

DL-062695-05

**Newport News Industrial
Corporation**

Subsidiary of
Newport News Shipbuilding
A Tenneco Company



700 Thimble Shoals Blvd
Suite 113
Newport News, Virginia 23606-2544
804-380-7053

June 26, 1995

US Nuclear Regulatory Commission, Region II
Nuclear Materials Safety Section
101 Marietta Street, Suite 2900
Atlanta, GA 30323

ATTN: Mr. Hector Bermúdez

Gentlemen:

Subject: Response to Request for Additional Information Regarding License Renewal
Application dated April 10, 1995, (Reference Control No. 256401; Docket No. 030-06601)

Enclosures:

- (1) Sample written examination for radiation workers
- (2) Sample written examination for radiological control monitors

The following information is provided as requested by Nuclear Regulatory Commission (NRC) letter to Newport News Industrial (NNI) dated May 9, 1995. Paragraph numbers used in this letter correspond to the paragraph numbers of that letter.

The Radiation Safety Program described in the Application for Material License dated April 10, 1995 is based on the assumption that the likely radioactive materials to be worked under this license are activated corrosion products in which the most limiting radionuclide, for purposes of exposure control, is Cobalt-60. NNI will not perform work where radioiodine or noble gas exposure would be a concern. In the event that some other radionuclide, such as an alpha emitter, is more limiting than Cobalt-60, the radiation protection program will be modified to provide the same degree of protection to the workers and public as is provided in the described program for the control of activated corrosion products.

1. Radiation workers and radiological control monitors demonstrate satisfactory completion of training by achieving passing scores on all written and practical abilities examinations of at least 75% for non-supervision and 80% for supervision. Practical abilities examinations are

used to evaluate proficiency in both operating and emergency procedures. Training of radiation workers and radiological control monitors will include the applicable license conditions and regulatory requirements prior to commencing radiological work under this license. Training and qualification record keeping requirements for radiological control monitors are the same as those described for radiation workers in item #8 of the Application for Material License dated April 10, 1995.

Radiological control monitors are required to requalify every 30 months. Requalification consists of satisfactory performance on comprehensive written examinations, response to complex radiological situations, control of job evolutions involving high levels of radiation and contamination, and performance of routine radiological monitoring duties such as the use of radiation detection instrumentation and performance of radiation and contamination surveys. Radiological control monitors attend a formal continuing education program each year. This program consists of approximately 80 hours of classroom and practical ability sessions conducted by qualified instructors. Additionally, monitors receive monthly self study information modules that contain new information, changes in requirements, and review of core material. Monitors also attend approximately 10 seminars a year conducted by designated radiological control personnel covering lessons learned and areas of weakness. Enclosures (1) and (2) are typical radiation workers and radiological control monitors written examinations respectively.

2. Ventilation system design, installation, operation, and maintenance are controlled by internal detailed written work procedures. Motors, blowers, filters, and sample pumps are used and maintained consistent with manufacturer specifications. Ventilation systems and associated exhaust flow rates vary and are dependent on the method of work to be used and the expected contamination levels. Typically, the exhaust flow rate is controlled by internal procedures and ranges from 450 ft³/min to 2000 ft³/min (33.75 lbm/min to 150 lbm/min). These systems are designed to provide sufficient capture velocity to reduce airborne levels in the work space to as low as reasonable achievable (ALARA). To ensure exhaust ventilation system design specifications are maintained, prior to initial use and periodically, at least every 90 days, flow rates are checked to be in accordance with internal procedures and design specifications. HEPA filter adapters are tested for efficiency by Dioctylphthalate (D.O.P.) tests prior to installation, annually, and whenever the HEPA filters are replaced, disturbed, or suspected of damaged. Ventilation systems are D.O.P tested for leaks prior to initial use. Containment tents are inspected prior to initial use by radiological control personnel. Prior to each use the radiation worker must inspect the tent to ensure that it is free of rips, holes, or tears; it is properly secure; the ventilation is operating and has negative pressure maintained according to internal procedures. When in use, the differential pressure across the exhaust HEPA filters will be checked daily to ensure the integrity of the HEPA filter.
3. NNI's exhaust ventilation environmental monitoring systems consists of an in-line filter holder or an in-line sample tube centered in the exhaust duct connected to an external filter holder, a regulated air pump with flow meter, an hour meter, and tubing to connect the filter

holder to the suction side of the pump. The pump is an Eberline Model RAS-1 or equivalent. Whenever an exhaust ventilation system is energized, air sampling equipment draws air at 30 liters/min through a filter sample element. The regulated pump's air flow rate meter is tested annually for accuracy. While in use, regulated air pumps are checked periodically at least monthly. Air sample elements are changed and evaluated annually, if air flow is excessively restricted, or when requested by radiological control personnel. Ventilation system design, sampling method and counting practice are established to ensure sensitivity to less than 40 CFR part 61 "Concentration Levels for Environmental Compliance" for the applicable isotopes. Exhaust ventilation is also monitored by an air particulate detector (APD) set to alarm if the airborne concentration level reaches 1×10^{-9} $\mu\text{Ci/ml}$. If the alarm sounds, work is secured and the applicable exhaust ventilation system is secured. An investigation will be initiated to determine the significance of the release to the environment. NNI will notify the NRC of any event which meets the criteria of 10 CFR 20.2202 or results in a member of the public to exceed 10 CFR 20.1301 exposure limits.

Work practices that reduce the generation of airborne activity and spot ventilation systems are used to maintain airborne activity levels in the work space to less than 100 times the applicable DAC. Air samples in the work space are taken periodically and as directed in detailed work procedures. The sampling frequency is dependent upon the nature of the work and the level and type of contamination. If airborne activity in the work space is greater than 100 times the applicable DAC, work is immediately secured and the ventilation is adjusted, modified, or re-engineered or different work practices are used to ensure that work progresses with airborne levels below this limit. Respiratory protection is donned if airborne activity levels greater than 10% of the applicable DAC are expected. To reduce the air concentration levels discharged to the environment, exhaust ventilation passes through HEPA filters with 99.97% efficiency for removal of 0.3 micron sized particles. Experience using these systems for this type of work shows typical removal efficiencies greater than 99.9999%. This filtration reduces exhaust air concentration levels from 100 times the applicable DAC to less than 0.01% of the applicable DAC. The dose attributable to airborne concentrations at 0.01% of the applicable DAC at the exit point of the exhaust system and prior to any dilution results in 0.5 mrem for 2000 hrs/yr exposure. Assuming 24 hour occupancy exposure to a hypothetical person from a continuous discharge at 0.01% of the applicable DAC with no dilution for 8766 hrs/yr results in a dose of 2.2 mrem/yr. Typically ventilation systems for work spaces with radioactive airborne concentration at 100 times the applicable DAC level will not discharge continuously to the environment. They will exhaust into an area under industrial occupancy conditions with extensive dilution prior to reaching a point of free occupancy. At only 2.2% of the dose limit to the general public this, less than credible, worst case internal dose estimate is not considered significant enough to include in the Total Effective Dose Equivalent (TEDE) to the public. Therefore, the use of HLD's and occupational factors proposed in Item #9 of the license renewal application can be used to demonstrate compliance with 10 CFR 20.1301 dose limits to the general public.

