 6 weeks. Early medical treatment will improve chances of recovery.
450	Fatal to 50 per-cent; high percentage of permanent disability. Early medical treatment will improve chances of recovery.
800 or more	Fatal in almost all cases.

TABLE II	Conversation of Rad to Rem		
Radiation	Rad x RBE = Rem		
X-rays, gamma rays and beta particles	1	1	1
Thermal or slow neutrons	1	3	3
Fast neutrons and protons	1	10	10
Alpha particles	1	20	20

2.5 Tabulation of Exposure Limits

The following tabulation is for general information only. Reference should be made to the appropriate sections indicated for detailed requirements.

(See Next Page)

2.5.1 External	
Whole body and critical organs 5 rem/year 3 rem/quarter 100 mrem/week (administrative limit at NYS)	(Section 5.2.1)
Skin of the whole body 30 rem/year 10 rem/quarter	(Section 5.2.2) For low penetrating radiation; betas and low energy gammas.
Extremities 75 rem/year 25 rem/quarter	(Section 5.2.2)
Emergency Exposure 25 rem once a lifetime	(Section 5.3)

2.5.2 Surface Contamination	
Uncontrolled Area	(Section 7.5.1)
Loose Surface Contamination	β-γ - less than 100 µµc/100 cm^2 alpha - less than 50 µµc/100 cm^2

Fixed	β-γ - less that 1 mrem/hour (intermittant exposure)
Surface Contamination	β-γ - less than 0.1 mrem/hour above background (continuous exposure)
	alpha - less than 50 $\mu\mu c/100\ cm^2$

Controlled Contamination Area	(Section 7.5.2)

Surface contamination levels exceed limits for uncontrolled areas but usually less than:

Loose contamination

β-γ - 1000 $\mu\mu c/100\ cm^2$

alpha - 50 $\mu\mu c/100\ cm^2$

2.5.3 Airborne Radioactivity		(Section 6)
Activity from reactor operation.		Respiratory Equipment
GROSS β-γ	Less than 1×10^{-9} $\mu c/ml$	None
	1×10^{-9} $\mu c/ml$ to 1×10^{-7} $\mu c/ml$	Respirators
	greater than 1×10^{-7} $\mu c/ml$	Air Supply Respirators
Activity <u>not</u> from reactor operation Use 1/10 limits of U.S. Dept. of Commerce, NBS Handbook 69.		

2.6 Radiation Areas - Accessible areas where a major portion of the body could receive a dose greater than 1 mrem/hr shall be conspicuously posted as "Radiation Areas". The signs shall also state the normal occupancy in hours/day. No bunking or loitering shall be allowed in these spaces. (Section 14 details the appropriate signs).

2.7 High Radiation Areas - Accessible areas where a major portion of the body could receive a dose in excess of 100 mrem/hr shall be posted and locked. No loitering or bunking or entry by unauthorized personnel shall be permitted to such areas. Entry to such areas shall be authorized only by Dept. 22. A Department 22 monitor shall remain in the vicinity at all times when work is being accomplished in High Radiation Areas and shall immediately secure such areas upon completion of the required work. (Section 14 details the appropriate signs).

2.8 Controlled Access Areas - any area, such as Radiation Area, High Radiation Area, Controlled Contamination Area, to which Department 22 shall control entry and exit.

2.9 Entrance to Controlled Access Areas

2.9.1 The basic criteria which determine if an individual shall be permitted entry to a Controlled Access Area are as follows:

a. A specific need for such entry must exist as evidenced by the issuance of a Radiological Work Permit.

b. The individual must be qualified for entry by virtue of having passed a special medical examination and satisfactorily completing a prescribed radiological training program.

NOTE: Contractor employees may substitute a letter from the contractor certifying to the employee's qualification.

2.9.2 Subsequent sections of this manual detail the responsibilities of those persons who:

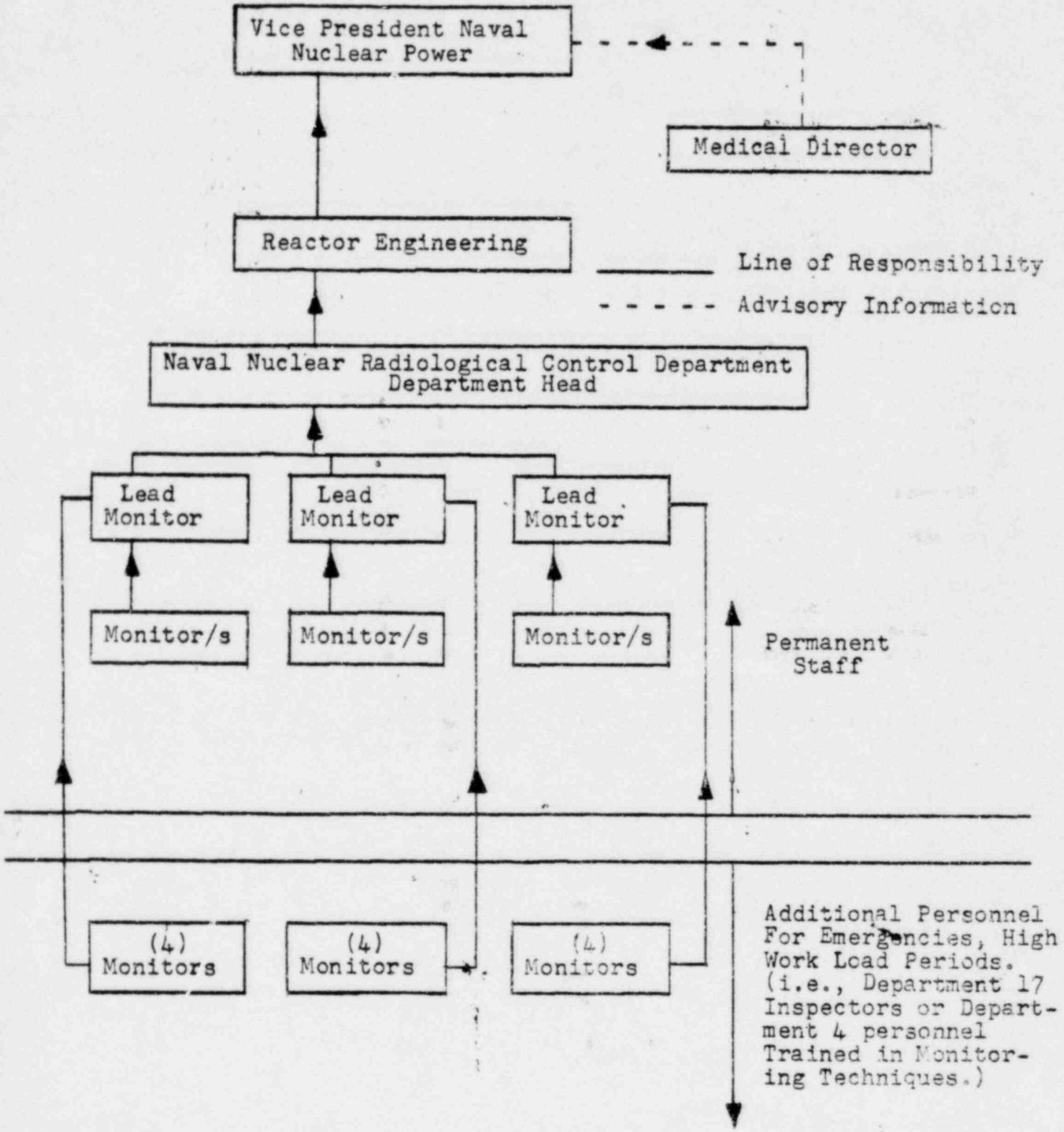
a. Issue radiological work permits,

b. Conduct the necessary medical examinations,

c. Conduct radiological training,

d. Determine the anti-contamination clothing and equipment requirements, etc.

2.10 [A] RADIOLOGICAL CONTROL ORGANIZATION



3. RESPONSIBILITIES

3.1 Naval Nuclear Power Department (Dept.4) Responsibilities.

The Naval Nuclear Power Department is responsible for:

3.1.1 Conducting periodic audits to insure procedures are adequate and deficiencies in procedures or practices are corrected.

3.1.2 Approving prior to implementation each deviation to this manual and maintaining records in which such deviations are numbered consecutively.

3.1.3 Submitting to BuShips (Code 1500) each change to this manual, for information, concurrent with its issuance in the shipyard.

3.1.4 Directing and coordinating all work involving radiation resulting from nuclear power operation. This includes:

a. Preparing detailed work procedures.

b. Providing a sufficient number of trained personnel for conducting the initial shield survey (Section 4.3.2).

c. Initiating action to secure special facilities.

d. On the site supervision of the actual work through Dept. 22, as appropriate.

e. Contacting BuShips (Code 1500) as required for the use of special abrasive materials, (Section 8.4.2.3), and for disposal or decontamination of reactor plant components (Section 8.3.1).

f. Approving of liquid radioactive waste disposal by NYS to the Delaware River prior to such disposal (Section 9.3.3).

g. Selecting the personnel required to attend the formal training programs (Section 10).

h. Awarding certification cards to those persons who are medically qualified and who have satisfactorily completed a prescribed training program.

3.1.5 Preparing the formal reports required by Section 13 and submitting these reports to the applicable activities.

3.1.6 Informing Departments 22 and 76 of manning estimates for major radioactive jobs.

3.2 Naval Nuclear Radiological Control Department Responsibilities

The Naval Nuclear Radiological Control Department is responsible for the following:

3.2.1 Conducting routine monitoring of work areas in which radiation is an actual or potential hazard to insure personnel safety and detect contamination of adjacent areas. [Sections 4 (except 4.3.2), 7 and 8].

3.2.2 Posting Controlled Access Areas with warning signs and labelling radioactive materials. (See Section 14 for details of required signs.)

3.2.3 Prescribing the anti-contamination clothing and equipment requirements based on the limits of Sections 6, 7.5 and 12.3 and the surveys conducted in accordance with Section 3.2.1.

3.2.4 Maintaining surveillance of all work in Controlled Access Areas to insure adherence to safe practice and approved procedure. The Department 22 monitor shall have the authority to stop work, involved with or affecting radioactive materials or systems, that is being conducted in an unsafe manner.

3.2.5 Issuing and collecting neutron film badges, anti-contamination clothing (plastic boots, nylon suits, plastic suits, etc.) and insuring that such items are properly worn. (Section 11). Changing film packs monthly or as required.

3.2.6 Evaluating hazards in the event of emergencies involving radioactive contamination or fire in a Controlled Access Area, and taking appropriate action for the safety of personnel present.

3.2.7 Establishing and maintaining a pocket dosimeter program. (Section 11.5 and Department 22 Form RC-4 in Section 14).

3.2.8 Collecting, storing and disposing of radioactive waste including necessary monitoring and record keeping (Section 9). Preparing and submitting to Department 4 an annual report of radioactive waste disposal. This report shall consist of a brief description of waste disposal operations including a summary of the total gallons and total curies of radioactive effluent discharged to the river from the shipyard (not including discharges directly from ships), and a simple map or sketch of the shipyard area showing the waste discharge points.

3.2.9 Conducting prescribed training programs in accordance with Section 10.

3.2.10 Establishing "Stay Time" limitations in Controlled Access Areas.

3.2.11 Reviewing and concurring in environmental monitoring measurements and reports.

3.2.12 Establishing and maintaining an adequate supply of special equipment and cleaning solutions necessary to limit personnel exposures, the spread of contamination and accomplish necessary decontamination.

3.2.13 Maintaining control of all contaminated equipment charged out to employees.

3.2.14 Taking such action as described in Section 8.2 in the event of injury to personnel within a Controlled Access Area.

3.2.15 Authorizing entry to Controlled Access Areas by completing the applicable sections of the radiation work permits presented. (See Department 22 Form RC-2, Section 14, for details).

[A] 3.2.16 Completing the radiation work permits, at the conclusion of each work shift, with the radiation exposure data and providing the completed forms to the cognizant supervisor.

[A] 3.2.17 Notifying the appropriate Department Heads, via Department 4, of any infraction of the requirements of this manual.

[A] 3.2.18 Maintaining a record of all persons (names, social security numbers and badge numbers) who are qualified to enter Controlled Access Areas.

3.3 Medical Department (Department 76) Responsibilities

3.3.1 The Medical Director has reviewed and approved all radiation exposure limits detailed in this manual as standards for the Naval Nuclear Program at N.Y.S.

3.3.2 The Medical Department is responsible for the following:

3.3.2.1 Acting in an advisory capacity for all Health Physics matters.

3.3.2.2 Scheduling and conducting medical examinations for those persons estimated by each Department Head to require qualification.

(a) Indicating on the check-off lists, that each Department Head will provide, those persons who are medically cleared.

(b) Forwarding the complete check-off lists to the appropriate Department Head with a copy to Dept. 22.

3.3.2.3 Providing Department 4 with a periodic IBM run-off of the Basic Input Card R-1 (Section 11.4.5) so that Department 4 may issue certification cards.

3.3.2.4 Providing and processing film badges; maintaining permanent records of film badge exposures and preparing personnel exposure records (Section 13) for submittal to the various activities, via Department 4.

3.3.2.5 Conducting environmental surveys for:

(a) Gross beta-gamma activity of weekly samples of river water from each end of the shipyard and in the vicinity where naval nuclear vessels are moored.

[B] (b) Gross beta-gamma activity of weekly samples of river bottom silt at two (2) points in the vicinity of where naval nuclear ships are moored and at two (2) control points well away from the location where these ships are moored.

(c) Gross beta-gamma activity of a weekly composite precipitation sample.

3.3.2.6 Preparing a brief description of the environmental survey measurements made, including a summary of the data, a comparison with previous results and possible explanations of any trends.

3.3.2.7 Preparing a simple map or sketch of the shipyard area showing locations of environmental sample points and ship moorings.

3.3.2.8 Submitting annually to Department 4 the data and information required by Sections 3.3.2.5, 3.3.2.6 and 3.3.2.7.

3.3.2.9 Concurring with approval of Department 4 for liquid radioactive waste disposal by N.Y.S. to the Delaware River, prior to such disposal (Section 9.3.3).

3.3.2.10 Determining the need for hospitalizing any personnel exposed to high doses of radioactivity or injured within Controlled Access Areas (Sections 5.3 and 8.22).

3.4 Departmental

Each Department Head is responsible for:

3.4.1 Estimating his needs for people qualified for work in Controlled Access Areas.

3.4.2 Contacting the Medical Director to schedule his personnel for special medical examinations.

[A] 3.4.3 Providing the Medical Director with a check-off list (in duplicate) indicating the names and badge numbers of the personnel selected for the required medical examinations.

3.4.4 Notifying his production supervisors of the names of those persons who are medically cleared or of the need to process additional personnel for qualification.

3.4.5 Maintaining accurate records indicating those persons within his department who are medically cleared and radiologically trained.

3.4.6 Maintaining an adequate pool of qualified personnel to prevent the need for emergency processing of additional personnel.

3.5 Supervisor's Responsibilities:

3.5.1 Briefing each of his workmen on the particular job to be accomplished in a Controlled Access Area so that the workmen may enter, do their jobs and get out in as short a time as possible.

3.5.2 Insuring that each of his workmen remains familiar with and follows the procedures necessary for the control of radiation and radioactive materials as presented in the formal training programs (such as the proper method for passing from a Controlled Access Area through a Control Point to an unrestricted area, Section 12.5).

