SUPERVISOR OF SHIPBUILDING, CONVERSION AND REPAIR, USN
SAN FRANCISCO, CALIFORNIA 94135

IN REPLY REFER TO:
165-52
19 AUG 1979

From: Supervisor of Shipbuilding, Conversion and Repair, USN, San Francisco
To: Commander, Naval Sea Systems Command (SEA 07014), Department of the Navy, Washington, D.C. 20362
Via: Officer in Charge, Naval Nuclear Power Unit, Port Hueneme, CA 93043
Commander, Naval Facilities Engineering Command (Code 11H), 700 Stovall Street, Alexandria, VA 22332

Subj: Monitoring and decontamination of ex-NRDL buildings 815, 364 and 816

Ref: (a) SUPSHIP SAN FRAN ltr 100-97 of 11 Dec 78

Encl: (1) Report of Monitoring and Decontamination of Building 815, Hunter's Point Shipyard, San Francisco, California
(2) Report of Monitoring and Decontamination of Buildings 364 and 816, Hunters Point Shipyard, San Francisco, California

1. In accordance with the recommendations of reference (a), funding was provided by NAVSEA, Code 07014 and monitoring and consultive support was provided by the Radiological Affairs Support Office (RASO) of the Naval Nuclear Power Unit (NRDL), Port Hueneme, California for the monitoring and decontamination of buildings formerly occupied by the Naval Radiological Defense Laboratory (NRDL), San Francisco, California.

2. The work proceeded as scheduled and was completed on 16 July 1979. Reports of the monitoring and decontamination efforts are submitted as enclosures (1) and (2).

3. Based on the data contained enclosures (1) and (2), it is recommended that all buildings formerly occupied by NRDL be recertified for unrestricted occupancy and use.

4. This Command wishes to express appreciation for the assistance provided by the Radiological Affairs Support Office in the planning and execution of the building clearance project.

A. F. WARDWELL

SUPERVISOR OF SHIPBUILDING, CONVERSION AND REPAIR
SAN FRANCISCO, CALIFORNIA

REPORT OF MONITORING AND DECONTAMINATION OF BUILDING 815 HUNTER'S POINT SHIPYARD SAN FRANCISCO, CALIFORNIA

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ENCLOSURE (1)

ABSTRACT

A detailed radiological survey of Building 815. Hunter's Point Shipyard, was performed during the period 25 February to 16 April 1979. Areas found to be contaminated were decontaminated and a post-decontamination survey performed during the period 5 - 8 June 1979. Low level radioactive waste material generated by the decontamination operations was packaged and prepared for shipment from 8 May to 22 June 1979. The waste shipment was released to the disposal contractor on 16 July 1979.

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REFERENCES

A. SUPSHIP San Francisco ltr 100-97 of 11 Dec 78

B. International Atomic Energy Agency (IAEA) Technical Report Series No. 120, "Monitoring of Radioactive Contamination on Surfaces"

I. DISCUSSION

A. As a continuation of the task outlined in reference (a), a detailed radiological survey of Building 815 was performed during the period 25 February to 16 April 1979. To obtain a reasonably complete picture of the radiological situation without the expenditure of an inordinate amount of time and manpower required some selectivity in applying the monitoring effort.

B. Using the information provided in reference (a) and by visual inspection of working spaces, it was determined that the building areas would be segregated into three categories for the survey effort: (1) "High potential" areas were designated as those areas with a high probability for radioactive contamination due to the past use of unsealed radioactive materials within the area; (2) "Low potential" areas were those areas where radioactive materials were not thought to have been used or where sealed radioactive sources only were used, in essence, the remaining areas within the building; and (3) "Cafeteria", where the potential exists for future use of the area for food storage, preparation, serving and consumption.

C. The "high potential" areas were monitored to a much greater extent and detail than were the "low potential" and "cafeteria" areas. In the event that contamination was located during the survey of the "cafeteria" or of a "low potential" area, that area was subsequently designated as a "high potential" area and that survey methodology applied. The survey methodology utilized for the three area categories is described in Section IV.