4. Warehouse receiving personnel receive annual training to identify radioactive shipments by package markings and shipping papers. Once a shipment or package is identified as containing radioactive materials the radiological control monitoring section is immediately

notified and surveys are performed according to 10 CFR 20.1906. If any problems such as wet or damaged packaging is noted by warehouse receiving personnel, handling of the shipment or package is halted, the package is guarded, and radiological control monitors are notified and informed of the problem. Radiation surveys are performed on the vehicle and packages. Beta/gamma contamination surveys and if appropriate, alpha contamination surveys, are performed on the vehicle and packages. If the package is damaged or wet, samples of the package material and liquids are taken as appropriate.

For a "non exclusive use" shipment, management is immediately notified if surveys exceed 200 mrem/hr on contact with the package or 10 mrem at 1 meter from the package. For an "exclusive use" shipment, management is immediately notified if surveys exceed 1 rem/hr on contact with the package, 200 mrem/hr on contact with the vehicle or 10 mrem/hr at 2 meters from the vehicle. A restricted area is established with rope barriers to ensure unmonitored personnel receive less than 2 mrem/hr. An investigation is initiated to determine the extent of the problem and develop a course of actions. Exposure evaluations are performed for all unmonitored personnel as appropriate. Notifications to the shipping company, shipper, Department of Transportation (DOT), and the NRC are made as required by applicable regulations.

If smear contamination surveys on a shipment exceed or equal 2200 dpm/100cm² beta/gamma or 220 dpm/100cm² alpha on the package the area is immediately isolated and management is immediately notified. A restricted area is established with rope barriers to ensure unmonitored personnel receive a dose of less than 2 mrem/hr. Actions are taken to contain the contamination. Detailed radiation and contamination surveys are performed. An investigation is initiated to determine the extent of the problem and develop a course of action. Restricted areas are established around areas with contamination greater than 450 pCi/100cm². Contaminated personnel are decontaminated, internal gamma scans are performed, and exposure assessments are made. Additional notifications to the shipping company, shipper, DOT, and the NRC are made as required by applicable regulations.

5. The following four ranges are available for self-reading pocket dosimeters (PCD):

PCD Range	3/4 Scale
0 - 200 mrem	150 mrem
0 - 500 mrem	375 mrem
0 - 1000 mrem (0 - 1 rem)	750 mrem (0.75 rem)
0 - 5 rem	3750 mrem (3.75 rem)

The "useful range" of the PCD is considered to be 0 to 3/4 of full scale. Personnel are taught to read PCD's before entering restricted areas, frequently while in restricted areas, and upon leaving restricted areas. Personnel are trained to leave the restricted area before their exposure reaches 3/4 of full scale. In the event an individual's PCD reaches or exceeds 3/4 of full scale personnel are trained to:

- Warn others in the area that you have reached or exceeded 3/4 scale on your PCD.
- Leave the area immediately
- Report the problem to a radiological control monitor

PCD's are calibrated at least every 6 months by exposure to 3/4 of full scale using NIST traceable sources. PCD's must read between -10% to +20% of the net exposure. Any PCD's that do not met these criteria are removed from use.

6. If alpha contamination on licensed related material is suspected or known the following controls will be implemented in addition to the controls specified in Item #10 of the license application.

Alpha radiation and contamination surveys will be conducted on incoming or outgoing radioactive material shipments, weekly for work areas, daily for areas with temporary boundaries, and whenever contamination levels are likely to change. A record shall be made of the surveys performed as specified above. These records shall be retained indefinitely.

Removable alpha contamination on tools, equipment, or materials will be controlled or decontaminated to less than 220 dpm/100cm². Personal clothing will be controlled if alpha contamination measured by direct scan is greater than 220 dpm. If alpha contamination measured by direct scan is detected in excess of 220 dpm on the skin, personnel will be decontaminated at the direction of radiological control or medical personnel.

If there is a potential for generating airborne alpha contamination greater than 10% of the applicable DAC in the work space engineered HEPA filtered ventilation systems will be utilized. If there remains a potential for generating airborne alpha contamination greater than 10% of the applicable DAC in the workers breathing zone then air supplied hoods will be required. If the airborne activity exceeds 100 times the applicable DAC established for the work space, work is immediately secured and the ventilation is adjusted, modified, or re-engineered or different work practices are used to ensure that work progresses with airborne levels below this limit.

An Eberline model PAC-1SA or similar detector will be used for surveys or to analyze smear test paper or air sample elements. Calibration of alpha survey instruments are performed by Newport News Shipbuilding at least every six months with at least two check points on each scale up to the highest scale of 2,000,000 cpm. All instruments are checked daily for proper response to a known source.

7. NNI intends to use 450 pCi equivalent Cobalt-60 as measured by direct scan using an HP210 or equivalent probe for personnel monitoring. Direct scanning of the skin is preferred over survey techniques for removable contamination with low collection efficiencies. The 450 pCi scan limit is established because it is low enough that personnel do not ingest significant amounts of radioactivity from normal contact, the limit is measurable, convenient and practicable. Radiation workers and monitors have significant experience in frisking technique and instrumentation to reliably detect by direct scanning contamination at the 450 pCi level. Personnel monitoring is performed after removal of anti-contamination clothing and prior to any decontamination. Personnel are instructed to use strict personal frisking techniques using instrumentation with audible responses. This includes proper probe position and taking a least 2 - 3 minute to frisk the entire body and paying particular attention to body, hair, bottoms of shoes and hands. If the audible response on the instrument increases, personnel are required to hold the probe at that location for 15 seconds to allow the instrument to achieve a maximum count. The exposure to personnel resulting from monitoring using the 450 pCi scan limit is negligible and meets the criteria for as low as reasonably achievable (ALARA).
8. When radiological work may generate airborne contamination, ventilation systems are engineered to maintain airborne contamination levels in the work space to less than 100 times the applicable DAC. Detailed work procedures direct when air samples are to be taken. Specially trained and qualified workers don air supplied hoods as a protective measure if airborne is expected to exceed 10% of the applicable DAC. If samples in the work space indicate airborne contamination levels greater than 100 times the applicable DAC, work is immediately stopped and actions are taken to correct the situation.

Written local procedures control the maintenance, inspection, repair, storage, donning, use and operation of respiratory protection equipment. Respiratory protection equipment is NIOSH approved and is used in accordance with the manufacture's recommendation. Radiation workers and monitors receive special training to use fresh air hoods. Filtered respirators will be used in casualty or drill situations only. Radiation workers and monitors qualified to wear respiratory protection equipment must pass an annual medical examinations to ensure they are physically and mentally qualified to wear respiratory protection under work conditions. A portion of the workers qualified to wear respiratory protection will be assessed by gamma spectroscopy to evaluate the effectiveness of the respiratory protection program.

9. In Item 10.II.C.3.3, page 10-6 of the license renewal application the reference to Item 13 was carried over from a previous draft of the application and should be deleted.
10. Smoking, eating, and drinking are prohibited in contamination control areas.
11. Personnel monitoring contamination surveys that indicate no loose radioactivity above the licensed limit on their skin or clothing are not recorded or retained. Records of personnel monitoring contamination surveys that indicate radioactivity above the licensed limit on

their skin or clothing are retained in accordance with 10 CFR 20.2173 and as such are retained permanently or until the Nuclear Regulatory Commission terminates the license requiring this record.