3.5.3 Issuing to each employee under his control a work permit in duplicate for work in a Controlled Access Area. (See Section 14 for details on work permit). The carbon copies of each work permit will be returned to the supervisor daily so that subsequent work permits may be satisfactorily filled out.

3.5.4 Insuring that employees under his control have the required anti-contamination clothing and equipment and personnel monitoring devices as prescribed and issued by Dept. 22 prior to entering a Controlled Access Area.

3.5.5 Keeping personnel in Controlled Access Areas to a minimum.

3.5.6 Notifying Dept. 22 sufficiently in advance of operations requiring radiological control. (Section 4)

3.5.7 Notifying Dept. 22 of all spillages and incidents of possible contamination and taking emergency action if necessary.

3.5.8 Stopping any operation when Dept. 22 advises that such operations are radiologically unsafe.

3.5.9 Keeping employees with any break of the skin out of Controlled Access Areas.

3.5.10 Making sufficient preparations, under the guidance of Dept.22, for work on radioactive system components so that work can progress safely and without undue delay. (Section 7)

3.5.11 Maintaining records of personnel qualified for work in Controlled Access Areas from information received from their respective department head; maintaining records of exposure data from information obtained from Department 22 on the completed work permit form.

3.6 Individual Responsibilities:

Employees are responsible for the following:

3.6.1 Carefully following all oral and posted instructions concerning radiological safety issued by the cognizant radiological control monitor on duty and reporting to Dept. 22 the occurrence of any of the following incidents:

3.6.1.1 Exceeding the specified radiation exposure limit or dosimeter reading. (Section 11.5.1).

3.6.1.2 Damage to an exhaust system in a Controlled Access Area.

3.6.1.3 Damage to protective equipment or anti-contamination clothing.

3.6.1.4 Leaks in primary system.

3.6.1.5 Any spill of radioactive material or suspected radioactive material.

3.6.1.6 Damage to a radiation shield.

3.6.1.7 Any wound resulting in a break in the skin or incident where radioactive material may have entered a person's body.

3.6.1.8 Any fire, injury, or emergency in a Controlled Access Area.

3.6.2 Keeping daily radiation exposures as low as possible.

3.6.3 Minimizing the spread of contamination. (Section 7.8).

3.6.4 Maintaining good personal hygiene when working in a Controlled Access Area.

3.6.4.1 No eating, drinking, or smoking is permitted in a Controlled Access Area. Take no food or beverage into the area.

3.6.4.2 Keep hands away from face.

3.6.4.3 Wash hands and face before eating, smoking or toileting.

3.6.5 Cleaning up or having cleaned up any contamination which your work has caused.

3.6.6 Having a thorough understanding of the job and how it is to be done.

A 3.6.7 Obtaining their film badge from the film badge rack when the area in which they will be working requires that a film badge be worn. Returning their film badge to the appropriate rack at the conclusion of their work shift.

A 3.6.8 Obtaining neutron film badges and dosimeters from Department 22, wearing them as prescribed and assuring their safekeeping. (See Sections 11.2 and 11.3)

A 3.6.9 Obtaining required anti-contamination clothing and equipment before entering a Controlled Access Area. (See Sections 12.3 and 12.4.3)

A 3.6.10 Having all material, tools, hands, feet and clothing monitored before leaving a Control Point. (See Section 12.4.3 for description of Control Point; Section 7.7 for procedure for monitoring personnel).

A 3.6.11 Reporting to his supervisor any circumstances where there is doubt to the correct procedure or to the safety of the operation.

A 3.6.12 Returning dosimeters, anti-contamination clothing and equipment to Department 22 at the conclusion of each working shift.

4. RADIOLOGICALLY CONTROLLED OPERATIONS & REQUIRED RADIATION SURVEYS

4.1 General

For work in Controlled Access Areas and for work on contaminated materials or when excessive exposure to radiation or radioactive material is possible, radiological controlled procedures and surveys are required.

4.2 List of Radiologically Controlled Operations

4.2.1 Installation of neutron test sources.
4.2.2 Installation of reactor core.
4.2.3 Initial fill of reactor with water after core installation.
4.2.4 Initial approach of criticality.
4.2.5 Dockside operation of a reactor.
4.2.6 Entry into a reactor compartment at any time after initial criticality.
4.2.7 Making any opening into the primary coolant systems after initial criticality. Radioactive primary coolant systems include but are not necessarily limited to the following:

a. Main coolant
b. Coolant pressurizing
c. Coolant purification
d. Coolant charging and valve operating
e. Coolant discharge
f. Coolant pressure relief
g. Coolant sampling
h. Emergency cooling

i. Primary shield
j. Bilge drain
k. Aux. sea water
l. Sanitary tank

} These are not considered primary coolant systems but may be radioactively contaminated.

4.2.8 Discharge of radioactive fluid from primary coolant systems
4.2.9 Removal from the ship of any item which has been in contact with primary coolant after initial criticality or has otherwise been contaminated.
4.2.10 An operation after initial criticality which reduces the thickness of the primary or secondary shields or makes an opening in them.
4.2.11 Removal from the shield tank of any instrument or material after initial criticality.
4.2.12 Any change in level of the primary shield tank or other tank adjacent to the reactor compartment unless the tank is definitely known not to be part of the shielding.
4.2.13 Work on any contaminated item
4.2.14 Decontamination operations
4.2.15 Waste Disposal operations

4.3 Required Radiation Surveys

4.3.1 Radiation surveys are conducted with portable radiac equipment to determine radiation levels and are required to assist in minimizing personnel exposure to radiation. The following list constitutes the minimum requirement with regard to the number and type of surveys to be conducted. This list shall in no way limit the number of surveys which may be conducted, i.e., additional surveys shall be conducted if abnormal radiation levels are suspected or anticipated.

4.3.2 Initial Shield Survey.

Detailed measurements shall be made of gamma and neutron levels near the surface of the shield and at various locations throughout the ship. The objective of this survey is to show that the shielding is adequate and the radiation levels are satisfactory. The requirements of this survey are prescribed in T/P 786-5.2, NYS No. S-90-04-002.

4.3.3 Minimum Radiation Survey Requirements.

Situation		Survey	Minimum Frequency
4.3.3.1	Reactor Operation		
	Occupied spaces adjacent to secondary shield.	γ N_f N_t	Daily Weekly For high N_f
	Sampling stations (when taking reactor coolant samples)	γ	Each Event
	Engineering spaces - (particularly around the sampling stations, in passageways leading to other occupied areas of ship). - When not ventilating overboard (near air ejector exhausts).	SS AP gaseous air activity	Daily
	Non machinery spaces (particularly in messing areas).	SS	Weekly
	Additional (when abnormal levels are suspended). Outside ship when alongside a pier or another ship .	γ,N,A-P, gaseous air activity, SS. γ,N.	As appropriate to insure personnel will not receive significant doses.

Situation	Survey	Minimum Frequency
4.3.3.2 MAINTENANCE OPERATIONS		
Entry to reactor compartment after shutdown.	β-γ, Contin. A-P, SS	Entry
All accessible radioactive test sources. (See Section 7.6.6)	SS	Every 6 Months
Reactor compartment accessible after shutdown.	β-γ A-P SS	2/Shift Daily 2/Shift
4.3.3.3 CASUALTY OPERATION		
Loss of primary shield water - areas adjacent to secondary shield.	β-γ N_f	Each Event Each Event
Loss of solid shield - areas adjacent to lost shielding.	β-γ N_f	Each Event Each Event
High concentration of fission products in primary coolant - sampling stations and water chemistry areas.	β-γ A-P SS	Each Event Each Event Each Event
4.3.3.4 RADIOACTIVE WORK & SOURCE STORAGE FACILITIES		
Radiological control facility Sub Test Barge Temporary shop	β-γ A-P SS	2/Shift When in Operation
Source Storage Facility	β-γ N_t	Weekly
4.3.3.5 CONTROL POINTS & CHANGE AREAS		
Physical area.	β-γ SS	2/Shift 2/Shift
Personnel	β-γ	At Exit

β-γ = Gross Beta-Gamma
N_f = Fast Neutron
N_t = Thermal Neutron
A-P = Air Particle
SS = Surface Swipe
$\mu\mu c$ = micro micro curie

4.3.3.6 Surveys shall be required for all operations listed in Section 4.2 and shall also be conducted in radioactive material receiving areas.

4.3.3.7 Swipe survey requirements are detailed in Section 7.6.

5. EXTERNAL EXPOSURE LIMITS

5.1 The following maximum allowable exposure limits are to be applied at New York Ship. The limits indicated are based on recommendations of the National Committee on Radiation Protection and Measurements as contained in National Bureau of Standards Handbooks 48, 51, 59, 63, and 69 and are consistent with the latest recommendations of the Federal Radiation Council. These limits were selected so that no detectable biological effects would be expected even if exposure were to extend for a lifetime at these levels. Nevertheless, personnel should endeavor to maintain their own exposures as low as practicable, even below these limits.

5.2 External Radiation Exposure Limits

5.2.1 External Exposure of Whole Body and Critical Organs to Penetrating Radiation. For general exposures of penetrating radiation to major portions of the body and also exposures of certain organs (head, gonads, active bloodforming organs, lenses of eyes).

Yearly Limit* 5 Rem

* For each year in a person's life over age 18.

Quarterly Limit 3 Rem

Where calendar quarter is defined as 1 January through 31 March, 1 April through 30 June, 1 July through 30 September, or 1 October through 31 December.

Weekly Limit 100 MREM (Administrative limit to be applied at New York Ship).

UNDER NO CIRCUMSTANCES SHALL ANY EMPLOYEE AT N.Y.S., LESS THAN 18 YEARS OF AGE, BE OCCUPATIONALLY EXPOSED TO RADIATION.

5.2.2 Exposure to the Skin of the Whole Body.

Low penetrating radiation; betas and low energy (less than 0.1 MEV) gammas.

Quarterly Limit	10 Rem
Yearly Limit*	30 Rem

*For each year in a person's life over age 18.

Exposure to Extremities for Any Energy Betas or Gammas (Hands, forearms, feet or ankles).

Quarterly Limit	25 Rem
Yearly Limit	75 Rem

5.3 Emergency Exposure to Penetrating Radiation.

An accidental or emergency dose of 25 Rems to the whole body, occuring only once in a lifetime of a person, need not be counted in meeting the limits of Section 5.2. This emergency dose refers to an unexpected situation where a person may accidentally receive such a dose or where a person may deliberately take such a dose to save life or to prevent serious property damage. A person exposed to whole body radiation greater than 25 Rems in a single exposure shall be placed under medical observation. (The Medical Director shall determine whether hospitalization is required). Subsequent allowable exposures for such a person shall be determined on a case basis.

6. AIRBORNE RADIOACTIVITY

6.1 Airborne radioactivity may cause both external and internal radiation exposure to personnel. The external exposure being primarily from the radioactive gases; the internal exposure results primarily from breathing or swallowing suspended particles in the air. The limits provided below are designed to limit internal exposure to 1/10 the permissible external exposure limit, i.e., less than 10 mrem/wk. since the measurement of internal exposure is difficult and the biological effects of such internal exposures are not well known.

6.2 Airborne Radioactivity Limits.

6.2.1 The following tabulation indicates the respiratory equipment required when it is known that the airborne activity is from reactor operation.

Level of Airborne Activity	Equipment Required
GROSS β-γ: Less than 1×10^{-9} µc/ml	None
GROSS β-γ: 1×10^{-9} µc/ml up to 1×10^{-7} µc/ml	Respirators
GROSS β-γ: 1×10^{-7} µc/ml or greater	Air Supply Respirators

6.2.2 One tenth the limits of U.S. Department of Commerce, National Bureau of Standards, Handbook 69, for airborne activity shall be used when it is known that reactor operation is not causing the activity.

7. SURFACE CONTAMINATION AND CONTROL

7.1 Determination of Surface Contamination Radiation Levels.

7.1.1 Different types of surface contamination and varying background radiation levels require different monitoring.

7.1.2 Swipes shall be taken to determine levels of surface contamination when such contamination is loose and there is a high background level. (See Section 7.2 for procedure).

7.1.3 Survey meters may be used to determine levels of surface contamination when such contamination is loose and there is a low background level (Section 7.3), or such contamination is fixed. (See Section 7.4 for procedure).

7.2 Procedure for Taking Swipes.

7.2.1 Swipes (consisting of one dry piece of filter paper) shall be used to wipe loose surface contamination so that they can be counted to determine the contamination level.

When measuring loose contamination the filter paper should not be used wet or dipped in a detergent solution as this swipe would not be representative of the contamination spread by hands, feet or clothing in contact with the surface being measured for activity.

7.2.2 The Department 22 Monitor taking the swipe shall wear gloves to limit the contamination of his hands should the surface being swiped have a high contamination level.

7.2.3 The Department 22 Monitor shall wipe the dry filter paper over 100 square cm. of the surface in the area of highest expected contamination. When the surface to be examined is less than 100 square cm. then the entire surface shall be wiped when taking a swipe.

7.3 Counting of Swipes.

7.3.1 The standard method for counting beta-gamma activity of a swipe shall be to make use of the counting equipment in the Radiological Control Laboratory on board the Test Barge. (See NNEP 20-1 for details).

7.3.2 An alternate method for counting beta-gamma activity (when an approximate on the spot determination is desired) is to use the AN/PDR-27 or equivalent to measure the radiation dose rate from the swipe. (See NNEP 20-1 for details) This method shall normally be used only when contamination levels are very high. When measuring the swipe the AN/PDR-27 shall be located in a low background radiation level.

7.3.3 To determine the alpha activity of a swipe the AN/PDR-10 or equivalent shall be used. Normally alpha surface contamination for flat surfaces is obtained by simply holding the meter over the surface to be measured. However, when the surface is irregular or inaccessible to the meter, counting a swipe is necessary to determine the level of alpha surface contamination. The details for determining the alpha contamination level of a swipe shall be the same as the method used for determining alpha activity of reactor coolant. (See Refs. 15.8 for details)

7.4 Procedure for Measuring Fixed Contamination

Fixed contamination may be measured with the AN/PDR-27 with closed end window for gamma levels, with open window for beta-gamma level. The AN/PDR-10 or equivalent shall be used for measuring fixed alpha contamination levels. (See NNEP 20-1 for details)

7.5 Surface Contamination Limits

The radioactive contamination limits which define whether an area is uncontrolled or controlled are as follows:

7.5.1 Uncontrolled Area - An area in which the limits specified below are not exceeded.

7.5.1.1 Loose surface radioactive contamination limits

Beta-gamma	100 μμc/100 cm^2	Compartment surfaces & equipment, personal clothing, clean anticontamination clothing and skin.
Alpha	50 μμc/100 cm^2	

7.5.1.2 Fixed surface radioactive contamination limits.

Beta-gamma	on surface of equipment and on clean anti-contamination clothing, where <u>personnel are not continuously exposed</u>.	1 mrem/hr.
Beta-gamma	on compartment surfaces, equipment, personal clothing & skin where <u>personnel may be continuously exposed</u>.	0.1 mrem/hr. (above background)
Alpha	for clothing, skin, equipment and compartment surfaces.	less than 50 μμc/100 cm^2

7.5.2 Controlled Contamination Area - is any area in which the limits specified for an uncontrolled area are exceeded but which normally do not exceed the limits specified below.