D. Upon completion of monitoring, supplies and equipment needed for decontamination were procured and the decontamination effort started on 1 May 1979. In-house personnel available to Supervisor of Shipbuilding, Conversion and Repair (SUPSHIP), San Francisco accomplished the decontamination and waste packaging under the direction and with the assistance of the Project Manager, completing the job by 22 June 1979.

E. The following personnel participated in the Building 815 clearance effort:

1. NAVAL OCEAN SYSTEMS CENTER

   Mr. A. L. Smith, Project Manager

2. RADIOLOGICAL AFFAIRS SUPPORT OFFICE, NAVAL NUCLEAR POWER UNIT

   C. A. Johannesmeyer, LCDR, USN, Director, RASO

   Mr. R. H. Smith, Technical Director, RASO

HMC G. M. Jones, USN, Health Physics Technician

HMC E. M. Colbert, USN, Health Physics Technician

HMC R. G. Carl, USN, Health Physics Technician

HM1 R. J. Frank, USN, Health Physics Technician

3. NAVAL SUPPORT FORCE ANTARCTICA

CM1 R. F. Geisbert, USN

RM2 R. A. Conklin, USN

RM3 J. E. Shimpaugh, USN

4. SUPERVISOR OF SHIPBUILDING, CONVERSION AND REPAIR

Mr. F. H. Stivender

Mr. R. L. Soares

Mr. G. Vorpahl

II. BUILDING CLEARANCE GUIDELINES

A. The following documents were used in determining contamination limits:

1. NAVMED P-5055, Radiation Health Protection Manual

2. Nuclear Regulatory Commission Regulatory Guide 1.86, "Termination of Operating Licenses for Nuclear Reactors"

3. Nuclear Regulatory Commission Draft Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material, December 1975

4. American National Standards Institute (ANSI) N328-147, "Control of Radioactive Surface Contamination on Materials, Equipment and Facilities to be Released for Uncontrolled Use" (Proposed)

B. For beta-gamma emitting radionuclides, the limits for the most restrictive nuclide, Strontium-90, were selected for determining an action level reading (smear and potential decontamination required). These limits were 1000 dpm/100cm^2 fixed contamination averaged over an area not greater than one square meter, 3000 dpm/100cm^2 maximum fixed contamination over an area not to exceed one hundred square centimeters, and 200 dpm/100cm^2 removable contamination. The averaged limit of 1000 dpm/100cm^2 fixed contamination was selected as the action level reading. Assuming a ten percent removal factor (Reference B), this action level equates to a maximum of 100 dpm/100cm^2 removable which is 50 percent of the Strontium-90 removable contamination limit. Should Strontium-90 prove to be present following smear survey analysis, these limits were utilized as the building clearance guidelines below which no further action was required. In the event that Strontium-90 was ruled out as a contaminant, the beta-gamma limits of 5000 dpm/100cm^2 fixed contamination averaged over an area not greater than one square meter, 15,000 dpm/100cm^2 maximum fixed contamination over an area not to exceed one hundred square centimeters, and 1,000 dpm/100cm^2 removable contamination were utilized as building clearance guidelines below which no further action was required.

C. For alpha emitting radionuclides, the limits for the most restrictive, the transuranics, were used. These limits were 100 dpm/100cm^2 fixed contamination averaged over an area not greater than one square meter, 300 dpm/100cm^2 maximum fixed over an area not greater than 100 square centimeters, and 20 dpm/100cm^2 removable contamination. Again, utilizing the same rationale as in Paragraph II.B above, the averaged limit of 100 dpm/100cm^2 for fixed contamination was selected as the action level reading. These limits were also utilized as building clearance guidelines below which no further action was required.