12. The gamma spectroscopy system for assessing the uptakes of Cobalt-60 consists of a Canberra Series 35 Plus Multichannel Analyzer with a 3"x3" sodium iodide (NaI) scintillation detector. The detector is shielded and mounted in a sliding bracket that allows the detector to be easily positioned. Trained personnel are always present to operate the system. The system is maintained in a calibrated state. The system is available and operational at any time.

Instrumentation calibration is controlled by in-house operating procedures that establish a counting duration sufficient to achieve a minimal detectable activity (MDA) of 3.0 nCi or less of internally deposited Cobalt-60 at a 90% confidence interval. Instrument efficiency is determined using Alderson tissue equivalent phantoms loaded with NIST traceable calibration sources.

13. Calibration of contamination survey instruments is performed by Newport News Shipbuilding at least every six months with at least two check points on each scale. Instruments with scales that are not calibrated are clearly and conspicuously marked. Contamination detection instruments (beta-gamma) are checked daily for proper response to a check source of about 500 pCi of Cobalt-60 or Technetium 99.
14. NNI will maintain the calibration records and "Certification of Calibration" which demonstrate that survey instrumentation is calibrated as approved by the NRC pursuant to this license renewal action.
15. In the event that NNI is unable to dispose of radioactive waste by transfer for burial, NNI will maintain storage on site until the next regional low level radioactive waste disposal site opens. NNI is aware of and will meet the requirements contained in Appendix F to 10 CFR 20 regarding manifests, certification, control and tracking for transfer and disposal at land disposal facilities of low level waste.
16. In paragraph 3 above the internal dose estimate was shown to be less than 2.2% of the TEDI for a member of the public and is not significant. Radioactive material will be controlled and surveys performed to assure that radiation levels outside work facility in the restricted area are less than 0.15 mrem/hr. The work facility building will be located on a site in an industrial park section of the city inside a fenced controlled area. The outside area immediately surrounding the work facility restricted area is used only for pedestrians or vehicular traffic and meets the criteria of an "Occasional Occupancy" defined by NCRP Report No. 49, "Structural Shielding Design and Evaluation for Medical Use of X-rays and Gamma Rays of Energies up to 10 MeV." NCRP assigns an occupancy factor of 1/16th. Using a maximum exposure rate of 0.15 mrem/hr for 8766 hrs/yr and an occupancy factor of 1/16th the exposure to a member of the public in this low traffic area is estimated to be less

than 83 mrem/yr. The distances from the work facility building to the closest unrestrict area at the fence is a minimum of 100 yards. For a continuous exposure of 8766 hrs/yr the worst case estimated dose to a member of the public in the closest unrestricted area at the fence is less than 0.1 mrem/yr. TLD badges will be posted on all sides of the fenced controlled area and the work facility restricted area perimeter and read quarterly to confirm licensed operation do not result in exceeding the dose limit of 100 mrem/yr to a member of the public.

17. NNI intends to process or solidify liquid wastes for disposal as radioactive solid waste.

Note: On page 10-5 paragraph C 1.2 of the license renewal application the first sentence should read "Radioactive loose surface contamination limits in occupied contamination control areas shall not be more than 1,000,000 pCi/100cm²."

Yours very truly,



T. Bond
Radiation Safety Officer

NNS Radiological Control Examination 106.1-94-1B

Fully Qualified Radiation Worker

Name:		
<small>Last Name</small>	<small>First Initial</small>	<small>Middle Initial</small>
Social Security Number:	Department:	
Are you a supervisor? (Yes/No):		
Today's Date:		
Sample		
Total Points:	x 1 = Grade:	
Graded By:		

DIRECTIONS

1. Read all questions carefully before you answer.
2. Remember ALL aspects of your RadCon training.
3. Write or print clearly
4. The amount of space or number of lines provided for each question is not meant to indicate the length of your response
5. Ask the instructor for help if you don't understand a question
6. Maximum points = 100 points.
7. Passing score for supervisors = 80 points
8. Passing score for workers = 75 points

Approved by:  Date: 5/8/95

Enclosure (1)

Practical Ability Sign off Dosimeters

This form documents your ability to read all types of dosimeters in use.

There is NO point value assigned to this exercise.

Using the dosimeters provided, write down their ACTUAL readings.

(A) _____

(B) _____

(C) _____

Verified by: _____

Date: _____

This sheet is to be used for Qualification / Requalification
examinations ONLY.

Situation

79 Points

Your department is assisting in the development of a Technical Work Document (TWD). You will be required to enter a reactor compartment onboard a nuclear surface ship. On the worksite tour you will be required to take measurements and assess shipboard conditions.

Use this information for question A

- (A) You arrive at the Badge Issue Station. Explain in detail how you obtain dosimetry equipment?

What items should you check before leaving the Dosimetry Issue Station?

You are now onboard the ship and you check to make sure you still have your dosimetry.
Use this information for questions B through C

- (B) Where on your body will you wear your dosimetry?
- (C) A Radiation monitor tells you to wear your dosimetry at a location other than the location you specified in your answer to question B.

What will you do?

Why would the monitor tell you to move your dosimetry to another location?

Prior to entering the Control Point Area you see a co-worker wiping down some tools with diapers he has dampened with controlled pure water.

Use this information for question D

(D) What actions do you take?

Why did you take the actions you stated in the question above?

You have now entered the reactor compartment. You notice four other co-workers doing their jobs.

- **2 co-workers are removing a main coolant pump with a radiation level of 60 mrem/hr.**
- **1 co-worker is removing lagging from a primary coolant pipe.**
- **1 co-worker will bag up a screwdriver he used while working in a drape type CSCA.**

Use this information for questions E through H

(E) There are many different ways that you and your co-workers could minimize your radiation exposure. One example would be to plan the job prior to entering the radiation area. List four (4) other specific examples.

(F) What material/items will your co worker need to package the screwdriver he used while working in the CSCA drape?

(G) List all the steps your co worker will take when packaging the screwdriver he used while working inside the drape type CSCA.

(H) How will this screwdriver be accounted for as radioactive material when transferred between radiologically controlled areas?

The measurements are now complete. You exit the reactor compartment and enter the Control Point Area (CPA).

Use this information for questions I through K

(I) You are about to perform a whole body frisk. What will you check on the frisker prior to frisking?

(J) While frisking your left arm, the audible response increases. As you hold the frisker over your arm, the frisker alarms. What actions will you take?

(K) What does the frisker alarm indicate?

You have finished frisking and have exited the Control Point Area. RadCon is talking to you about your Dose Control Form when you see a co-worker, who is wearing dosimetry equipment, enter the reactor compartment without receiving RadCon's permission.

Use this information for question L

(L) What are four (4) of the radiological and disciplinary consequences your co worker can receive by violating the ropes and signs posted at the reactor compartment entrance?

You have now completed your Dose Control Form and are leaving the ship. While walking through the Engine Room you see a drape type CSCA with no one in the vicinity. There are no other rope barriers or signs at the entrance to this area.

Use this information for questions M through N

(M) What actions will you take?

(N) Why did you take the actions you stated in the question above?