7.5.2.1 Loose surface radioactive contamination limits.

Beta-gamma	1000 μμc/100 cm^2	*	Compartment surfaces, and equipment, anti-contamination clothing which personnel may touch.
Alpha	50 μμc/100 cm^2	*	

* When these limits are exceeded, the areas involved should be decontaminated as soon as possible to prevent the creation of significant levels of airborne radioactive contamination.

7.5.3 Fixed surface radioactive contamination limits.

The limits on the total radiation doses from fixed contamination or from the combination of fixed and loose surface contamination are contained in Section 7.5.1. When areas have average dose rates exceeding 1 mrem/hr. these areas shall be posted as radiation areas.

7.6 Frequency of Surveys for Monitoring Surface Contamination

Routine surveys of surface contamination shall be conducted as indicated in Section 4.3.3. The following additional surveys shall be conducted to determine the anti-contamination clothing requirements and to restrict the spread of contamination.

7.6.1 Swipes shall be taken in areas with high levels of airborne radioactivity to check for possible surface contamination.

7.6.2 Swipes shall be taken during maintenance operations before and after each decontamination procedure when detectable loose surface contamination exists. At least one swipe/working shift shall be taken for those operations extending beyond one work shift.

7.6.3 Swipes shall be taken during maintenance on components of steam systems if radioactive contamination is suspected as a result of leakage of reactor coolant through steam generators.

7.6.4 Swipes shall be taken where reactor coolant leaks have occurred.

7.6.5 Swipes shall be taken in the vicinity of any operation which could possibly spread contamination.

[A] 7.6.6 All accessible radioactive test sources, except alpha sources, shall be swiped for surface contamination every six months to check that the sources are not leaking. Accessible alpha sources shall be swiped for surface contamination every three months.

7.7 Procedure for Monitoring Personnel Contamination

7.7.1 Personnel are monitored for external radiation levels since this provides rapid verification that contamination will not cause significant external radiation doses to the body. Swipes shall not normally be used for determination of skin contamination as they may tend to imbed radioactive particles in the skin.

7.7.2 Personnel monitoring shall be performed when personnel leave contaminated areas, and when necessary during and after personnel decontamination.

7.7.3 Monitoring of personnel for surface contamination must be conducted in low activity background areas and will normally be accomplished with either of the following survey instruments, Model 2612M manufactured by Nuclear Chicago Corporation or the AN/PDR 27J manufactured by Chatham Electronics Division. The survey probe (with beta window open) shall be held about 1 inch from the body surface and moved slowly over the body. The lowest instrument scale (i.e., 0.0-0.2 mr/hr. for the 2612M, 0.0-0.5 mr/hr. for the AN/PDR-27J) shall be used for personnel monitoring. Personnel shall be considered contaminated if the survey instruments indicate levels higher than background activity as the probe is moved over the body.

7.8 Control Required to Minimize the Spread of Surface Contamination

7.8.1 In work with radioactivity, it is of great importance to reduce the spread of contamination, both to reduce personnel exposures and to reduce the cost and scope of decontamination operations. The following general procedures are designed to reduce the spread of contamination; additional procedures may be provided by Department 22 to meet specific situations. (Section 12 details the procedures and requirements for wearing anti-contamination clothing).

7.8.1.1 Do not unnecessarily touch a contaminated surface or handle contaminated equipment.

7.8.1.2 Do not allow clothing, tools, or any other items to come in contact with a contaminated surface.

7.8.1.3 When (required) contact is made with a contaminated surface with gloves or other items of clothing, avoid transferring radioactivity to other surfaces.

7.8.1.4 Avoid contact with primary coolant except as required to contain or control a spill.

7.8.1.5 Contaminated tools or components shall never be placed directly on a deck or work surface, but shall be placed on impervious materials such as polyethylene.

7.8.1.6 When contaminated tools and equipment are no longer required on the job, they shall be wrapped and sealed in polyethylene and removed from the work area as soon as practicable.

7.8.1.7 When work is being accomplished in a contaminated area, one of the workers should avoid contamination in order that he may handle packaging of contaminated items and their removal from the work area.

7.8.1.8 When any operation is planned which may generate radioactive dust, local exhaust ventilation shall be provided to efficiently collect the radioactivity. (See Section 7.10 for further details).

7.8.1.9 Contact Department 22 whenever any doubt exists as to the radioactive contamination level.

7.9 Preparation for Work on Installed Radioactive System Components

7.9.1 Area around the item to be worked shall be covered with sheet plastic and absorbent paper arranged to catch any spillage of radioactive water or dirt.

7.9.2 Where welding, grinding, or any other operation which may generate quantities of radioactive dust is to be performed; ventilation to contain the contamination shall be provided. (See Section 7.10.2).

7.9.3 Adequate supplies of polyethylene bags, wrapping materials, tape, rags, etc., shall be available at the place of work for wrapping contaminated items.

7.9.4 Adequate supplies of funnels, buckets, trays, absorbent rags or other materials shall be provided for catching and containing any minor spillage of radioactive water.

7.9.5 When the possibility exists of spillage of a substantial quantity of radioactive water, an air or electrically-operated pump shall be provided with the discharge connected to an adequate collection tank.

7.9.6 Radioactive systems shall be drained as completely as possible prior to start of work on them.

7.9.7 It is the responsibility of the lead department to accomplish preparation of 7.9.1 through 7.9.6 and to notify Department 22 prior to starting work.

7.10 Shop Work on Contaminated Material.

7.10.1 When work on contaminated material must be accomplished in a regular shop area, special measures are required to control the spread of contamination. Department 22 shall be consulted to assist in developing necessary control measures and must approve of the measures to be employed prior to use.

7.10.2 A Controlled Contamination Area shall be set up around the machine or space to be used. The minimum contamination control area shall consist of floor covering of herculite, a waist-high enclosure of the same material and appropriate warning signs. Where the spread of contamination is of greater concern, (contamination levels are higher), a complete enclosure will be required with exhaust ventilation. Ventilation systems shall consist of a prefilter (similar to oil burner filters) plus a filter that will remove particles as small as 0.3 microns.

7.10.3 Machine tools used shall be covered with plastic to the maximum extent possible to minimize clean-up problems.

7.10.4 Entry to, departure from, and work in this area shall be accomplished only under Department 22 supervision.

7.10.5 Anti-contamination clothing and personal monitoring devices shall be prescribed by Department 22.

7.10.6 The machine and area shall be monitored and decontaminated if necessary prior to normal use.

DECONTAMINATION

8.1 Personnel Decontamination Procedures.

8.1.1 Should contamination be detected on the person of any individual, when such individuals are leaving a contaminated area through a control point (see Section 12.4.3 for control point details) or at any other time personnel are monitored, immediate action shall be taken to remove the radioactive material. The first step taken normally will be to wipe the affected area with a clean cloth or Kimwipe. Clean anti-contamination clothing shall be issued to cover the area, and the individual shall be directed to a Decontamination Area, such as the Radiological Control Facility.

8.1.2 Minor contamination of the hands or forearms only, may be treated by washing and scrubbing the affected parts. Contamination found on other areas of the body will require showering with repeated soaping and rinsing. The hands should be thoroughly washed before cleaning of other areas of the body is attempted. Particular attention should be paid to the hair and fingernails.

8.1.3 Decontamination will be under the surveillance of a Department 22 Monitor, and will be continued until contamination is no longer indicated when using a properly calibrated AN/PDR 27J, 10 or 2612M. In the event that the contamination cannot be reduced to such a level, the Medical Department shall be contacted for assistance in the decontamination.

8.1.4 Should an employee's personal clothes become contaminated his clothes will be held for decontamination. (see Section 12.5.3 for additional details).

8.1.5 Additional details for decontaminating personnel with injuries are contained in Section 8.2.

8.2 Procedures for injured Personnel.

8.2.1 Minor Injuries -

8.2.1.1 For minor injuries resulting in a break of the skin occurring in any work area where Anti-contamination clothing is required, immediate action shall be taken to remove possible contamination from the wound. The employee shall notify the Department 22 Monitor who shall monitor the wound, advise the employee of the extent of contamination, and assist with decontamination. A contaminated wound should be washed under an abundance of flowing tap water, spreading the wound to insure complete watering of the entire wound surface. No amount of later scrubbing replaces early, thorough watering as a means of removing radioactive contamination.

8.2.1.2 As soon as emergency precautions have been taken to assure proper monitoring and decontamination, the employee shall receive prompt medical treatment.

8.2.1.3 If the nature of the wound is such that decontamination by watering is not possible, the wound shall be considered as a serious injury and action shall be taken as indicated below.

8.2.2 Serious Injury in Contaminated Areas

8.2.2.1 Personnel seriously injured and requiring emergency medical care shall be transported by ambulance to the Hospital without delay for decontamination. If the injury permits, contaminated outer clothing should be removed and the patient enclosed by a protective cover to prevent the spread of radioactive contamination prior to entering the ambulance. If the injury is such that removal of outer contaminated clothing would cause a loss of valuable time or possible further injury to the patient, the patient should be wrapped in a protective cover to prevent spread of radioactive contamination.

8.2.2.2 Seriously injured personnel shall, under no condition, be delayed for decontamination. A Department 22 Monitor shall accompany the seriously injured to the hospital in order to assist in limiting the spread of contamination. These cases shall be decontaminated and treated at the Hospital. The Medical Director shall determine the extent of the injury and decide if it is such that decontamination should be accomplished before transportation for treatment.

8.3 Material Decontamination

8.3.1 After a water-cooled reactor plant has been operated at power, components of primary systems will have become radioactive to various degrees. When it becomes necessary to perform repair work on components it will normally be advantageous to decontaminate such components to acceptable limits prior to working on them. During the performance of repair or maintenance on reactor plants, tools and equipment will become contaminated. These cannot be released for general use until fully decontaminated. Decontamination is a time-consuming, costly and sometimes ineffective process. When decontamination is required for maintenance of a reactor plant component, the cost and practicability of replacement should be considered. BuShips Instruction 9890.12 provides details for disposing of components and repair parts. For the same reasons, Chit Sheets and other instructions specifying reactor compartment decontamination, should clearly specify the limits required, the areas which are to be treated and those areas which need not be decontaminated. Decontamination shall be done only with Department 22 Supervision and in approved facilities.

8.3.2 Primary plant components being shipped should not be decontaminated unless specified by the cognizant engineer and approved by Department 22.

8.3.3 Tools and equipment must be decontaminated until the levels of contamination are below the limits of Sections 7.5.1.1 and 7.5.1.2 in order for unrestricted handling to be permissible. When this is not possible, the item may be retained in special storage for future radioactive jobs or disposed of as radioactive waste.

8.3.4 Reactor Plant Components Decontamination - Reactor plant components are controlled by the Bureau of Ships. If they require decontamination, it must be done in strict accordance with the procedures given below. No decontamination shall be attempted except as directed by the cognizant engineer and supervised by Department 22. When decontamination is desired, the cognizant engineer shall indicate the following:

8.3.4.1 The extent of disassembly required prior to decontamination.

8.3.4.2 The area of the component where decontamination is necessary or desirable; for example: "One inch valve, decon. nozzle interiors from outer end to four inches back from end. Decon. exterior overall."

8.3.4.3 Special precautions such as those relating to electrical components, unusual materials of construction, application of special seals or caps, or other precautions.

8.3.4.4 All radiation surveys and smear data shall be recorded by Department 22.

8.4 Material Decontamination Procedures

8.4.1 Initial Survey

Upon arrival in the decontamination area, the item shall be monitored by Department 22 and the following information recorded.

(a) External surface smear activity
(b) Internal surface smear activity
(c) Maximum gross beta-gamma activity, external surface
(d) Where distinctly different activity levels may be encountered on a given item (i.e., hydraulically operated valve), surveys should be made in each general type of area.

8.4.2 Materials and Methods

8.4.2.1 Decontamination shall be accomplished in accordance with the instructions contained in MIL-STD-711 (Ships). The following general information shall not remove the need to frequently refer to MIL-STD-711 (Ships) and other instructions such as MIL-C-19874 during the preparation of decontamination procedures and during decontamination operations.

8.4.2.2 Normally, decontamination is accomplished by soaking, wiping, brushing or scrubbing the surfaces involved with detergent or mildly acidic solutions.

8.4.2.3 Cloths, hand or motor operated brushes, natural or synthetic sponges, or stainless steel wool (Grade 000 or finer) may be used. Brushes of Synthetic fiber, tampico, or wire brushes with corrosion-resisting bristles of size less than 0.014 inch as specified in MIL-B-19888 (rotary) or MIL-B-2797 (hand) may be used. Abrasive materials may be used but only when approval from Dept. 4, Naval Nuclear Power Department is obtained. (See MIL-C-19874 for restrictions on the use of abrasive materials). These include silica, alumina, silicon carbide, pumice, or lava stone of 150 mesh or smaller particle size.

8.4.3 Solutions-The usual decontamination will make use of a detergent or a citric acid-EDTA solution-No decontamination solution shall contain more than 25 ppm chloride ion. However, acetone may be used in lieu of a detergent.

8.4.3.1 Quality of water to be employed:

Grade 1: Distilled or deionized water of not more than 10 ppm total solids, with a chloride content not greater than 1 ppm and a resistivity not less than 50,000 ohm-cm.

Grade 1 water shall be used for the initial immersion of components having crevices, in an effort to fill these crevices with pure water and prevent the entrance of the decontaminating solutions. Grade 1 water shall be used also for final rinses.

Grade 2: Water with a chloride content not greater than 25 ppm. Water of Grade 2 may be used to prepare the decontaminating solutions and for intermediate rinses. When this water is used to prepare solutions, the chloride of the final solutions shall not be greater than 25ppm.

8.4.3.2 Detergent Solution

This solution shall consist of 0.1 to 1 ounce of synthetic nonionic detergent (Specification MIL-D-16791) per gallon of water. It may be used at a temperature in the preferred range of 150 to 180°F or at a lower temperature. This solution may be employed for the preliminary washdown of a component to remove loose contamination.

8.4.3.3 Citric acid - disodium EDTA solution - This solution shall have the composition given below. It is prepared by dissolving the ingredients in hot water in the order given. It may be used at a temperature in the preferred range of 160° to 200°F, or at a lower temperature.

Disodium EDTA①	1 oz./gal.
Citric acid (Specification O-C-366)	1 oz./gal.
Synthetic nonionic detergent (Specification MIL-D-16791)	0.1-1 oz./gal.
pH②	3.0-4.5
Temperature	160-200°F
Normal immersion or scouring time	2-4 hours

① Disodium ethylenediaminetetraacetate (Chloride impurities should be low enough so that the chloride concentration of final solution will be less than 25 ppm).

② Adjust pH of only the initial solution with sodium hydroxide. (ACS reagent grade).

8.4.3.3.1 The citric acid - disodium EDTA solution should be applicable to any component without injurious corrosion. Decontamination with this solution shall be carried out by soaking and scrubbing the component.

8.4.3.3.2 Tests

The Grade 1 water shall be tested daily if delivered from a dockside supply. If from a tank, it shall be tested each time the tank is filled. (See NYS NNEP No. 12, Providing & Sampling Pure Water).

The pH of the citric acid-EDTA solution shall be checked daily. The chloride content of tank solutions shall be measured when first prepared. Each tank solution shall be tested for radioactivity during use. Department 22, with the approval of Department 4, NNPD, shall determine when decontamination solutions are no longer of any practicable use because of radioactivity levels.