D. The limits for average and maximum radiation levels associated with surface contamination resulting from beta-gamma emitters were 0.2 mRad/hr and 1.0 mRad/hr at one centimeter, respectively, measured through not more than seven milligrams per square centimeter of total absorber. Survey results presented in Appendix A are in terms of dpm/100cm^2. Navy publication "Principles of Radiation and Contamination Control" NAVSHIPS 250-341-3, Volume 2, Page 201, states that a surface beta contamination level of 35,000 dpm/100cm^2 will produce a surface dose rate of one mRad/hr. This relationship of surface contamination concentrations to radiation levels was verified during comparison measurements between the Eberline DT-304/PDR probe and the Eberline Model RO-2 ionization chamber survey instrument of contaminants in Building 815.

E. The building clearance guidelines in effect during the decommissioning effort in 1969 specified that a localized radioactive area could be considered to be decontaminated when the beta-gamma dose rate at one centimeter averaged less than 0.2 mR/hr with a maximum of 1.0 mR/hr and the removable activity per 100cm^2 of surface was less than 1,000 dpm. For alpha contamination the fixed activity limit was 500 dpm/100cm^2 while the removable activity limit was 100 dpm/100cm^2.

III. INSTRUMENTATION

A. The basic beta-gamma monitoring instrumentation utilized was the Eberline Model E-140N count rate meter with a DT-304/PDR detector probe. The E-140Ns were equipped with speakers for audible indication of count rate and with Radiac Counter-Timers (Model 2) for timed digital measurements.

B. The alpha monitoring instrument used was the AN/PD-56 alpha scintillation radiac set with the DT-228 probe and equipped with speakers. Timed-digital measurements were again obtained utilizing the Model 2 Radiac Counter-Timer.

C. Portable instrument counting efficiencies, backgrounds, probe areas and minimum detectable activities are presented in Appendix A.

D. Laboratory instrumentation for counting alpha smear samples was the Eberline SAC-4 scintillation alpha counter with a typical background of 0.2 counts/minute and an efficiency of 26.4 percent. For counting times of one minute, the minimum detectable activity was four dpm.

E. Beta wipe samples were counted in a thin end window GM detector with a typical background of 21 counts/minute. The Cesium-137 beta counting efficiency was 31.3 percent. For counting times of one minute the minimum detectable activity was 24 dpm. All smears exhibiting 200 or greater dpm/100cm^2 gross beta-gamma using the Cesium-137 response data above were counted a second time. This second count was performed with a 100 mg/cm^2 beta absorber to determine the presence of Strontium-90 in the sample. For the second count, requiring a lower shelf, a Strontium-90 counting efficiency of 19.3 percent and a minimum detectable activity of 20 dpm was applied. All beta-gamma and alpha smears were counted at the Radiological Affairs Support Office Laboratory, Port Hueneme, California.

IV. SURVEY METHODOLOGY

A. The methodology for surveying rooms described as "high potential" in Section I was as follows:

1. Using chalk or marking crayon, one square meter grids were delineated on the floor; one meter wide by two meter high grids were delineated on each wall; and one-half square meter grids were marked on bench tops and fume hood interiors. Each sink cabinet interior and horizontal portions of shelves were treated as a separate grid. Cabinet exteriors, fume hood exteriors and shelf vertical areas were combined with the respective wall grid where possible. When not possible these were recorded as separate grids.

2. Utilizing the E-140N, each grid was audibly scanned for one minute while accumulating counts on the counter-timer, and the gross counts per minute obtained were recorded. If a hot spot (area of higher than average reading within the grid) was located during the audible scan the area was counted for one minute and the gross counts per minute were recorded. A smear was obtained of $100 cm^2$ of surface area if equal to or greater than 1000 $dpm/100cm^2$ (72 gross counts per minute) was located during the one minute scan or counting of a hot spot.

3. A smear sample was obtained from each fume hood and exhaust duct as far in as reach permitted and at a point of dust accumulation, if possible.