You have left the ship and are reporting back to your supervisor. He reviews the data you collected and decides to go to the reactor compartment for a look. You remind him before he leaves, that you have a doctor's appointment the next day to receive radiation medical therapy involving radioisotopes.

Use this information for questions O through P

(O) What should you do when you return to work from your doctors appointment?

(P) What could this therapy affect?

You are now putting your tools away to get ready for your next assignment. A co-worker states that he is going to 106.1 Radiation Worker Training next week. He asks you some questions about concerns that he has.

Use this information for questions Q through R

(Q) What is the main potential health effect from exposure to ionizing radiation?

(R) What do you tell your co worker about the risks associated with the exposure to radiation within NAVSEA limits?

Problem

21 Points

You and a co-worker are assigned a job in the lower level of the Main Pump Room onboard the Surface Ship Support Barge (SSSB). Your co-worker has already gone to the job site. When you enter the pump room, you see a nuclear vacuum cleaner. The hose has become disconnected from the vacuum cleaner, and is lying on the deck. There is some dust on the deck at the open end of the hose. The other end of the hose is sealed with a yellow plastic bag. Your co-worker has already started work deconning a glove box in another area of the pump room.

- You and your co-worker are the ONLY people in the lower level.
- A spill kit is located behind you.
- There is a RadCon Monitor located at the Control Point Area.
- There is a bag of damp diapers next to the glove box.
- The vacuum cleaner is NOT in operation.

TURN TO SKETCHES A AND B FOR HELP

Use this information for question 5

(S) What actions should you take and HOW would you accomplish these actions?

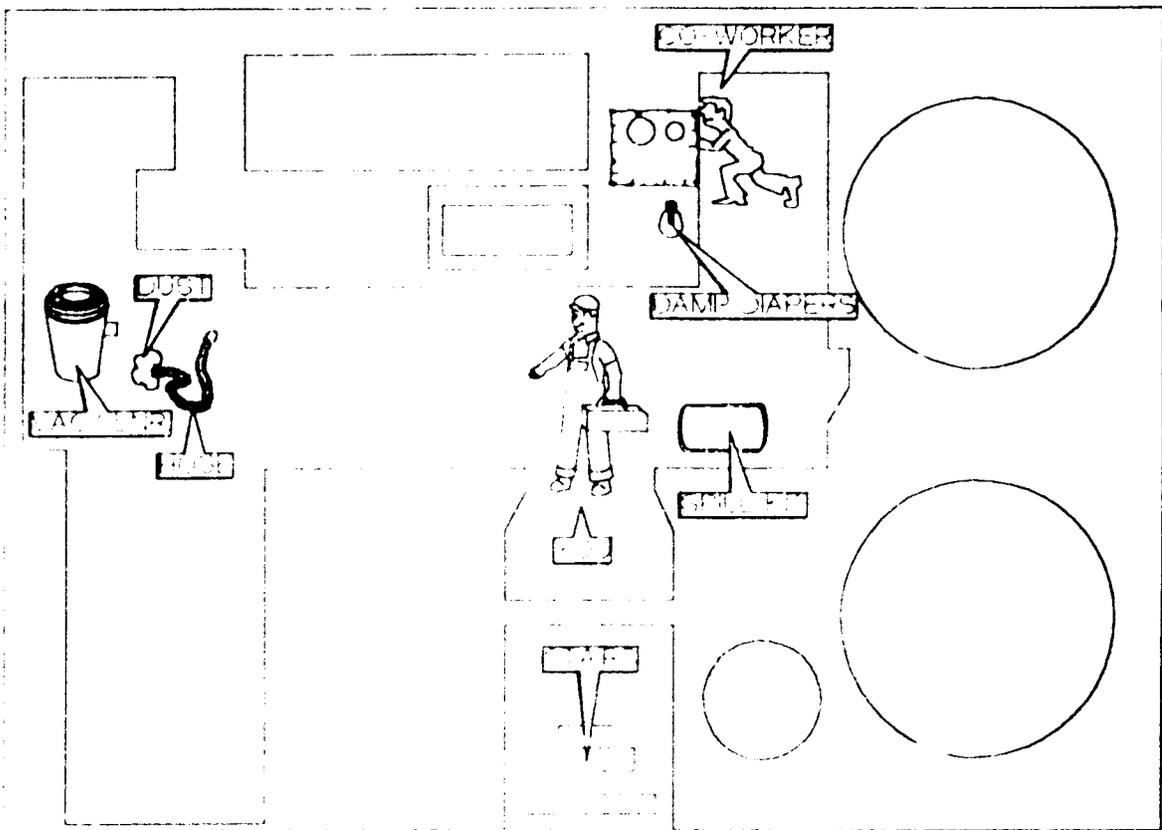
1061 94 1B
Examination

Blank lined area for examination notes.

Exam 106.1-94-1B
Sketch Book

SKETCH A

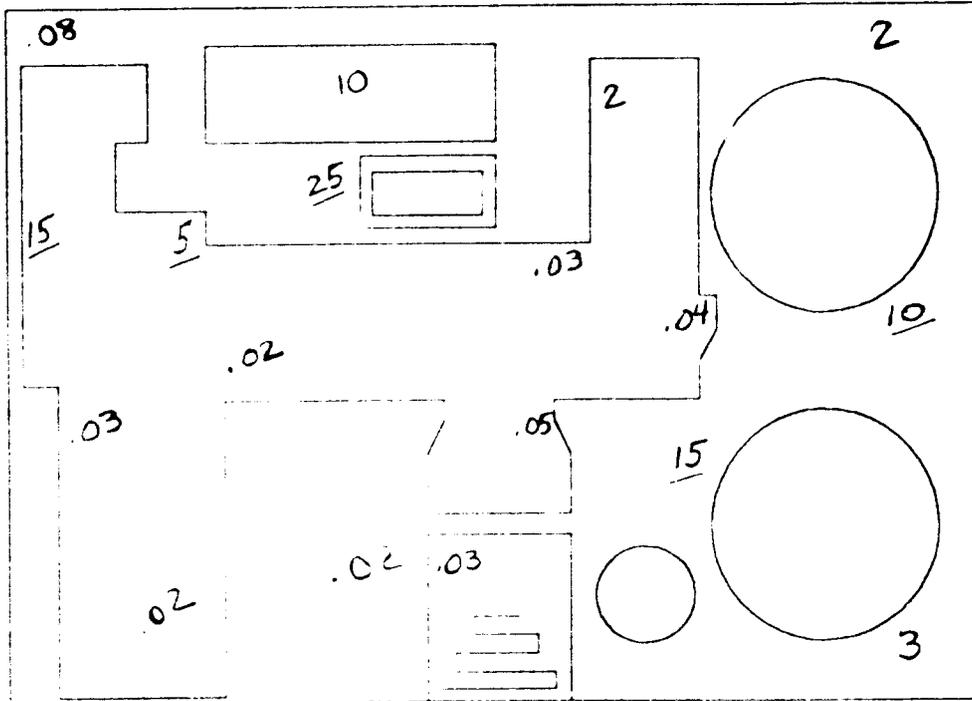
LOWER LEVEL MAIN PUMP ROOM



SKETCH B

RADIATION SURVEY # _____ REV 5/93 RADIATION SURVEY RECORD FORM # _____

LOWER LEVEL MAIN PUMP ROOM



TRAINING USE ONLY

The person responsible to sign this form is a fee based on an annual evaluation and is different from the person who actually performed the survey in accordance with the approved log number.