8.4.4 Sequence of Operations

8.4.4.1 Remove outer wrappings, disassemble item as required and request Department 22 to conduct initial survey.

8.4.4.2 Rinse item with Grade 1 water to fill all crevices.

8.4.4.3 Scrub item with detergent solution or soak item in the solution with frequent scrubbing, for a period of one-half hour or longer.

8.4.4.4 Rinse with Grade 1 water and make smear surveys.

8.4.4.5 Repeat until smears show less than 100 micro microcuries per 100 sq. cm. on the exterior and on the specified interior surfaces, or no significant improvement is noted in three successive treatments. The item may be dried after each treatment prior to smearing if this is more convenient.

8.4.4.6 If the above-specified level cannot be reached, the item shall be wrapped in plastic and the cognizant engineer notified.

8.4.4.7 If the cognizant engineer so specifies, the operation shall be repeated with Citric acid-EDTA Solution.

8.4.5 Reports

A report of the decontamination of all primary plant components shall be forwarded to Naval Nuclear Power Dept. by Department 22. The report shall contain the following information: Identification of the component, initial contamination levels, contamination levels after each cycle of the decontamination process, and the process used.

8.5 Decontaminati of Shipboard Areas and F ioactive Work Facilities.

8.5.1 When shipboard or shipyard areas become contaminated, it will be necessary to take prompt corrective measures. Since the hazard to personnel and the cost to the shipyard increases in proportion to the size of the area involved, every effort should be made to prevent the spread of contamination. The affected area should be roped off or entry otherwise prevented and decontamination begun as soon as possible. In some cases the area may be covered or wrapped with a plastic film to prevent spread of contamination. Although dependent on the type of decontamination processes, work in nearby areas is not necessarily precluded.

8.5.2 Method - Removal of radioactivity will almost always be accomplished by scrubbing and wiping with appropriate cleaning solutions. Wiping and brushing should be from the outer part of the area toward the inner. The final wipe should be a single wipe with a previously-unused cloth.

8.5.3 Solutions

For most surfaces which are to be decontaminated, NAVSHIPS 250-342-1, "Handbook of Cleaning Practices" gives acceptable cleaning methods for various kinds of surfaces. For most surfaces a water solution of one ounce per gallon of non-ionic detergent (MIL-D-16791) is suitable and harmless. Rusty, rough, porous and many painted surfaces may prove very difficult to completely decontaminate. In these cases, special measures may be required.

8.6 Decontamination of Tools and Equipment

8.6.1 Tools and equipment requiring decontamination can ordinarily be decontaminated by the same methods useful in cleaning these tools. The materials and methods of Section 8.4.2 may be used. In particular, grease removal using tri-sodium phosphate or sodium metasilicate, 8-12 ounces per gallon of hot water will be generally useful. Avoid excessive contact with the skin and particularly splashing in the eyes. Use face shield, and for protecting hands use rubber gloves. Electrical equipment can best be cleaned, when approved by the cognizant engineer; using non-ionic detergent, one ounce per gallon of water, followed by a thorough rinsing in pure water and drying.

9. RADIOACTIVE WASTE

9.1 General

9.1.1 This section provides instructions for the treatment and processing of those radioactive wastes under the control of the shipyard which will result from the operation, repair, or maintenance of naval nuclear propulsion plants.

9.1.1 (Continued)

Radioactive wastes are defined as those unwanted or unusable solids and liquids, which contain radioactivity, or have become radioactive.

9.1.2 Department 22 is responsible for the collection, packaging, storage, and disposal of radioactive waste.

9.2 Solid Radioactive Waste

9.2.1 Definition

Solids will be considered to be radioactive if they show a contamination level in excess of the limits of Section 7.5.1.

9.2.2 General

Solid radioactive wastes will consist mainly of:

9.2.2.1 Primary plant components and piping.

9.2.2.2 Contaminated tools and equipment for which the replacement cost is less than the cost of decontamination.

9.2.2.3 Spare components and repair parts - for disposal and processing of such items reference shall be made to BuShips Instruction 9890.12.

9.2.2.4 Various wrappings and coverings which have become contaminated.

9.2.2.5 Rags, brushes, etc., which have become contaminated during decontamination and cleaning operations.

9.2.3 Collection

Dry contaminated items requiring disposal will be wrapped in an impervious material (plastic sheet, barrier paper, Herculite, etc.) prior to removal from the radiation area and transferred to a specially designated storage or packaging area. If water may be present in wet items so that dripping is possible, the items must, in addition, be enclosed in a water-tight metal container.

9.2.4 Packaging of Solid Radioactive Waste

9.2.4.1 Solid wastes shall be packaged in fifty-five gallon metal drums provided with lids, locking rings and gaskets or other containers approved by Dept. 22 and the Naval Nuclear Power Department. These containers shall be marked prior to filling, with labels indicating that the contents are radioactive. Items packed may be damp but should be free of appreciable liquid water. After filling, the lids shall be put on and the locking rings installed and firmly bolted. The drums should be filled as tightly as possible without regard to weight or activity except that:

9.2.4.1 (Continued)

(a) Radiation at surface must be less than 200 mr/hr.

(b) Radiation at one meter (39.4 inches) from surface must be less than 10 mr/hr.

(c) See Sections 9.4.7 and 9.4.8 for additional requirements for shipment by U.S. Mail, Air, Rail or truck.

9.2.4.2 Some items of solid waste may not fit into 55 gallon drums. These items must first be wrapped in polyethylene and then in canvas or herculite.

9.2.5 Disposal of Solid Radioactive Waste

9.2.5.1 No primary components shall be disposed of except on specific direction of the Naval Nuclear Power Department.

9.2.5.2 Packaged radioactive waste will be disposed of to a commercial AEC licensed disposal activity only. See Section 9.4.2 for records required.

9.2.6 Primary Plant Demineralizer Resin

After power operations, the primary plant demineralizer becomes highly radioactive. When it is necessary for a nuclear-powered vessel to discharge such resin in port, the resin and the water associated with it must be collected. The collection and disposal of this resin must be accomplished in accordance with special procedures provided by the Naval Nuclear Power Department and approved by Department 22. This resin is the most radioactive solid waste which requires collection by the shipyard and every care should be exercised in its collection and disposal. Appropriate special containers and shields will be provided.

9.2.7 Special Cases

Special cases will arise where, due to unusual size, weight, or high radiation levels, the procedures above are not possible, or are not appropriate. These cases will be covered by special procedures prepared by the Naval Nuclear Power Department and having Department 22 approval.

9.3 Liquid Radioactive Wastes

9.3.1 General

Radioactive liquid wastes will be generated and require disposal when:

9.3.1.1 It is necessary to collect primary coolant discharged from a nuclear vessel, i.e., ship is in dry dock or activity levels exceed the limits of Reference 15.2.

(Continued) Dir[illegible] overboard discharge of [illegible]imary coolant water into the Delaware River, due to heat up of the reactor plant is the responsibility of the ship's crew; & will be accomplished in accordance with Reference 15.2.

9.3.1.2 During a radioactive resin collection operation.

9.3.1.3 During decontamination operations. All radioactive liquid wastes must be collected and analyzed prior to disposal.

9.3.2 Collection

Liquid wastes shall be collected in specially-designated storage tanks. All attachments and fittings shall be in first class, leak-tight condition. A means shall be provided for determining the liquid level in the tank. The tank shall be marked to show that it is for radioactive liquid collection and it shall be used for no other purpose. Whenever possible, wastes of high and low activity shall be kept separate to simplify disposal procedures.

9.3.3 Disposal

Radioanalysis of liquid waste is the responsibility of Dept. 22. Liquid radioactive waste will be disposed of to a commercial AEC licensed disposal activity or will be discharged into the Delaware River. Under no circumstances will liquid radioactive waste be discharged into the Delaware River by NYSC without prior approval of the Naval Nuclear Power Department and the Medical Director, NYSC shall meet the requirements of the New Jersey Radiation Protection Code, Chapt. 1, Sections 7.2, 7.3, 7.5, & 13 when discharging radioactive liquid waste to the Delaware River.

9.4 Procedure for Receiving, Transferring, Shipping of Radioactive Material.

9.4.1 This section provides the procedures required for controlling radioactive materials received, transferred at N.Y.S., and shipped from N.Y.S. Strict radiological control procedures are required for such materials to minimize the internal and external radiation exposure of personnel and to prevent the uncontrolled spread of radioactivity to areas where it might affect the public.

9.4.2 Records required for radioactive materials received at N.Y.S. or to be shipped from N.Y.S.

(a) Description of material
(b) Time and date material was received or shipped.
(c) Origin shipped from, or destination shipped to, including the name of the individual responsible for the material at its destination and reference to his license or authorization.
(d) Method of transportation (truck, rail, U.S. Mail, etc.).
(e) Method of packaging (for example, unit sealed in a plastic bag within a wooden box).
(f) Type of label affixed.
(g) Estimated highest radiation dose rates at the surface of the material and measured radiation dose rates on the

9.4.2 (Continued)
(g) surface of the package.
(h) Estimation of the most significant radionuclides and number of curies thereof.

9.4.3 Records required for radioactive materials transferred within NYS.
(a) Description of material.
(b) Time and date, movement was begun _____, completed _____.
(c) Movement took place from _____ to _____.
(d) Movement accomplished by _____(i.e., truck, rail).
(e) Movement controlled by _____, (Department 22).
(f) Level of activity of item being moved _____ measured $\approx$ 1" from surface of item.
(g) Level of activity of package _____.
Item shall be tagged with NYS Form 22RC-1 Part B of Form 22RC-1 shall be removed when movement is begun. Strict accountability must be maintained for all radioactive material (including contaminated tools and equipment until such time as they are decontaminated or disposed of as waste in accordance with Sections 8.6 or 9.2). "B" stubs shall be checked against "A" stubs at the conclusion of each working shift. When movements have been completed the "A" stubs shall be removed by Department 22. Form 22RC-1 shall be completed for all movements of radioactive or contaminated material except when the initial and final positions of the object are within the same facility or control area and the object does not leave the facility or control area during the move.

9.4.4 Removal of Radioactive Material from a Ship

9.4.4.1 All material being removed through the ship shall follow a route which has been approved by the Ship's Medical Officer.

9.4.4.2 All material which is removed from a radioactive contaminated area will be monitored and assumed to be contaminated. It will be wrapped in polyethylene and labeled by a Department 22 Monitor. (See Section 14 & 9.4.3 for details on required labels and tags.)

9.4.4.3 The material of the above paragraph will be taken to the Radiological Control Facility where it will be processed as directed by Department 22 under the cognizance of the Naval Nuclear Power Department.

9.4.4.4 Department 22 shall maintain control of contaminated equipment charged out to employees.

9.4.4.5 Radioactive Liquids shall be removed in capped containers or by pumping to a collection tank outside the ship.

9.4.4.6 Where dripping of water is possible, ends of pipe or components shall be sealed. In some cases, it will be advantageous to package rags or other absorbent material with the component so that spillage is confined.

9.4.4.7 Incidental contamination of Ship's surfaces shall be cleaned as necessary.

9.4.5 Transportation of Radioactive Material

Within the shipyard the vehicle that is used must be appropriately covered with plastic or other impervious material in the areas where the item being transported could contact the vehicle and transfer activity to it. The vehicle used shall bear standard radiation warning signs, and the material shall be deposited only in an area designated for radioactive items. If any loose contamination is present in or on the item, appropriate plugs, caps, wrapping and containers will be required to contain the activity.

9.4.6 Procedures for Shipping Radioactive Materials

9.4.6.1 Radioactive materials shall be shipped or transferred only to persons or facilities licensed or authorized to receive these materials.

9.4.7 Shipment by U.S. Mail

9.4.7.1 Low-level radioactive materials such as samples of reactor coolant for laboratory analysis may be shipped by U.S. Mail.

9.4.7.2 Records shall be maintained in accordance with Section 9.4.2. above.

9.4.7.3 The following requirements contained in the U.S. Postal Regulations must be met. For additional detailed requirements reference should be made to U.S. Postal Regulations.

a. Radioactive materials (liquid, solid, or gaseous) should be packaged in strong, tight containers and marked "Radioactive Material - Gamma Radiation at Surface of Parcel less than 10 Milliroentgens for 24 hours - No Significant Alpha, Beta or Neutron Radiation." This radiation limit should be met.

b. The package should contain not more than 100 μc of radium, or polonium; or 135 μc of strontium 89, strontium 90, or barium 140; or 1350 μc of any other radioactive substance.

c. The package should not leak radioactive materials under conditions normally incident to transportation in the mails in sacks. Liquids should be packed in tight glass, earthenware, or other suitable inside containers surrounded by an absorbent material sufficient to absorb the entire liquid contents.

9.4.8 Shipment by Air, Rail, or Truck.

9.4.8.1 Radioactive materials being shipped by rail, or truck should meet the requirements of the Interstate Commerce Commission which are contained in the Code of Federal Regulations Title 49, Parts 71 to 78. Regulations for air shipments are contained in the Code of Federal Regulations Title 14, Part 49. The requirements of these codes are summarized below; for additional detailed requirements reference should be made to the indicated codes.

9.4.8.2 Packages of radioactive materials meeting the provisions of Section 9.4.7.3 above may be shipped by air, rail or truck.

9.4.8.3 Radioactive materials meeting the following requirements may be shipped by air, rail, or truck.

9.4.8.4 Maximum quantities of radionuclides in one package are 2 curies of radium or polonium, and 2.7 curies of other nuclides.

9.4.8.5 Dose rates should not exceed 200 mrem/hr. on the surface of the package, or 10 mrem/hr. at 1 meter from the radioactive material, or 0.5 mrem/hr. 15 feet from the package.

9.4.8.6 The radioactive material should be packed in containers approved by the Interstate Commerce Commission or the Bureau of Explosives. (Approved types of containers are described in Code of Federal Regulations Title 49, Part 78. Section 9.4.7.3C for packaging liquids applies).

10. TRAINING

10.1 The training programs to be given at NYS, for personnel who will be directly or indirectly involved with radioactive materials, are outlined below. The scope of each program is designed to meet the needs of the individuals who will be required to attend.

B 10.2 Program I

Basic Course in Radiation Safety and Controls - Topics to be presented are:

10.2.1 Fundamentals of Radioactivity and Radiation Hazards (including discussion of biological effects) .

10.2.2 Introduction of Health Physics (relation of Department 22 i.e., controlling activity for all work involving radioactive materials).

10.2.3 Maximum Permissible Exposure Limits (External and internal limits, methods for controlling exposure, individuals responsibility to keep exposure to a minimum).

10.2.4 Contamination and Contamination Control (Description of loose and fixed contamination, basic procedures and need to prevent the spread of contamination, anti-contamination clothing, basic decontamination procedures).

10.2.5 Personnel Monitoring (proper use of film badges and dosimeters) Radiological Control Rules and Regulations.

10.2.6 This course will be presented in the form of two (2) one and one half (1½) hour lectures. This course shall be given to all tradesand personnel who have not had previous training, or indoctrination in this field.