4. Utilizing the AN/PDR-56, each grid was audibly scanned as in Paragraph 2 above. Where alpha was located equal to or greater than 100 $dpm/100cm^2$ (three gross counts per minute) a one minute counter-timer reading and smear sample were obtained.

5. In areas where reference (a) indicated that Hydrogen-3 or Carbon-14 were utilized (the fifth floor), monitoring had to be by other than the DT-304 probe, which is incapable of detecting Hydrogen-3 and inefficient in detecting Carbon-14. These areas were, in addition to the DT-304, monitored by smear testing with the samples sent to the Naval Research Laboratory, Washington, D.C. for liquid scintillation counting. Utilizing metracel filter paper, smears were obtained from each grid and area as described in Paragraph 2 above. Each smear sample was placed in a separate liquid scintillation counting vial (20 ml) cross referenced with room number and grid location.

B. The methodology for surveying rooms described as "low potential" in Section I was as follows:

1. Using chalk or marking crayon, a number of one square meter grids representing ten percent of the floor surface area and one meter wide by two meter high grids totalling ten percent of wall surface areas were delineated. Grids were located at areas most likely to have become contaminated, i.e., near sinks, work benches, fume hoods, floor drains, etc. Any fume hood was treated as a "high potential" area.

2. Each grid was scanned for beta-gamma as in "high potential" areas. If any one minute count indicated beta-gamma readings greater than 1000 dpm/100cm^2 (72 gross counts per minuts), then the entire room was surveyed for beta-gamma and alpha as in the "high potential" area methodology.

3. The entire surface area of bench tops, sinks and any movable furniture or equipment within "low potential" spaces was audibly scanned.

C. The methodology for surveying the "cafeteria" as described in Section I was as follows:

1. Food storage, preparation, and serving areas were surveyed as a "high potential" area. This methodology was applied not because contamination was a high probability, but due to the possible future use as a food handling area.

2. The food consumption area, office spaces, and corridors were surveyed as in "low potential" areas.

V. FINDINGS

A. The results of the building survey of "high potential" areas are presented as room diagrams in Appendix A. Each grid survey is annotated with the gross counts per minute reading obtained and, where readings above the minimum detectable activity were found, with the dpm/100cm^2 value. Appendix A also includes those "low potential" areas which became "high potential" areas by the finding of above action level readings. For each grid fixed contamination reading annotated in Appendix A, an alpha reading was obtained. However, for simplicity, since relatively few readings above MDA were found, alpha readings of zero have not been recorded on the room diagrams. Where alpha readings were obtained, they are recorded on the room diagrams and are indicated by the use of the standard alpha symbol (α).

B. "Low potential" area survey results are presented in tabular form in Appendix B. When a "low potential" area contained a fume hood, the fume hood was treated as a "high potential" area and the survey results are presented as diagrams in Appendix B. Again, alpha readings of zero are not recorded.

C. Appendix C is a summary of areas to be decontaminated, indicates areas with contamination levels above the building clearance guidelines and above the action levels before decontamination, presents results of smear counting at the Radiological Affairs Support Office, and presents readings/dispositions after decontamination. The building clearance guidelines stated in Section II notwithstanding, it was decided that in keeping with the as low as reasonably achieveable principle, any area exhibiting contamination above the action level readings (1000 dpm/100cm^2 beta-gamma and 100 dpm/100cm^2 alpha) would be decontaminated.

To facilitate comparison of the contamination levels shown in Appendix C with the clearance guidelines in effect during decommissioning of NRDL in 1969, survey results have been annotated to indicate those locations that exceed the 1969 guidelines. No attempt has been made to account for radioactive decay during the intervening years. Considering the survey instrumentation commonly available for use during decommissioning and the sensitivity of present day instrumentation, the fact that some findings exceed the 1969 guidelines should not be construed as meaning that the building was improperly released to unrestricted use at that time.

D. The results of smear samples, analyzed by the Naval Research Laboratory for Hydrogen-3 and Carbon-14, are presented in Appendix D.