DESCRIPTION RADIATION SURVEY	DATE 7/20/07	TIME 11:00 AM	LOCATION LLP	INSTRUMENT MODEL RAI-1000
INSTRUMENT 27				Readings taken of general area unless otherwise noted. All readings are in microR unless otherwise noted. Check here <input type="checkbox"/> if readings are in CPM. <input type="checkbox"/> if readings are in R/hr. Instrument readings taken at contact.
SERIAL NUMBER 3-12				User's Name: <u>3 SUPERVISOR</u>

**NNS Radiological Control Monitor
Examination**

CWE 4-95

NAME: _____
DATE: _____ SS#: _____
CHECK ONE: <i>Instructor</i> _____ <i>Supervisor</i> _____ <i>Monitor</i> _____
GRADE: _____ GRADED BY: _____

Sample

Prepared By: A. M. Weber Date: 4-7-95
A. M. Weber

Reviewed By: E. J. Doherty Date: 4/7/95
E. J. Doherty

Approved By: C. W. Amos Date: 4-7-95
C. W. Amos

RULES FOR TAKING EXAMINATIONS

MEMOS.rules

1. No training manuals or other reference materials are to be used while taking examinations.
2. Sheets removed from manuals, notes, and cue cards shall not be used while taking examinations.
3. Looking at answers on other examinees' test shall not be allowed during examinations.
4. No Rules-of-Thumb shall be used while taking the examination.
5. **All** questions concerning interpretation of examination questions shall be directed to the instructor administering the exam. The instructor is not permitted to interpret or answer any questions concerning the intent of the technical content of the examination.
6. **All** examination material must be returned to the instructor administering the examination at the completion of the examination.
7. **Carefully read each question** before you write an answer. Be sure your answer is complete and as clear and concise as possible.
8. **Do not use scratch paper.** All notes, calculations, etc. are to be made on the examination sheets.
9. Once the examination has started, any person leaving the classroom **must** have prior approval from the instructor administering the examination.
10. No talking or discussions shall be allowed in the classroom during examination sessions, except with the instructor.
11. Upon completion of the examination, review the examination and cover sheet to ensure that all information is complete and legible and that the employee data and date is entered in the appropriate blocks. If remaining in the room, stay in your seat and refrain from talking until the examination is complete and the instructor has collected all examinations.
12. **Do not write additional answers, notes, or comments on a graded examination.**

I have read the above rules concerning the administration of examinations in the training program. I fully understand each of the above rules and understand that cheating in any form or violation of any of these rules may result in disciplinary action.

Printed Name

Signature

Date

Part 1 - 51 Points

You have been assigned to provide coverage for the removal of a bonnet assembly from a Coolant Discharge 2" globe valve during Selected Restricted Availability (SRA) on a 688 Class Submarine. The valve has been isolated from the system. The insulation and lagging have been removed from the valve. The pre-job radiation survey has been performed (See enclosure 1). The work steps for this job are:

- Install the canopy cutting machine.
- Install convertible top glovebag (drape CSCA).
- Cut the body-to-bonnet seal ring.
- Vacuum and wipe down the cutting area.
- Remove the canopy cutting machine from the drape and ship it to the appropriate storage area.
- Close and seal the glovebag top and disestablish the CSCA.
- Unscrew and remove the bonnet assembly.
- Install the FME plug.
- Remove the bonnet assembly via the access sleeve and ship it to the Nuclear Repair Machine Shop.
- Decontaminate the glovebag with damp diapers.

NOTES:

During this job on previous SSN 688 SRAs:

- One to five gallons of water were collected upon removal of bonnet assembly.
- Radiation levels on the bonnet assembly after removal from the valve body have ranged from 10 - 40 mrem/hr.
- Contamination above the limits has been found in two locations:
 - (1) Inside the valve body (30,000 - 600,000 μCi /swipe)
 - (2) Solid samples of metal shavings from the canopy cut
 $3 \times 10^5 \mu\text{Ci/gm}$

Use this information for questions 1 - 14

(108.7.n.,108.13.a.,108.17.n.,108.17.C ,108.17.z.)

(6.5) 1. Describe the surveys that you would take during this job by completing the following table.

Type of Survey

When Taken

Location Taken

- (108.8.a.)
- (4.5) 2. The use of a containment for this job is an Engineered Control; List (6) other Engineered Controls that can be used to reduce airborne radioactivity.

- (108.7.a.)
- (4) 3. Discuss the packaging requirements for the removed bonnet assembly.

(108.7.a.)

- (6) 4. Discuss the Radiological Control requirements for establishing the drape and the work controls used to remove the canopy cutting machine from the work area.

- (6) 5. Use the radiation map from enclosure (1) to calculate the work site radiation level resulting from the 5' section of piping. (108.2.d.)

Note: Piping is 2" in diameter with 7" of lagging.

- (4) 6. Recalculate the radiation level after adding 1" of lead shielding to the 5' section of pipe. (108.2.c.)

(108.5.o.,108.5.p.)

- (3) 7. Regarding any alteration of temporary shielding, when must the associated special radiation survey(s) be performed?

(108.9.d.,108.9.e.)

- (2) 8. When inspecting the radiologically controlled vacuum cleaner, how can you verify that its HEPA filter meets the DOP test frequency requirement?

(108.4.q.)

- (2) 9. While briefing the workers on the job, the newly qualified helper expresses concern over getting cancer from entering the high radiation area. What can you tell him of the risk involved in receiving radiation exposure?

(2) 10. Provide a numerical risk estimate to explain your answer to question #9. (108.4.q.)

(2) 11. Give a description of the basic components of the PCD. (108.3.b.)

(3) 12. Explain the general principles of operation of the PCD. (108.3.b.)

(108.1.b.)

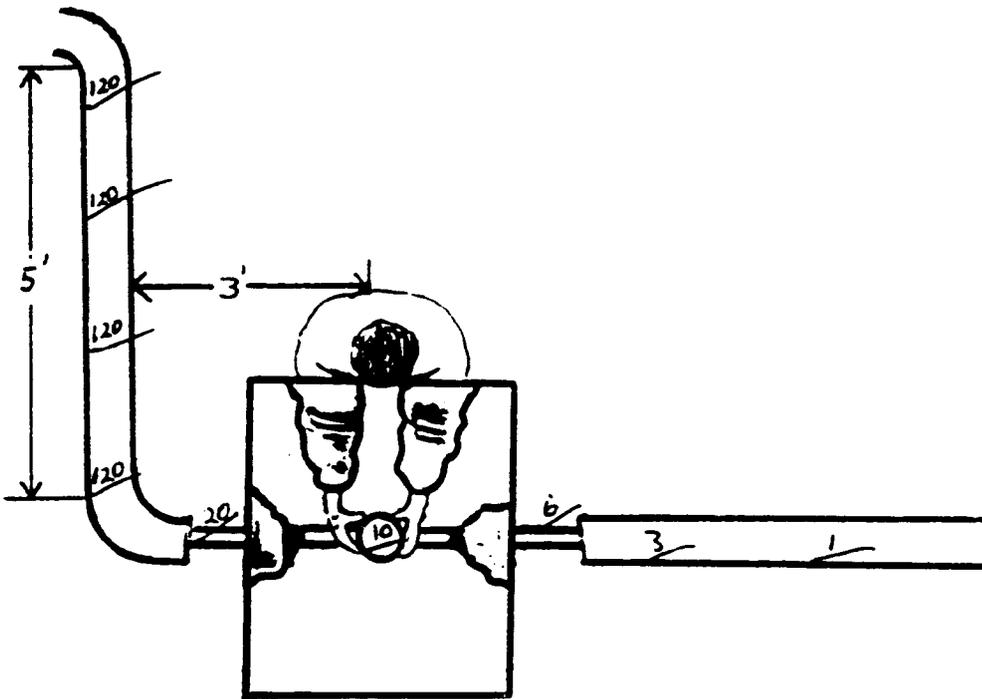
- (4) 13. PCDs read in units of roentgen (milliroentgen). Explain the difference between rem and roentgen.