B 10.3 Program 2

Comprehensive Course in Radiation Safety and Controls - topics to be presented are:

10.3.1 Fundamentals of Radioactivity -
(Types of radiation, atomic structure, radioactive decay)

10.3.2 Radiation Hazards and Biological Effects -
(Internal and external effects, genetic effects, rates of exposure, protection from exposure)

10.3.3 Maximum Permissible Exposure -
(External and internal limits, critical and noncritical organ doses, emergency doses, whole body vs. fractional body dose limits)

10.3.4 Contamination and Contamination Control -
(Types and sources of contamination, anti-contamination clothing, handling of contaminated material, decontamination procedures)

10.3.5 Personnel Monitoring -
(Types of monitoring devices, operating principles of monitoring devices, exposure records and reporting procedures, rules for wearing personnel monitoring devices)

10.3.6 This course will be presented in the form of two (2) two (2) hour lectures and shall be given to supervisors, Naval Nuclear Test Group Personnel, and other personnel as selected by Department 4; except that for training of emergency monitoring personnel (Program 3) the course will be presented in the form of five (5) two (2) hour lectures.

10.4 Program 3

Course in Monitoring Techniques
A prerequisite to this course shall be : satisfactory completion of Program 2.

10.4.1 Portable survey instruments - description and use.

10.4.2 Anti-Contamination clothing - proper use and handling.

10.4.3 Laboratory instrumentation and simple counting procedures.

10.4.4 Field use of monitoring and counting equipment.

10.4.5 This course will be presented to selected personnel i.e., Department 17 inspectors who in the event of an emergency or high work load period will act in the capacity of junior monitors. This program, with emphasis on the field use of equipment, will be repeated as necessary to insure that such personnel remain completely familiar with monitoring techniques.

10.5 Certification cards will be awarded for each of the training programs, (see sheets 73, 74 for sample certification cards), to those persons who demonstrate their understanding of the subject material presented.

10.6 NNRC Monitor Qualification and Training

[A] 10.6.1 All permanently staffed NNRC monitors must be physically and mentally capable of handling all health physics duties and must also be able to effectively handle fundamental algebraic expressions. To insure that each monitor can effectively meet his responsibilities, each monitor shall be trained, as necessary, and must satisfactorily complete the formal qualification detailed in Reference 15.11.

11. PERSONNEL MONITORING EQUIPMENT

11.1 Film badges and pocket dosimeters are worn, by personnel in areas where exposure to radiation is known to exist or is expected to reduce the possibility of receiving radiation doses in excess of the limits specified in this manual. Photographic film badges (described in Section 11.2) provide means for legally determining dosages received since a permanent record is obtained. Pocket dosimeters provide a means of immediately (without waiting for film badges to be developed) determining dosages received and supplement film badges in higher radiation areas.

11.2 Photographic Film Badges

[B] For administrative purposes at N.Y.S. film badges are to be worn in any area where the radiation level is above 2.5 mr/hr. when an individual is expected to receive a dose above 25 mrem/wk., or as directed by NNRC Department. The film packet normally will be fitted with a film pack which is sensitive to beta gamma radiation. The beta gamma dose is determined by developing the film and measuring the density of the film with a densitometer. When there is a possibility that personnel will be exposed to neutron radiation,

an additional film pack can be placed in the same holder in order to determine the amount of neutron radiation received. To evaluate neutron radiation, the tracks left in the neutron sensitive film by particles recoiling from neutron collisions must be counted individually under a microscope.

11.3 Pocket Dosimeters

Dosimeters shall be worn in areas where radiation levels exceed 5 mr/hr and as prescribed by Dept. 22. A dosimeter is essentially a electrostatic ionization chamber which contains a fiber electroscope and provides a direct means for reading dosage. Pocket dosimeters are approximately the size and shape of fountain pens. The fiber is positively charged with respect to the barrel of the dosimeter and when fully charged will indicate zero on the scale built into the barrel. As radiation produces ionization within the barrel, part of the electrostatic charge leaks from the fiber to the barrel and the position of the fiber relative to the barrel changes in proportion to the amount of radiation the dosimeter has received. By holding the dosimeter up to a light and looking through the eye piece lens the image of the fiber can be seen against the built in scale calibrated in mr. Because dosimeters will not retain the initial electrical charge for prolonged periods, dosimeters should be freshly charged one or two days prior to use.

11.4 Film Badge Details

[A] 11.4.1 Issue

A shed located adjacent to the Guard Force Security Shack (at the head of Pier 2) will be used to rack all film badges and will also contain a status board to indicate those areas for which film badges or additional equipment are required for entry. NOTE: A work permit is not required to obtain a film badge but is required to obtain any additional personnel monitoring devices or any additional equipment which may be required.

11.4.2 Wearing Rules

Film badges shall never be tampered with or opened. If the badge is inadvertently opened or otherwise damaged, it must be returned to Dept. 22 immediately. Film badges fitted with Beta-gamma film packets shall be worn as follows:

11.4.2.1 By all persons entering any controlled access areas.

11.4.2.2 By all persons handling radioactive materials or engaged in decontamination operations.

11.4.2.3 Only by the person to whom it is specifically issued.

[B] 11.4.2.4 By all persons in areas where the radiation level is above 0.5 mr/hr.

[B] 11.4.2.5 By all persons who are likely to receive a dose in excess of 25 mrem/7 consecutive days.

11.4.2.6 By all persons who will be working within the machinery spaces or who will frequently enter these spaces.

11.4.2.7 By all persons conducting the initial shield surveys.

11.4.2.8 Film badges fitted with neutron film packs (in addition to Beta-gamma film packs) shall be worn by all persons requiring frequent access near the secondary shield, handling neutron sources or conducting the initial shield survey.

11.4.2.9 By all persons instructed to do so by Department 22.

[A] 11.4.2.10 On the outside of the clothing (except as noted below) on the upper part of the body. When Grade "A" considerations or radioactive contamination considerations require some form of coveralls film badges shall be worn underneath these coveralls to prevent:

(a) the film badges from inadvertently entering a primary coolant system

(b) possible contamination of the film badge.

11.4.3 Visitor's Badges

11.4.3.1 Visitors to the Shipyard, or others requiring a one-time entry to a Controlled Access Area must be issued a Visitor's film badge by Department 22. In order to expedite film badge issues to these persons, advance notification of their need should be given to Department 22.

11.4.4 Film Badge Processing

Film badges will routinely be developed and evaluated on a monthly basis by CON-RAD. However, when the possibility of high exposures has existed or neutron film has been placed in the badge, film shall be developed as necessary to keep personnel exposures within the limits detailed in this manual.

11.4.4 (continued)

It is especially important to process neutron film as soon as possible after a suspected high dose (no later than two weeks) as the film tracks fade.

11.4.5 Film Badge Record System

11.4.5.1 Basic Data Input Card R-1

This card notes social security number, NYS employee identification number, date of birth and name. For NYS employees this card is obtained automatically from a set of IBM cards which print paychecks.

For non-NYS employees the data is keypunched manually. Navy personnel cards are keypunched with name, rank, serial number and date of birth. Subcontractors and other federal employees are keypunched with name, job title, social security number, company or federal agency and digital code for sorting.

11.4.5.2 Laboratory Processing Card

These cards become part of the legal record of exposure and are filed by year and quarter as NYS permanent records. A set of cards accompany the film packets to the CON-RAD laboratory where the exposure information is written on the card. Upon return of the cards to NYS the exposure information is keypunched. These cards may be sorted into occupational groups by NYS department numbers, into groups such as NYS, USN and subcontractors, or may be sorted to determine less than or more than a given exposure in a given period.

11.4.5.3 Warning cards

These cards are sent when exposure accumulations either weekly or quarterly are in excess of 100 mrem or 1250 mrem (NYS administrative limit) respectively. They are distributed to Depts. 4, 22 and 76 (visible card rack in film. badge office). The appropriate action to be taken shall be indicated as either of the following:

1) Caution - alter work schedule to reduce exposure to _____ mrem/wk.

2) Investigate working procedure and outline corrective measures.

11.4.5.3 (Continued)

3. Stop all possible exposure by not permitting employee inside any controlled access area until _____ at which time his average for a 13 week period will be satisfactory.

Upon receipt of a warning card Dept. 22 shall investigate the situation and shall submit a written report to Department 4.

11.4.5.4 IBM equivalent of AEC-4 form.

These cards contain prior total exposure as estimated by 10CFR20 formula or actual exposure.

11.4.5.5 Annual report card

These cards indicate the exposure for the year in millirems, and contain advice and phrases required by 10CFR20. Automatic printout methods produce these cards.

11.4.5.6 Tabulator - printer reports

These reports printed at a quarter ends, year ends and contract ends are available for annual reports to appropriate agencies with special copies for subcontractors.

11.4.6 Procedure for Lost Film Badges or Dosimeters

If a film badge or dosimeter is lost in a Controlled Access Area, it must be reported to the NNRC monitor immediately so that the person concerned will have a minimum of unknown exposure. If a film badge is lost outside of a Controlled Access Area, report to NNRC on the Test Barge. Do Not attempt to use another person's badge. This will only result in the other person getting a false exposure record and is no protection for the person whose badge is lost.

11.5 Pocket Dosimeter Details

A 11.5.1 Issue

Pocket dosimeters shall be issued by Department 22, who will maintain records of dose on a daily basis. The wearer is expected to read the dosimeter at intervals (except under the condition cited in Section 11.5.2.3) to insure that the dosimeter reading does not exceed half scale (100mr).

11.5.2 Wearing Rules

Dosimeters shall be worn as follows:

11.5.2.1 By all persons in areas where the radiation levels are in excess of 5 mrem/hr. (N.Y.S. administrative limit).

11.5.2.2 By all persons entering the boundaries of the secondary shield at any time after initial criticality.

[A] 11.5.2.3 On the outside of the clothing (except as noted below) on the upper part of the body. When Grade "A" considerations or radioactive contamination considerations require some form of coveralls, dosimeters shall be worn underneath these coveralls to prevent:

a) the dosimeters from inadvertently entering a primary coolant system

b) possible contamination of the dosimeter

Under such conditions Dept. 22 shall carefully enforce "stay time limits" and shall insure that dosimeters are read each time individuals working under these conditions leave the controlled area.

11.5.2.4 By all persons instructed to do so by Department 22.

12. ANTI-CONTAMINATION CLOTHING AND EQUIPMENT

12.1 Purpose

Anti-contamination clothing and equipment serves to protect personnel both externally and internally from radioactive contamination. Anti-contamination clothing shall be stenciled with"NNRC" and shall be numbered consecutively to distinguish it from that clothing which is worn in clean areas (non-radioactive). Department 22 is responsible for maintaining anti-contamination clothing and equipment and for specifying required wear.

12.2 Types of clothing and equipment

12.2.1 Anti-contamination clothing consists of the following:

(a) Coveralls - nylon; front closure is by zipper; no cuffs, pockets or side slits.

(b) Shoe covers - plastic; elastic top.

(c) Gloves - nylon

(d) Gloves - rubber

(e) Caps - nylon

(f) Hoods - nylon

(g) Suit - plastic: 2 piece

12.2.2 Protective equipment consists of the following:

12.2.2 (a) Respirators - half face masks with high efficiency mechanical filters: full face masks with high efficiency mechanical filters and air supplied.

(b) Breathing apparatus: self-contained with full face mask and air tank.

12.3 Rules for wearing anti-contamination clothing and equipment

12.3.1 The basic uniform (coveralls, shoe covers, nylon gloves and a head cover) shall be worn when:

(a) Surface contamination levels in excess of the limits detailed in Section 7.5.1 exist.

(b) Maintaining Grade "A" clean conditions during such operations as described in Section 4.

12.3.2 In addition to the basic uniform, rubber gloves shall be worn when handling radioactive contaminated materials under wet conditions and also when surface contamination limits are in excess of those specified in Section 7.5.2.1.

12.3.3 Plastic suits shall be worn when splash hazards from contaminated liquids exist.

12.3.4 Respirators are required in all operations involving airborne radioactivity levels in excess of 1×10^{-9} µc/ml. (See Section 6 for required types of respirators for different levels of airborne activity).

12.4 Issue

12.4.1 Anti-contamination clothing and equipment will be issued in a plastic bag by NNRC on the Test Barge. Each suit is numbered and marked "NNRC".

12.4.2 Personnel who are issued anti-contamination clothing must empty their pockets and place the contents in lockers provided on the Test Barge. They will then proceed to the "Control Point" in the immediate vicinity of the reactor compartment or other controlled access area in which work is to be performed.

12.4.3 A Control Point is a sort of anteroom between work areas containing radioactive materials or equipment, and free access areas. Entry to and exit from controlled access areas shall be through the Control Point only. A Control Point will consist of (at least) a piece of Herculite or heavy film polyethylene placed on the deck and normally will also consist of polyethylene film placed over a simple frame to form walls around the area.

12.5 Controlled Access Areas (Engry and Exit)

12.5.1 Entry - Personnel requiring entry to the controlled access areas will change into anti-contamination clothing at the Control Point. Sleeves of coveralls shall be taped to gloves and legs of coveralls shall be taped to shoe covers to prevent entry of contamination beneath the anti-contamination clothing. Personnel may wear such clothing of their own as they wish for comfort under anti-contamination clothing.

12.5.2 Exit - Personnel leaving the controlled access area shall remove anti-contamination clothing within the Control Point under the supervision of a NNRC Monitor. The normal procedure for removal of anti-contamination clothing is as follows:

12.5.2.1 Remove rubber gloves, leaving nylon gloves on.

12.5.2.2 Remove head cover.

12.5.2.3 Remove coveralls inside out.

12.5.2.4 Remove one shoe cover (when this has been accomplished care should be taken not to step onto the deck covering within the Control Point when placing this leg into free access area).

12.5.2.5 Remove other shoe cover and step outside Control Point.(Do not step onto deck covering within Control Point once shoe covers have been removed).

12.5.2.6 Remove nylon gloves and place in receptacle.

12.5.2.7 Receptacles (usually 55 gallon drums) shall be provided for used anti-contamination clothing within the Control Point.

12.5.3 Each employee shall be carefully monitored after he has removed his anti-contamination clothing. In the event an individual is found to be contaminated he shall don a clean set of anti-contamination clothing and then proceed to the personnel decontamination area for decontamination. Should an individual's personal clothing be contaminated, it shall be held for decontamination, and later returned to the employee if possible. When an individual's clothing is held for decontamination, he shall be issued clean coveralls so that he can continue work or return home after he has been checked for contamination and decontaminated as necessary.

12.6 Laundering and Processing of Anti-contamination Clothing

12.6.1 Used, contaminated anti-contamination clothing shall be placed in containers suitable for shipment, sealed and appropriately tagged. These containers shall be transported under the supervision of NNRC Dept. to a storage and pick-up point.

12.6.2 Returned, laundered, anti-contamination clothing shall have acceptable limits of contamination. There shall be no removable contamination. The fixed beta-gamma activity shall not exceed a general reading of 0.2 mr/hr with no more than a few small spots up to 1.0 mr/hr. No clothing will be accepted from the laundry service if it comes back to New York Ship with a higher radioactivity than when it left. Clothing after laundering will be packaged in plastic bags and stocked in specially designated storage areas. New clothing will be kept separate from used clothing.

13. REQUIRED REPORTS AND RECORDS.

13.1 The following agencies require that N.Y.S.C., as an activity which will be engaged in work with radioactive materials, submit reports and maintain records:

Atomic Energy Commission
Bureau of Ships (Code 1500)
Bureau of Medicine and Surgery
New Jersey State Department of Health

13.2 The categories for which each agency requires a report/s or record/s are indicated below, along with the applicable sections of the appropriate reference which detail the specific report/s or record/s required.