E. The survey of the "cafeteria" resulted in no readings above natural background obtainable; therefore, no record of survey results is included in this report.

F. The after decontamination survey results indicate that no radiation levels associated with surface contamination exceed the building clearance guideline limits.

VI. DECONTAMINATION AND WASTE DISPOSAL

A. Decontamination measures included:

1. Removal of floor tile and, as required, scraping of tile adhesive from concrete floor under tile, and in some cases bush hammering a layer of concrete from the floor.

2. Removal of Contaminated Ceramic Sinks. Sinks were broken out with a sledge hammer, the pieces removed and then discarded.

3. Paint Removal. Fume hood interiors had been coated with strippable paint and decontamination was effected by removal of the paint with paint scrapers. Other painted surfaces were decontaminated by use of a methylene chloride base paint remover to soften the paint with removal accomplished by then scraping with a paint scraper.

4. Concrete Chipping. A ten pound electric hammer fitted with a bush hammer attachment was used to remove a layer of concrete. The chipped concrete was removed by sweeping and vacuuming.

5. Removal of Contaminated Surfaces. Bench and desk tops, fume hood backing plates, fume hood parts, and duct works were disassembled and packaged as waste.

6. Cleaning with Detergent Solution. All top surfaces of cabinets, light fixtures and crane rails in Room 1109 and contaminated fume hood interiors were cleaned by wiping with detergent.

7. Vacuuming. Duct interiors were decontaminated by vacuuming accumulated dust from base, walls and overhead.

8. Grinding and Scraping. Metal surfaces were decontaminated by power sanding or by manual scraping with a carbide-tipped scraper.

9. Floor Removal. Contaminated floor blocks in the machine shop, Room 470, were removed to waste. All clean blocks were removed from the room and accumulated dust, dirt and metal shavings were removed by sweeping and vacuuming. Remaining floor contamination was removed by scraping and/or bush hammering.

10. Sawing Out Portions of Surface. Metal parts (fume hood door ledges, metal partitions, etc.) were removed by sawing out the contaminated portion with a power metal cutting saw, a power saber saw, or a hand hack saw.

11. Removal of Plumbing Parts. Contaminated valves and valve handles were removed by unscrewing or sawing with a hack saw.

B. Personnel performing decontamination procedures wore coveralls and gloves during handling of potentially contaminated items. In addition, respirators were worn during dust-producing operations such as sawing, grinding, concrete chipping, sweeping, and vacuuming. Spot air samples were taken during some of the high potential aerosal producing operations. All samples indicated concentrations of beta-gamma contaminant in the range of 8×10^{-12} to 6×10^{-11} uCi/ml.

Personnel monitoring on the completion of each work period indicated no detectable clothing or body contamination. Some shoe sole contamination (below action levels) were noted - this was readily reduced to MDA by detergent cleaning.

C. Waste disposal measures included:

1. Ten 55 gallon specification DOT-17H drums and two plywood boxes, six feet by four feet by four feet, were used to package the waste for shipment and disposal. The metal drums were used for smaller, heavier items such as floor tile, ceramic sinks, concrete chipping materials, floor sweepings and vacuum cleaner contents. The boxes were used for large wood and metal parts such as bench tops and hood and duct parts. Duct parts were compressed as much as possible to reduce volume.

2. Each drum averaged 400 pounds in weight; each box averaged 1200 pounds in weight. Total waste volume was 267 cubic feet.

3. The boxes were banded and all containers were stenciled "RADIOACTIVE - LSA". Total activity is estimated as less than one millicurie.

4. A survey of packaged waste indicated no detectable radiation or contamination (alpha or beta) at surfaces of containers. Smear surveys also indicated no detectable removable alpha or beta contamination.

5. Disposal was accomplished in accordance with NAVSUPINST 5101.9B of 8 December 1978 through Naval Supply Center, Oakland. The disposal contractor, Southwest Nuclear Company, Pleasanton, California, took possession of the waste shipment on 16 July 1979.