(108.13.a.)

- (2) 14. List any error(s) on the survey record from enclosure (2).

RADIATION SURVEY RECORD

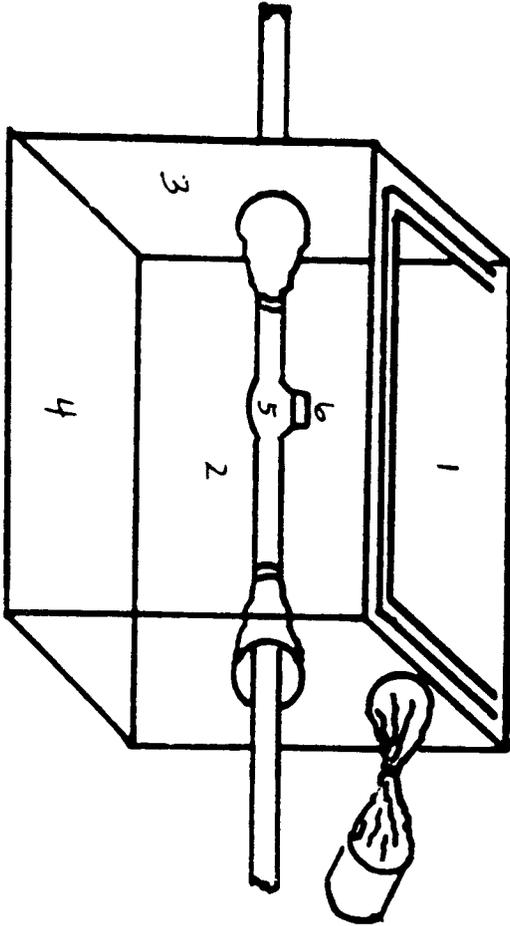
Enclosure (1)



"The person designated to sign for an action verifies, based on personal observation, and certifies by his signature that the action has actually been performed in accordance with the specified requirements."

SURVEY TYPE: RADIATION DATE: TODAY TIME: 0730 LOCATION: REACTOR COMPARTMENT 4A		Reason for survey: SPECIAL SURVEY TAKEN I.A.W. TWD 123
SURVEY FREQUENCY: ROUTINE: SHIFT <input type="checkbox"/> DAILY <input type="checkbox"/> WEEKLY <input type="checkbox"/> MONTHLY <input type="checkbox"/> SPECIAL: <input checked="" type="checkbox"/>		_____ _____ _____
INSTRUMENT: AN/PDR 27	CHECK TYPE OF RADIATION MEASURED (Use symbols if more than one type of radiation is being measured) GAMMA <input checked="" type="checkbox"/> NEUTRON <input type="checkbox"/> BETA-GAMMA <input type="checkbox"/> BETA <input type="checkbox"/>	Readings taken of general area unless otherwise noted. All readings are in microR unless denoted. Check here <input type="checkbox"/> if readings are in CPM ----- = RadCon Rope Barrier Underlined readings taken at contact
SERIAL NUMBER: T 143	_____ _____	_____ _____
Monitor's Signature: J m Monitor	Social Security Number: 225-36-8420	Supervisor's Signature: C. P. Richardson Social Security Number: 226-92-2825

Enclosure (2)



SURVEY TYPE: CONTAMINATION DATE: TODAY TIME: 1130 SHIFT: 1ST LOCATION: RC W/L

SURVEY FREQ: SHIRT DAILY WEEKLY MONI: SPECIAL SURVEY

INST: RM 14 SN: 9089

MONITOR'S SIGNATURE: Jm Monitor 225-36-8420

HP-318 PROBE 48 X NET COUNTS - PPCI
 PAC-13A8A SCAM 18 X NET COUNTS - PPCI
 PAC-13A8A SWIPE 88 X NET COUNTS - PPCI

NADCOM SURVEY #

LOCATION	1	2	3	GROSS - BKG	NET	ACTIVITY PPM
1 GB. TOP				60	60	0
2 WALL				60	0	< 450
3 ↓				60	0	
4 ↓ BOTTOM				100	40	
5 VALVE BODY				140	80	
6 FME. PLUG				60	0	
1 SCAN SURVEY						
2 SWIPE SURVEY 100 CM ²						
3 SWIPE SURVEY PER SWIPE						

REASON FOR SURVEY: SPECIAL SURVEY

READINGS TAKEN AT: W/L

ALL READINGS IN AIRMETER. * DENOTES DIRECT MONITORING.
 NADCOM ROPE BARRIER UNDERLINED READINGS TAKEN AT CONTACT

SUPV'S SIGNATURE: UR Supervisor SSN: 226-93-3825

*The person designated to sign for an action verified, based on personal observation, and certifies by his signature that the action has actually been performed in accordance with the specified requirements.

Part 2 - 49 Points

Name: _____

SSN: _____

It is 0900 Monday morning and you are the monitor performing a tour of the R/C on a 688 Class submarine. Two (2) X42 mechanics are in the lower level R/C performing a pre-cut on MC-12 in preparation for removal of the valve. One mechanic is operating the cutting machine through the sleeves of an open top glove bag while the other mechanic is standing nearby. The radiation survey taken on third shift is attached (See Enclosure 3). There is one (1) other worker in the middle level R/C installing lagging on some PR piping.

While checking containment in the lower level, you hear a hissing sound and notice that the noise from the cutting machine has stopped. You hear the X42 mechanic yelling for RadCon. As you turn the corner, you see water spraying from the glove bag containing MC-12.

As the pre-cut was being made, the machine unexpectedly cut through. An improper valve line-up causes water to spray from the system. After a brief time, the water stops. Approximately five (5) gallons of water is lost from the system. Some water stays in the glove bag while the rest sprays onto the mechanic, the deck, and into the bilge. The startled mechanic stumbles back pulling his arms out of the sleeves and strikes his elbow on a pipe hanger. His elbow is bruised and has a slight abrasion. He tells you he is OK.

There is another Radiation monitor at the CPA. You will be the senior radiological controls person for the next (30) minutes.

(See Enclosures 4 and 5)

Use this information for questions # 12 - 21

- (4) 12. Following the incident, the "Hot Spot" that was upstream of the valve now reads 500 mrem/hr. Estimate, by using calculations, the total amount of activity released from the spill. State all assumptions and show all calculations.

(108.18.a.)