13.3 Atomic Energy Commission Required Reports and Records (The requirements of this section pertain to those radioactive materials "owned" by Dept. 22 which are licensed by the AEC. (i.e, Gamma, neutron and alpha sources used to calibrate Department 22 survey equipment).

13.3.1 Personnel radiation exposures (Section 20.401, Reference 15.5).

13.3.2 Reports of theft or loss of licensed material (Section 20.402, Reference 15.5).

13.3.3 Notification of incidents (occurance involving a by-product, source or special nuclear material possessed by N.Y.S.C. which has caused or threatens to cause; overexposures, release of radioactivity, damage to property) (Section 20.403, Reference 15.5).

13.3.4 Reports of overexposures and excessive levels and concentrations (written report in addition to requirement of Section 13.3.3 above.) (Section 20.405, Reference 15.5).

13.3.5 Report to former employees of exposure to radiation (Section 20.404, Reference 15.5).

13.3.6 Notice to employees of exposure to radiation (Section 20.406, Reference 15.5).

13.3.7 Disposal of licensed material (Section 20.301, 20.302, 20.303, 20.304, 20.305, Reference 15.5).

13.4 Bureau of Ships (Code 1500) Required Reports and Records.

13.4.1 Environmental survey and summary of waste disposal (References 15.3 and 15.4).

13.4.2 Reports on decontamination of reactor plant components (Article 532, Reference 15.2).

13.4.3 Abnormal changes in radiation levels which cannot be explained by changing plant conditions (Article 225, Reference 15.2).

13.4.4 Copies of reports sent to the Bureau of Medicine and Surgery (See Section 13.5 below).

NOTE: The reports required by Sections 13.4, shall be submitted to BuShips (Code 1500) via Supervisor of Shipbuilding, Camden, N.J. by Department 4.

13.5 Bureau of Medicine and Surgery Required Reports and Records (For Navy personnel, i.e., SOS, PNROR and Ship's Force during period that NYS is providing film badges and dosimeters to crew).

13.5.1 Personnel radiation exposures (Article 238, Reference 15.2 and References 15.6 and 15.7).

13.5.2 Overexposures (Article 424, Reference 15.2 and References 15.6 and 15.7).

NOTE: N.Y.S.C. will provide each activity with the personnel radiation exposure data required for medical records and formal submittal to BuMed and Surgery and BuShips (Code 1500) i.e., radiation exposure data for SOS personnel will be forwarded to the Supervisor of Shipbuilding, Camden, N.J.

13.6 New Jersey State Department of Health Required Records and Reports.

13.6.1 Personnel monitoring records - shall be maintained and preserved for 10 years after termination of an employees employment. (Section 9.1 of Reference 15.1).

13.6.2 Records of surveys - All surveys (of an unclassified nature) conducted to determine the dose rates to which an individual may be exposed shall be maintained and preserved for at least 10 years. (Section 9.2, of Reference 15.1).

13.6.3 Records of radioactive material - The amounts of by-product and special nuclear material (calibration sources licensed by the AEC) on hand and the amounts of radioactive waste material produced and on hand must be recorded. Such records shall be retained for 2 years after final disposition of the material.

13.6.4 Sealed source testing - Alpha sources shall be swipe tested every 3 months; other radioactive sources shall be swipe tested every 6 months. Records of tests shall be preserved for at least 2 years.

13.6.5 Disposal of Radioactive Materials - Records shall be maintained detailing: 1. the method of disposal. 2. amount of material. 3. significant isotopes and 4. form of all radioactive material disposed of in accordance with Sections 13.7.2 and 7.3 of Reference 15.1. Similar information relative to radioactive waste discharged to the Delaware River (by Ship's force during operation of Naval Reactors while on N.Y.S.C. property) in accordance with Reference 15.2 shall also be recorded.

13.6.6 Reports of thefts and Radiation Incidents - Immediate notification required by telephone and telegraph of any theft or loss of radioactive material in such quantities and under such circumstance that a substantial radiation contamination hazard may result. (Section 16.1 of Reference 15.1).

Immediate notification required by telephone and telegraph of any radiation incident which may have caused or threatens to cause:

(a) Exposure of any individual to 25 rems or more of radiation; or

(b) Release of radioactive material in concentrations (averaged over 24 hrs.) which exceed 5000 times the limits of Section 7.4, Reference 15.1; or

(c) Loss of one working week or more of the operation of any facilities affected; or

(d) Damage to property in excess of $100,000. (Section 16.2.1, Reference 15.1).

13.6.6 (Continued)

Notification within 24 hours by telephone and telegraph of any radiation incident which may have caused or threatens to cause:

(a) Exposure of any individual to 5 rems or more of radiation; or

(b) Release of radioactive material in concentrations (averaged over 24 hrs.) which exceed 500 times the limits of Section 7.5, Reference 15.1; or

(c) Loss of one day or more of the operation of any facilities affected; or

(d) Damage to property in excess of $1000. (Section 16.2.2, Reference 15.1).

Written reports describing the nature of the incident and extent of exposure to individuals, levels of radiation and concentrations involved, cause of the incident and corrective steps taken or planned to assure against recurrence of the incident must be submitted within 30 days. (Section 16.2.3, Reference 15.1).

14. FORMS AND SIGNS

[A] 14.1 Index of Forms and Signs

A-Stub	B-Stub
DATE ______ SERIAL NO ______ 22RC-1 A-STUB	DATE ______ SERIAL NO ______ 22RC-1 B-STUB
DESCRIPTION OF MATERIAL	______ DESCRIPTION OF MATERIAL
TO BE MOVED: FROM ______ TO ______	MOVED FROM ______ TO ______
RADIATION LEVELS: ITEM ______	RADIATION LEVEL (PACKAGE) START OF MOVEMENT ______
PACKAGE ______	MOVEMENT COMPLETED ______
NNRC MONITOR ______	
MOVEMENT CONTROLLED BY: NNRC MONITOR ______	NNRC MONITOR ______
RADIOACTIVE MATERIAL	RADIOACTIVE MATERIAL ACCOUNTABILITY

SHIPPING TAG FOR MOVEMENT OF RADIOACTIVE MATERIALS WITHIN N.Y.S.

DEPT. 22 FORM RC-1

NOTE: Card to be yellow; symbol and lettering to be magenta.

RADIATION WORK PERMIT FOR CONTROLLED ACCESS AREAS — DEPT. 22 FORM RC-2

[1] NAME _____ [2] DEPT. _____ [3] BADGE # _____ [4] DATE ___ [5] SHIFT ___

[6] AREA IN WHICH WORK IS TO BE ACCOMPLISHED

[7] WORK DESCRIPTION

[8] ESTIMATED STAY TIME [9] EXPOSURE FOR CURRENT WK.

[10] CHECK FOR NO BREAK IN SKIN

[11] SUPERVISOR

[12] RADIATION LEVEL IN AREA

[13] STAY TIME LIMIT

[22] NNRC LEAD MONITOR

SPECIAL EQUIPMENT REQUIREMENTS

14	DOSIMETER	
15	PROTECTIVE CLOTHING	
16	RESPIRATOR	
17	AIR LINE RESPIRATOR	
18	PLASTIC SUIT	
19	FILM BADGE, NEUTRON	
20	FILM BADGE	
21	WRIST BADGE	

[23] I HAVE BEEN INSTRUCTED THAT THE PERMISSIBLE STAY TIME IS _____ AND HAVE RECEIVED SPECIAL EQUIPMENT ITEMS INDICATED.

SIGNED _____

[24] ACTUAL TIME IN _____

[25] ACTUAL TIME OUT _____

[26] a. DOSIMETER READING (AS APPLICABLE) _____ mrem

OR

b. ESTIMATED EXPOSURE (TIME X AMBIENT LEVEL) _____ mrem

[27] NNRC MONITOR _____

INSTRUCTIONS: ITEMS (1) THROUGH (11) SHALL BE COMPLETED BY DEPT. SUPERVISOR INVOLVED.

ITEMS (12) THROUGH (22) SHALL BE COMPLETED BY THE LEAD NNRC MONITOR ON DUTY.

ITEMS (23) SHALL BE COMPLETED BY THE WORKER WHO WILL BE ENTERING THE CONTROLLED ACCESS AREA.

ITEMS (24) THROUGH (27) SHALL BE COMPLETED BY THE MONITOR AT THE CONTROL POINT.

NNSP-20 REV. B

AIR SAMPLE COUNT LOG

DATE: FROM ________ TO ________

1	2	3	4	5	6	7	8	9	10	11	12	13	14
DATE	SAMPLE TIME	SAMPLE POINT	VOL. M3	15' CC/M	EFF.	μC/CC	180' CC/M	EFF.	μC/CC	24HR CC/M	EFF.	μC/CC	MONITOR

1. STANDARDIZE ALL AIR SAMPLES TO 4 M³ UNLESS OTHERWISE DIRECTED.
2. COUNT ALL SAMPLES AT EXACTLY 15'; 180'; AND 24 HRS. FROM END OF SAMPLING TIME
3. COUNT ALL SAMPLES FOR 5 MINUTES
4. CALCULATE 24 HR. ACTIVITY IN CPM BY:

$$C_{LL} = \frac{C_{24} - C_3 e^{-0.0635 \Delta T}}{1 - e^{-0.0635 \Delta T}}$$

WHERE: C_{LL} = COUNTS DUE TO LONG LIVED ACTIVITY; C_{24} = COUNTS OBSERVED AT 24 HRS. (CC/M); C_3 = COUNTS OBSERVED AT 3 HRS (CC/M); ΔT = ELAPSED TIME BETWEEN C_{24} & C_3 IN HRS.

5. THEN CONVERT C_{LL} INTO μC/CC USING STANDARD EQUATION

DEPT. 22 FORM RC-3

DOSIMETER LOG

NAME | BADGE №. | YEAR | QTR. 1 2 3 4

IBM WK. №.													
MON.													
TUES.													
WED.													
THUR.													
FRI.													
SAT.													
SUN.													
SUB TOTAL													

DOSIMETERS ISSUED (N.Y.S. №s.) | QTR. TOT. DOSIMETER ____ REM | QTR. TOT. FILM BADGE ____ REM

MON.													
TUES.													
WED.													
THUR.													
FRI.													
SAT.													
SUN.													

DEPT. 22 FORM RC-4, REV. A

NNEP-20
REV. B

NAVAL NUCLEAR RADIOLOGICAL CONTROL
SHIFT REPORT

REACTOR SHUTDOWN ☐
REACTOR CRITICAL ☐

SHIFT LEADER _____

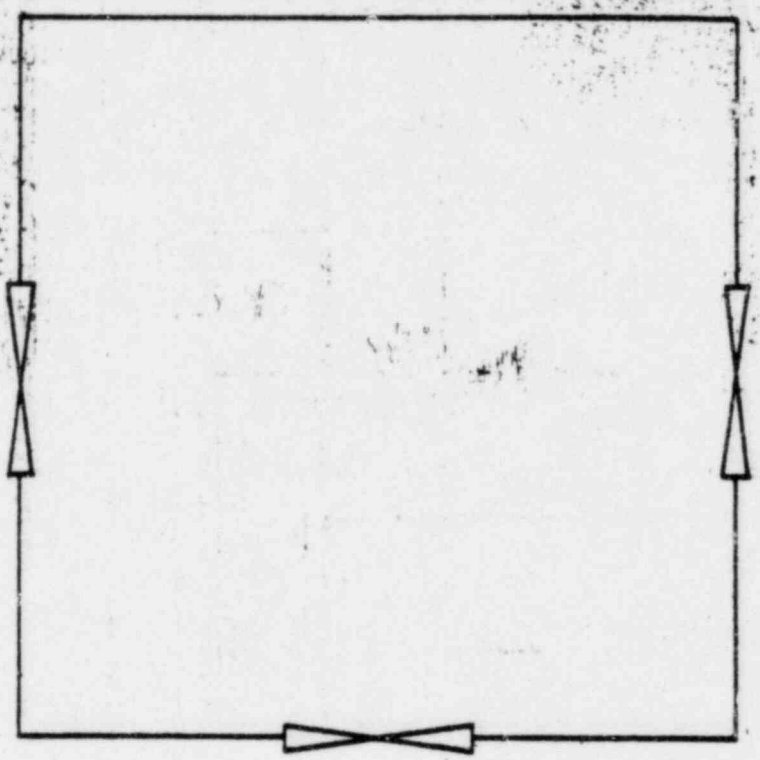
DATE _____
TIME _____
SHIFT _____

AREA	AIR ACTIVITY μc/cc	AREA DOSE RATE					HIGHEST GAMMA CONTACT READING		RADIO GAS μc/cc	REQUIREMENTS								
		Bβγ MREM/HR	NF MREM/HR	NT MREM/HR	TOTAL MREM/HR	SURFACE CONTAM. μc/100cm²	MR/HR	LOCATION		FILM BADGE	DOSIMETER	PROTECT. CLOTH	PLASTIC SUITS	GLOVES	SHOE COVERS	RESPIRATORS	WORK PERMIT	OTH F R

WASTE TANK READINGS		LIQUID WASTE TRANSFERRED	SPECIAL INCIDENT REPORT
TANK NO. 1	TANK NO. 2		
VOLUME _____ GAL.	VOLUME _____ GAL.	TANK NO. _____ GROSS ACTIVITY _____ μc/cc VOL. TRANSFERRED _____ GAL. TIME OF TRANSFER _____	
GROSS ACTIVITY _____ μc/cc	GROSS ACTIVITY _____ μc/cc	TANK NO. _____ GROSS ACTIVITY _____ μc/cc VOL. TRANSFERRED _____ GAL. TIME OF TRANSFER _____	
TIME OF READING _____	TIME OF READING _____		

DEPT 22 FORM RC-5

SOURCE STORAGE BUILDING (CHAPEL)