- (4) 13. Of the (5) gallons of water released from the system, approximately (3) gallons stayed inside the glove bag. The remainder of the water went onto the mechanic, deck, and into the bilge. Estimate, by using calculations, the potential β - γ loose surface contamination levels of the spill area. State all assumptions and show all calculations.

(108.4.1. 108.18.a.)

- (4) 14. Estimate, by using calculations, the potential β - γ dose to the skin of the X42 mechanic. State all assumptions and show all calculations.

- (4) 15. Estimate, by using calculations, the potential airborne radioactivity resulting from the spill. State all assumptions and show all calculations. (10R.18.a.)

- (4) 16. Estimate, by using calculations, the potential committed dose equivalent to the lungs (over 50 years) from the airborne radioactivity determined above. State all assumptions and show all calculations. (10R.4.E., 10R.4.M.)

(2) 17. Discuss the health effects of the exposures received to worker's skin and lungs.

Skin

Lungs

- (24) 18. Describe the immediate actions you would take to respond to this situation. Be specific as to **how** your response actions would be carried out. Also, specify **who** would perform the actions.

After you complete your answer indicate by each action the relative priority of the action. Do this by placing by each action I, II, or III to indicate one of the following categories:

- I. Those response actions that would begin in a time frame of **0 - 5 minutes** into the casualty.
- II. Those response actions that would begin in a time frame of **5 - 20 minutes** into the casualty.
- III. Those response actions that would begin in a time frame of **20 minutes or later** into the casualty.

Response Actions

Response Actions	How Performed/By Whom	Time Frame

Response Actions (cont.)

Response Actions	How Performed/By Whom	Time Frame

Response Actions (cont.)

Response Actions	How Performed/By Whom	Time Frame

(108.18.a.)

- (1) 19. Briefly state the reasons for the timing of your actions taken in the time period of Category I after the accident.

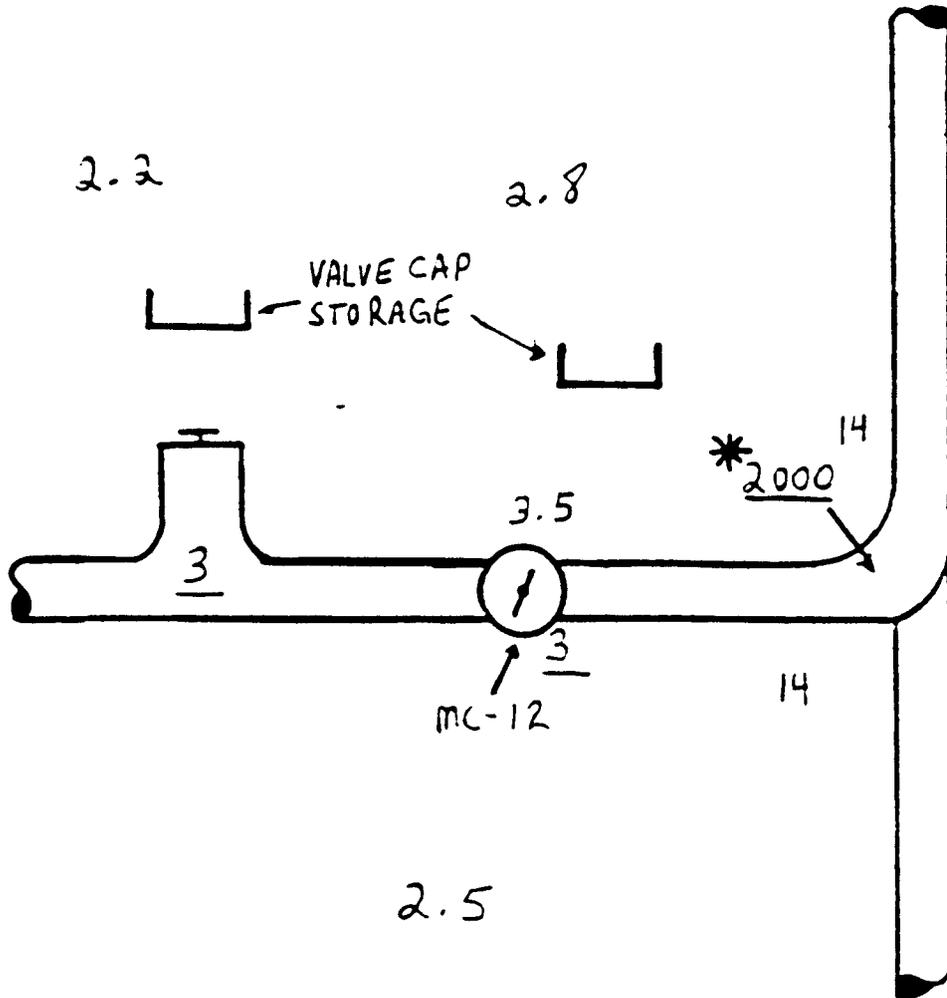
(108.18.a.)

- (1) 20. Briefly state the reasons for the timing of your actions taken in the time period of Category II after the accident.

(108.18.a.)

- (1) 21. Briefly state the reasons for the timing of your actions taken in the time period of Category III after the accident.

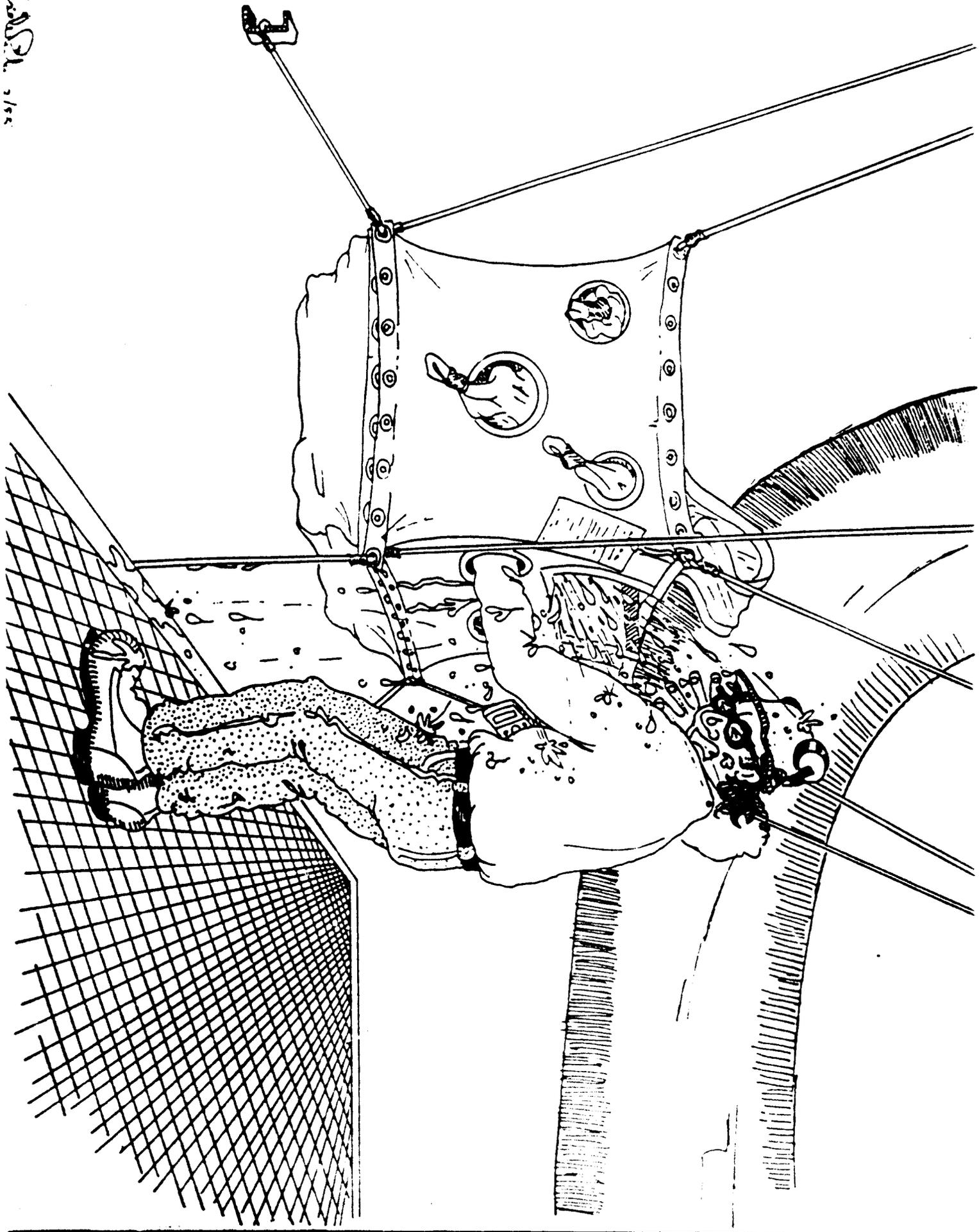
RADIATION SURVEY RECORD

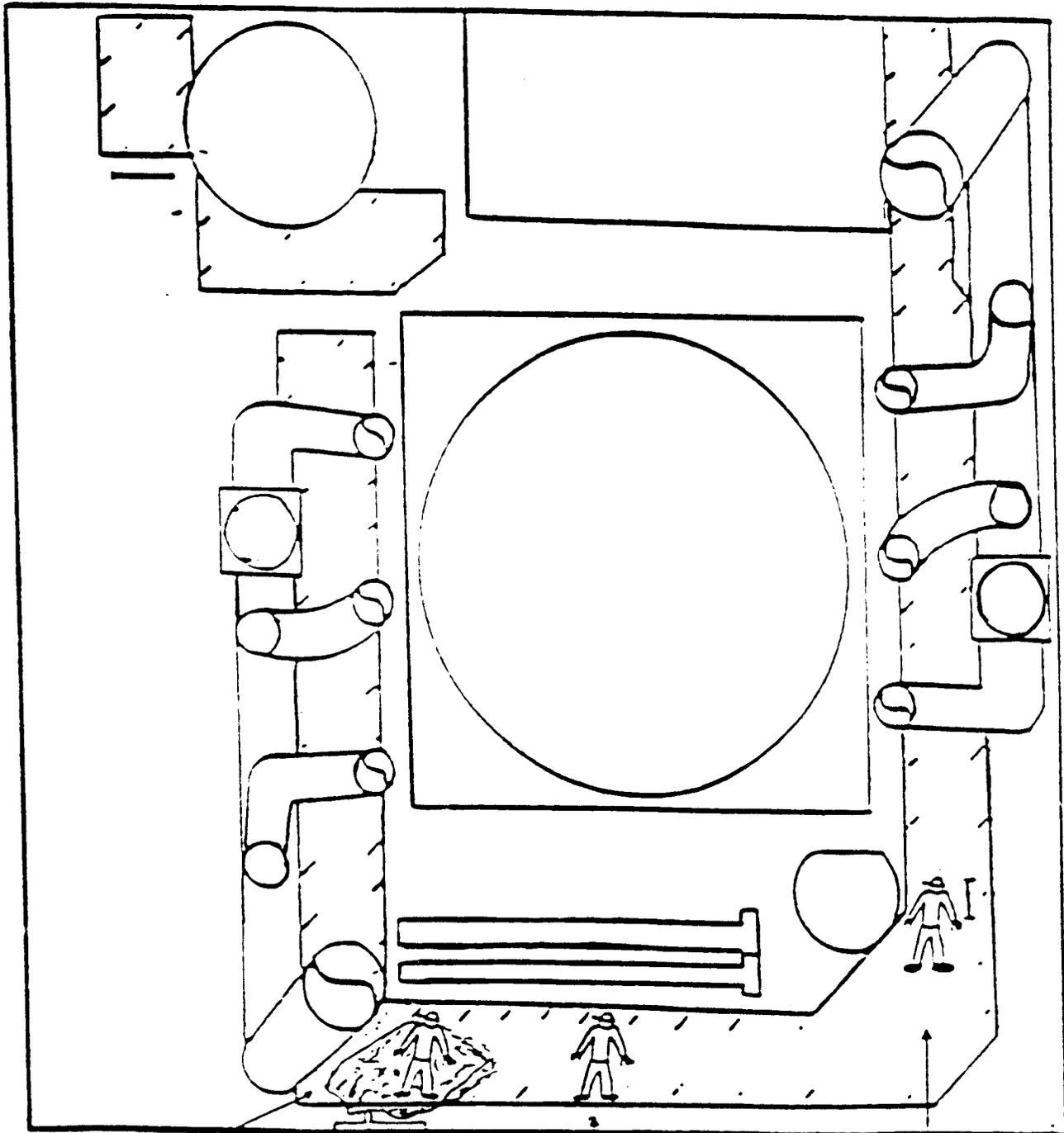


The person designated to sign for an action verifies, based on personal observation, and certifies by his signature that the action has actually been performed in accordance with the specified requirements.

SURVEY TYPE: RADIATION	DATE: TODAY	TIME: 0500	LOCATION: SSN 766 PIER #6 LOWER LEVEL R/C	Reason for survey: SPECIAL SURVEY PRIOR TO IGNITION OF PIG-CUT OPERATING ON MC-12
SURVEY FREQUENCY: ROUTINE: SHIFT <input type="checkbox"/> DAILY <input type="checkbox"/> WEEKLY <input type="checkbox"/> MONTHLY <input type="checkbox"/> SPECIAL: <input checked="" type="checkbox"/>				* DENOTES READING WITH ES30 2000 MREM/HR EXPOSED DUE TO REMOVAL OF PIG SHIELDING FOR INSTALLATION OF GLOVE BOX
INSTRUMENT: 27 + ES30		CHECK TYPE OF RADIATION MEASURED (Use symbols if more than one type of radiation is being measured)		Readings taken for general area unless otherwise noted.
SERIAL NUMBER: T-19 + EP-40		GAMMA <input checked="" type="checkbox"/> NEUTRON <input type="checkbox"/> BETA-GAMMA <input type="checkbox"/> BETA <input type="checkbox"/>		All readings are in mrem/hr unless denoted. Check here <input type="checkbox"/> if readings are in CPM
Monitor's Signature: I Radcon		Social Security Number: 123-00-1010		Supervisor's Signature: A. J. [Signature]
				Social Security Number: 321-00-5108

27
2/15/52





Injured X42
Worker

MC-12

X42 Helper

RadCon Monitor