TYPE SURVEY _____

DATE _____

TIME _____

SHIFT _____

INSTRUMENT _____

EFFICIENCY _____

BACKGROUND _____

MONITOR _____

M-2930

DEPT. 22 FORM RC-6

NNEP- 20
REV. 3

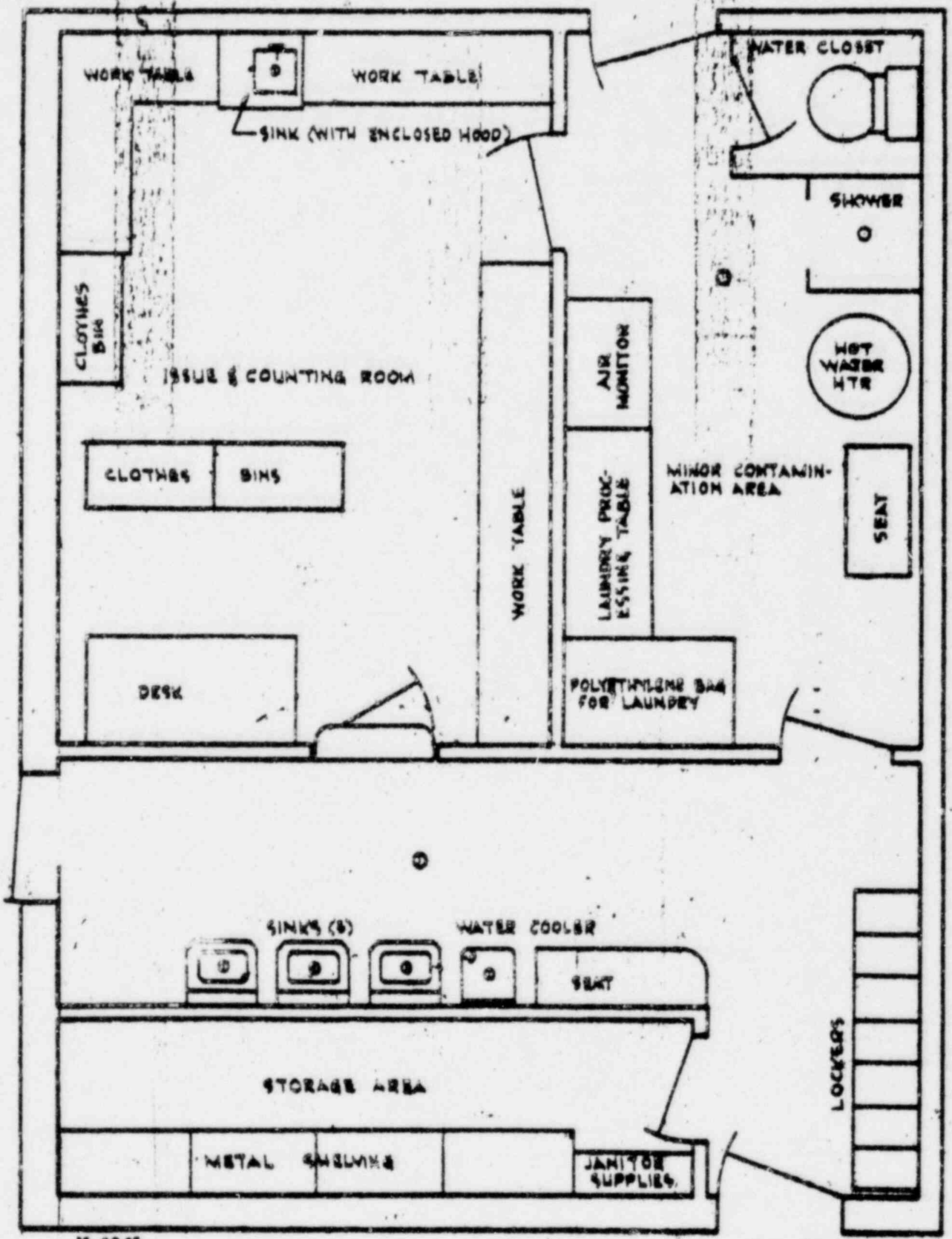
NAVAL NUC R RADIOLOGICAL CONTROL FA ITY – TEST BARGE

TYPE SURVEY ________________ DATE ________________

INSTRUMENT ________________ TIME ________________

EFFICIENCY ________________ SHIFT ________________

BACKGROUND ________________ MONITOR ________________



N-2932

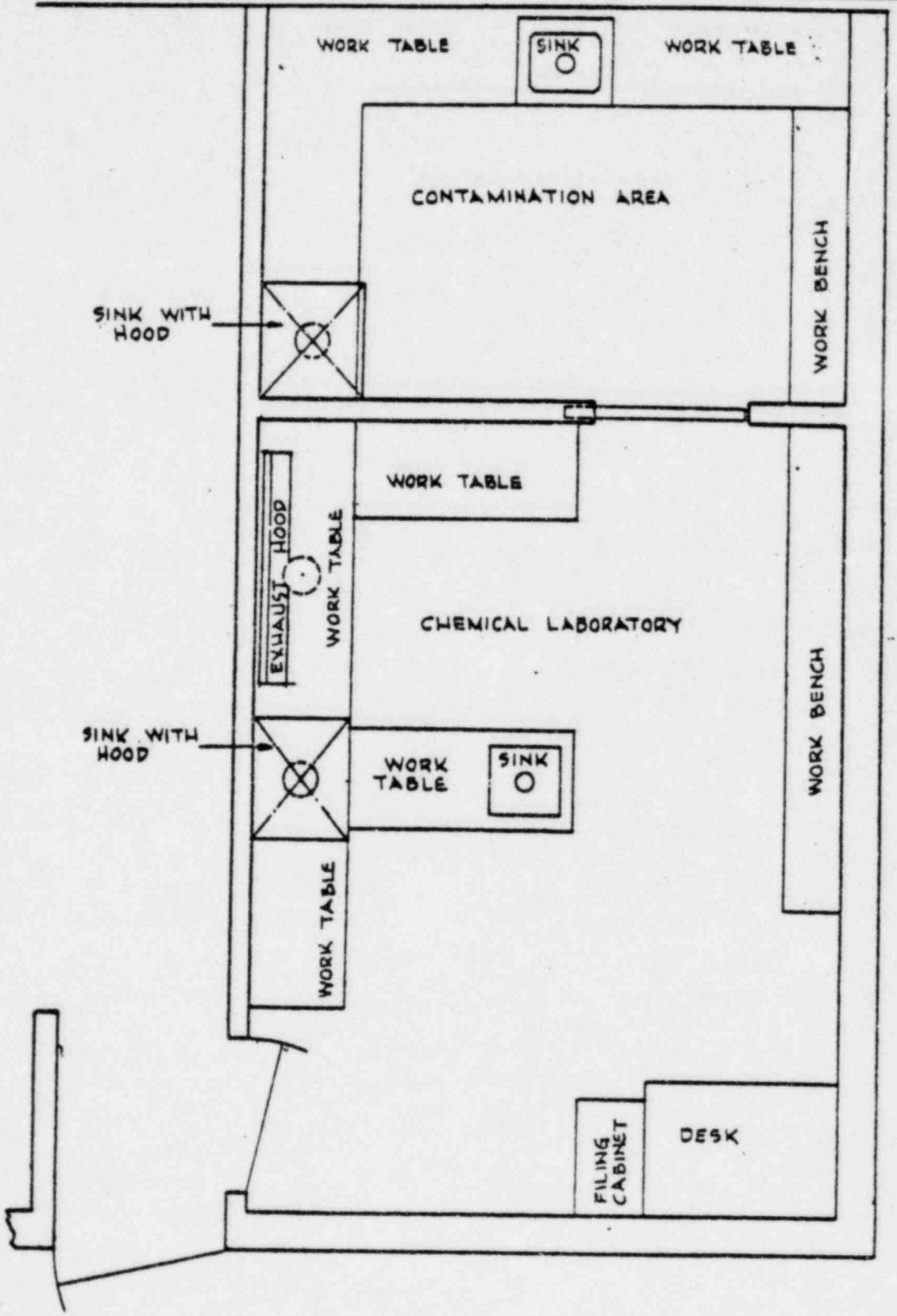
DEPT. 88 FORM RC-7

NNSP- 20
REV. B

Sheet 61 of 77

CHEMISTRY FACILITY - TEST BARGE (2ND DK.)

TYPE SURVEY _____ DATE _____
INSTRUMENT _____ TIME _____
EFFICIENCY _____ SHIFT _____
BACKGROUND _____ MONITOR _____



K-2932

DEPT. 22 FORM RC-8

NYEP- 20
REV. ____

Sheet 62 of 77

NAVAL NUCLEAR RADIOLOGICAL CONTROL
WASTE PROCESSING/DISPOSAL LOG
SHIFT LEADER ____________

DATE ____________
SHIFT ____________

TYPE WASTE	QUAN.	μC CONTENTS	ACTIVITY-MR/HR		SURFACE CONTAM μμC/100 cm²		LIQUID PROCESSING			DISPOSAL METHOD	REMARKS
			@1cm	@1 METER	α	βγ	ACTIVITY μC/CC	GAL PROC	ACTIVITY μC/CC		

H-2933

DEPT. 22 FORM RC-9

NAVAL NUCLEAR RADIOLOGICAL CONTROL
DECONTAMINATION OPERATIONS

ITEM	AUTH. FOR G.F. MAT'L	INITIAL ACTIVITY				AREA REQUIRING DECONTAMINATION	PROCESS USED	NO. OF CYCLES REQ'D	FINAL ACTIVITY				DATE	MONITOR
		INTERNAL		EXTERNAL					INTERNAL		EXTERNAL			
		α	$\beta\gamma$	α	$\beta\gamma$				α	$\beta\gamma$	α	$\beta\gamma$		

NNEP-20 REV. R

Sheet 64 of 77

K-2934

DEPT. 22 FORM

NAVAL NUCLEAR RADIOLOGICAL CONTROL
RADIOACTIVE SOURCE LOG

DATE FROM_____ TO_____

SOURCE	SER. NO.	ISSUED BY	ISSUED TO	DESTINATION	PURPOSE	DATE	TIME	RETURNED	DATE	TIME	REC'D BY

REV. - 80
8

Sheet 65 of 77

N-2935

DEPT. 22 FORM RC-11

NAVAL NUCLEAR RADIOLOGICAL CONTROL
RADIOACTIVE SOURCE INVENTORY

OWNER	SERIAL NO.	DATE REC'D	ISOTOPE	MFG/VENDOR	ORIGINAL STRENGTH	CALIBRATION DATE	PRESENT STRENGTH	PHYSICAL LOCATION	INVENTORIED		SWIPE TEST μμC/100cm²			MONITOR
									DATE	OBSERVER	DATE	α	β γ	

K-2936 DEPT. 22 FORM RC-12

INSTRUMENT CALIBRATION RECORD

CARD#

INSTRUMENT

MFG. SERIAL#

CALIBRATION DATE	MONITOR	REMARKS

X-2938 DEPT 22 FORM RC-13

INSTRUMENT MAINTENANCE RECORD

CARD#

INSTRUMENT

MFG. SERIAL#

DATE	MAINTENANCE PERFORMED	MONITOR

X-2939 DEPT 22 FORM RC-14

NAVAL NUCLEAR RADIOLOGICAL CONTRCL

WATER SAMPLE COUNT LOG

DATE FROM: TO:

DATE	TIME	SAMPLE POINT	COLLECTED BY	VOL. CC	SCALER NO.	TYPE DETECTOR	TOTAL COUNTS	COUNT TIME	CPM	BKG	CCM	EFF	μC/CC	COUNTED BY

N-2937

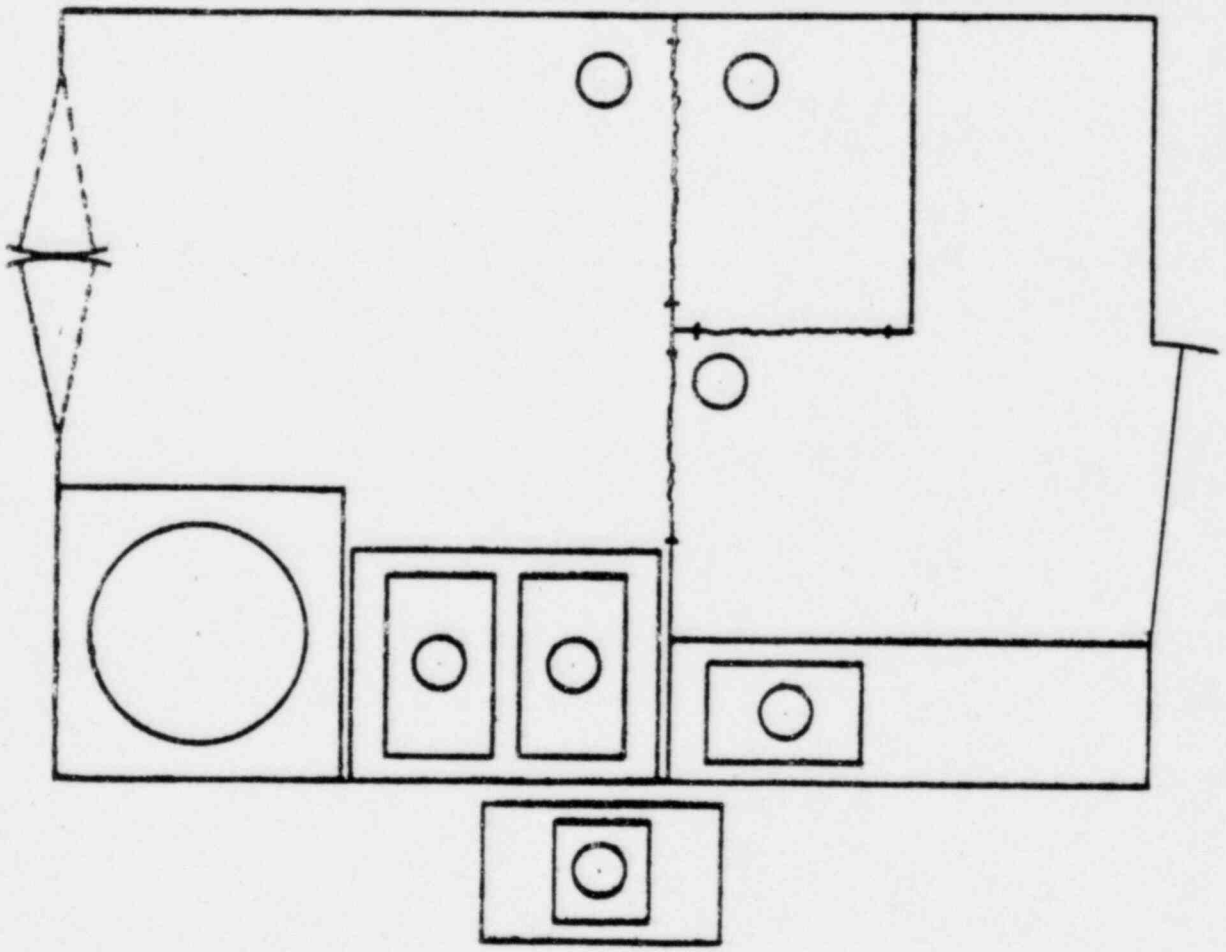
DEPT. 22 FORM 1

NNEP- 20
REV. B

P TABLE DECONTAMINATION SHEET

TYPE SURVEY _____
INSTRUMENT _____
EFFICIENCY _____
BACKGROUND _____

DATE _____
TIME _____
SHIFT _____
MONITOR _____



DEPT. 22 FORM RC-16

NEW YORK SHIPBUILDING CORPORATION

RADIOACTIVE MATERIALS RECEIVED OR SHIPPED

Shipped _____ Received _____

Description of Material: _____

Date & Time: _____

Shipped From / Shipped To: _____

Person Responsible, License or Authorization: _____

_____

Method of Transportation: _____

Method of Packaging: _____

Type of Label Affixed: _____

Dose Rate at Surface of Material: _____

Dose Rate at Surface of Package: _____

Principle Radioactive Component/s: _____
No. of Curies: _____

REMARKS: _____

_____

_____

Date: _____ Signature: _____

Dept. 22 Form RC-19

NNRC SPECIAL SURVEY .ORM

NOTE: Sketch area with identifying points (Buildings, Ways, etc.)

Type Survey_____
Date_____
Time_____Shift_____
Instrument_____
Efficiency_____Background_____
Monitor_____

DEPT. 22 FORM RC-20

NNSP- 22
REV.- P

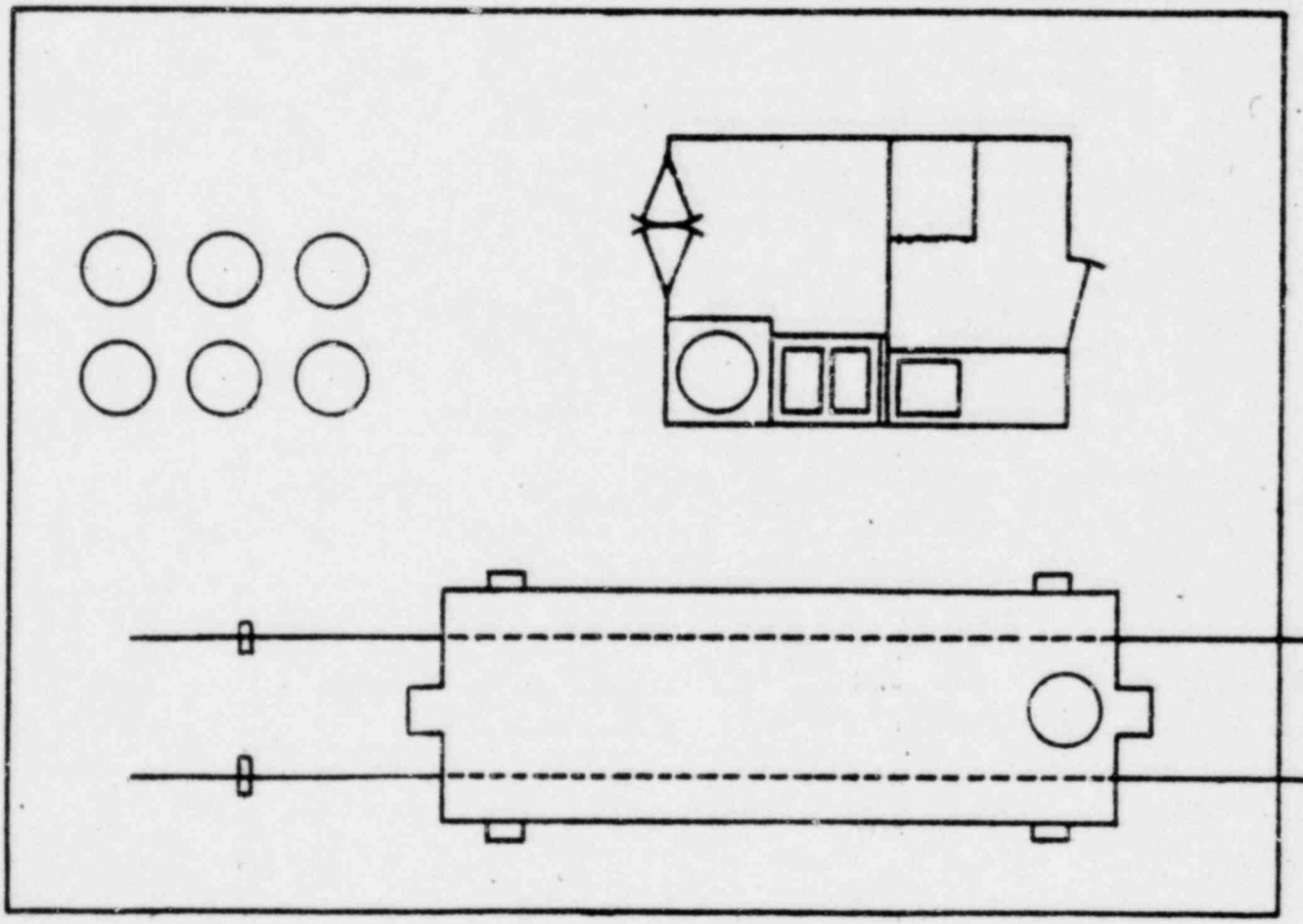
RADIOACTIVE MATERIAL STOWAGE
AND DECONTAMINATION FACILITY

TYPE SURVEY _____ DATE _____

INSTRUMENT _____ TIME _____

EFFICIENCY _____ SHIFT _____

BACKGROUND _____ MONITOR _____



DEPT. 22 FORM RC-21

NNEP- 20
REV. -3

NEW YORK SHIP[illegible]ILDING CORPORATION
This is to certify that

_____

has passed a special medical examination, has completed Training Program ___, and is now qualified for work in CONTROLLED ACCESS AREAS.

Vice President - Naval Nuclear

← FRONT

Individual Responsibilities

1. Carefully follow all oral and posted instructions concerning radiological safety issued by the cognizant D/22 monitor on duty.
2. Keep daily radiation exposures as low as possible.
3. Obtain [redacted], dosimeters, anti-contamination clothing and equipment from D/22 (these will be issued upon presentation of an approved work permit) and wearing such items as prescribed.
4. Minimize the spread of contamination:
   (a) Do not unnecessarily touch a contaminated surface or handle contaminated equipment.
   (b) Do not allow clothing, tools or any other items to come in contact with a contaminated surface.
   (c) Avoid transferring radioactivity to other surfaces when (required) contact is made with a contaminated surface with gloves or other items of clothing.
   (d) Avoid contact with primary coolant except as required to contain or control a spill.

SAMPLE

Individual Certification Card

(Black lettering on white Card)

   (e). Place contaminated tools or components on impervious materials such as polyethylene - never directly on a desk or work surface.
   (f). Wrap and seal contaminated tools and equipment in polyethylene when they are no longer required on the job.
5. Have a thorough understanding of the job and how it is to be accomplished.
6. Maintain good personal hygiene when working in a Controlled Access Area.
   (a). No eating, drinking, or smoking is permitted in a Controlled Access Area.
   (b) Take no food or beverage into the area.
   (c) Keep hands away from face.
   (d) Wash hands and face before eating, smoking or toileting.
7. Clean up or have cleaned up any contamination which your work has caused.
8. Report to D/22 the occurrence of any of the following incidents:
   (a) Exceeding the specified radiation exposure [illegible] or dosimeter [illegible].
   (b) [illegible] an exhaust system in a Controlled Access Area.
   (c) Damage to protective equipment or [illegible] clothing.
   (d) Leaks in primary systems.
   (e) Any spill of radioactive material [illegible] radioactive material.
   (f) Damage to a radiation shield.
   (g) Any wound resulting in a break in the skin or incident where radioactive material may have entered a person's body.
   (h) Any fire, injury, or emergency in a Controlled Access Area.
   (i) Whenever any doubt exists as to the radioactive contamination level.
9. Report to your supervisor any circumstance where there is doubt as to the correct procedure or to the safety of the operation.
10. Have all material, tools, hands, feet and clothing monitored before leaving a Control Point.
11. Return personnel monitoring devices and anti-contamination clothing and equipment to D/22 at the end of each working shift.

← BACK

NEW YORK SHIPBUILDING CORPORATION

This is to certify that

_____

has passed a special medical examination, has completed Training Program ___, and is now qualified for work in CONTROLLED ACCESS AREAS.

_____

Vice President - Naval Nuclear

FRONT

Supervisor's Responsibility

1. Briefing each of your workmen on the particular job to be accomplished in a Controlled Access Area so that the workmen may enter, do their jobs and get out in as short a time as possible.
2. Insuring that each of your workmen remains familiar with and follows the procedures necessary for the control of radiation and radioactive materials as presented in the formal training programs.
3. Notifying D/22 sufficiently in advance of all operations requiring radiological control.
4. Making sufficient preparations, under the guidance of D/22, for work on radioactive system components so that work can progress safely and without undue delay.
   a. Area around the item to be worked shall be covered with sheet plastic and absorbent paper arranged to catch any spillage of radioactive water or dirt.
   b. Where welding, grinding, or any other operation which may generate quantities of radioactive dust is to be performed; ventilation to contain the contamination shall be provided. Ventilation systems shall consist of a pre-filter (similar to oil burner filters)plus a filter that will remove particles as small as 0.3 microns.

SAMPLE

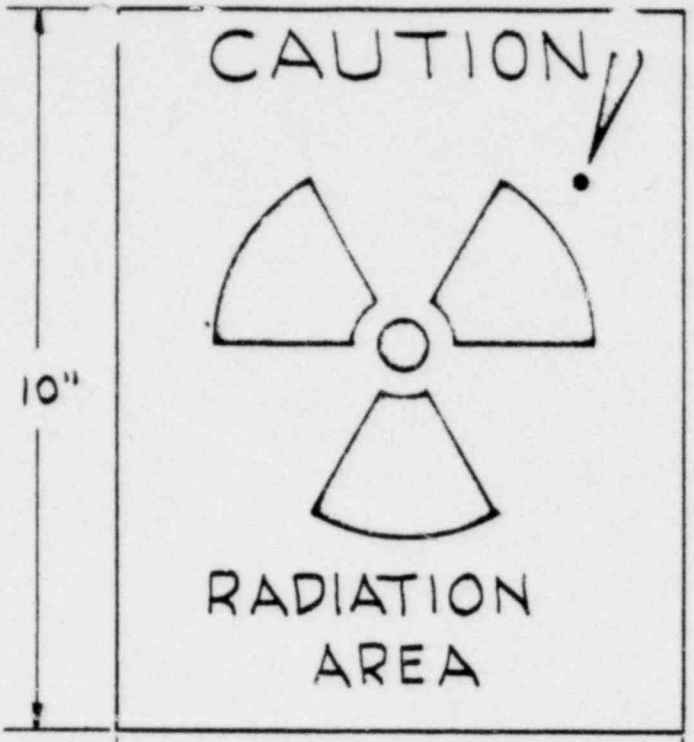
Supervisor Certification Card

(Black lettering on yellow Card)

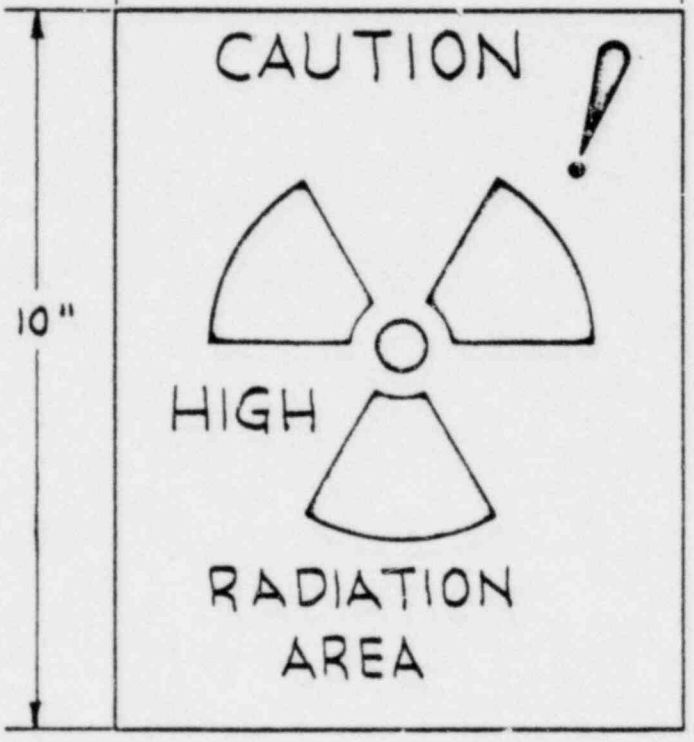
   c. Adequate supplies of funnels, buckets, trays, absorbent rags or other materials shall be provided for catching and containing any minor spillage of radioactive water.
   d. Adequate supplies of polyethylene bags, wrapping materials tape, rags, etc., shall be available at the place of work for wrapping contaminated items.
   e. When the possibility exists of spillage of a substantial quantity of radioactive water, an air or electrically operated pump shall be provided with the discharge connected to an adequate collection tank.
   f. Radioactive systems shall be drained as completely as possible prior to start of work on them.
   g. Machine tools used shall be covered with plastic to the maximum extent possible to minimize clean-up problems.
5. Keeping employees with any break of the skin out of Controlled Access Areas.

BACK

6. Maintaining records of personnel qualified for work in Controlled Access Areas from information received from your Department Head; maintaining records of exposure data from information received from D/22 on the completed work permit form.
7. Keeping personnel in Controlled Access Areas to a minimum.
8. Issuing to each employee under your control a work permit in duplicate for work in a Controlled Access Area.
9. Insuring that employees under your control have the required anti-contamination clothing and equipment and personnel monitoring devices as prescribed and issued by D/22 prior to entering a Controlled Access Area.
10. Notifying D/22 of all spillages and incidents of possible contamination and taking emergency action if necessary.
11. Stopping any operation when D/22 advises that such operations are radiologically unsafe.



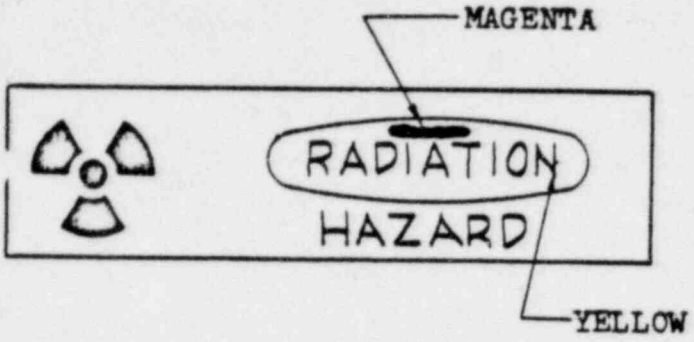
8"



NOTE:

SYMBOLS, LETTERING } MAGENTA

BACKGROUND - YELLOW



AUTHORIZED
PERSONNEL ONLY

CAUTION
RADIOACTIVE
MATERIAL

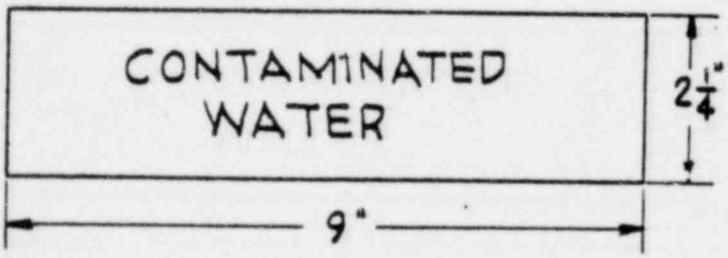
RADIATION WORK PERMIT
REQUIRED FOR ENTRY

CONTAMINATED
AREA

CONTAMINATED
CLOTHING

CONTAMINATED
WASTE

CONTAMINATED
MATERIAL



NOTE:

SYMBOLS & LETTERING - MAGENTA
BACKGROUND - YELLOW
(EXCEPT AS NOTED)

15. REFERENCES:

15.1 New Jersey Radiation Protection Code, Chapter I, General Requirements.

15.2 NAVSHIPS 389-0153, Radiological Controls for Naval Nuclear Propulsion Plants, (CONFIDENTIAL).

15.3 BuShips Letter Ser. 1500G-1436, Dated: 25 May 1961.

15.4 BuShips Letter Ser. 1500G-1494, Dated: 9 November 1961.

15.5 Rules and Regulations Title 10 Atomic Energy Part 20 Standards for Protection Against Radiation. (10CFR20)

15.6 NAVMED P-1325, Radiological Safety Regulations.

15.7 BUMEDINST 6150.18, Records of Exposure to Ionizing Radiation.

15.8 NAVSHIPS 389-0152, Water Chemistry Control for Naval Nuclear Propulsion Plants (CONFIDENTIAL).

15.9 NNEP #20-1, Radiological Control Instruments (Calibration, Maintenance, Operation).

15.10 NNEP #20-2, Radiological Control Facilities (description and operation).

A 15.11 NNEP #20-3, Department 22 Monitor (Qualification Procedure).

A 15.12 NNEP #20-5, Procedure for Submitting and Processing Radiological Control Deficiencies and Requests for Deviations to N.Y.S. NNEP No. 20.

B 15.13 BuShips Letter Ser. 1500G-609, Dated: 9 October 1963.