VII. CONCLUSIONS AND RECOMMENDATIONS

From the results of this survey, it is concluded that Building 815 meets established BUMED (NAVMED P-5055) limits and Nuclear Regulatory Commission Regulatory Guide 1.86 guidelines for unrestricted occupancy. Accordingly, it is recommended that the materials, equipment and facilities in Building 815 be released for uncontrolled use.

INSTRUMENT RESPONSE DATA

AND HIGH POTENTIAL AREA RADIATION SURVEY RESULTS

BUILDING 815

HUNTER'S POINT SHIPYARD

SAN FRANCISCO, CALIFORNIA

APPENDIX A

CALCULATIONS

BETA-GAMMA SURVEY

INSTRUMENT: Eberline Model E-140 Count Rate Meter with a DT-304/PDR Detector Probe in conjunction with a Radiac Counter-Timer (Model 2) for timed digital measurement readout.

BACKGROUND: 324 Counts/10 Minutes = 32.4 Counts/Minute (cpm)

EFFICIENCY:

$$Eff_{\%} = \frac{\text{Gross cpm} - \text{Background cpm}}{\text{Disintegrations/minute (dpm) of source}} \times 100$$

$$Eff_{\%} \quad \frac{228 - 32.4}{1000} \times 100 \qquad \text{Cs-137 Source}$$

Eff = 19.6%

MINIMUM DETECTABLE ACTIVITY (MDA):

$$MDA = 3\sqrt{\frac{\text{BKG cpm}}{\text{count time}}}$$

$$MDA = 3\sqrt{\frac{32.4}{1}}$$

$$MDA = 3\ (5.7)$$

$$MDA = 17.1 \text{ cpm}$$

$$\text{MDA as Gross cpm} = 32.4 + 17.1$$

$$= 49.5 \text{ or } 50 \text{ cpm}$$

1000 dpm/100cm^2 ACTION LEVEL FOR TAKING SMEARS EXPRESSED AS GCPM:

DT 304/PDR Detector Probe Size = 20 cm^2

$$\frac{(1000 \text{ dpm})\ (20 \text{ cm}^2)\ (.196)}{100 \text{ cm}^2} = \text{Net cpm}$$

NCPM - 39.2

GCPM - 39.2 + 32.4

GCPM - 71.6 or 72

CONVERSION FACTOR, NCPM TO $dpm/100cm^2$ FOR HOT SPOT IN GRID OR FOR GRID AVERAGE READING:

$$\frac{NCPM}{.196} \times \frac{100\ cm^2}{20\ cm^2} = dpm$$

$$\underline{NCPM\ (25.5) = dpm/100\ cm^2}$$

ALPHA SURVEY

INSTRUMENT: AN/PDR-56 Radiac Set with a DT-227 Probe in conjunction with a Radiac Counter-Timer (Model 2) for timed digital measurement readout.

BACKGROUND: 3 counts/10 minutes = <u>0.3 counts/minute (cpm)</u>

EFFICIENCY: $Eff_{\%} = \frac{3128 - 0.3}{12,680} \times 100$ Th-230 Source

$$\underline{Eff_{\%} = 24.7\%}$$

MINIMUM DETECTABLE ACTIVITY (MDA):

$$MDA = 3\sqrt{\frac{0.3}{1}}$$

$$MDA = 3\ (0.54)$$

$$MDA = 1.6\ cpm$$

$$MDA\ as\ GCPM = 1.6 + 0.3$$

$$= \underline{1.9\ or\ 2\ cpm}$$

100 dpm/100 cm^2 ACTION LEVEL FOR TAKING SMEARS EXPRESSED AS GCPM:

DT-228 Probe Size = 11.25 cm^2

$$\frac{(100\ dpm)\ (11.25\ cm^2)\ (.247)}{100\ cm^2} = NCPM$$

NCPM = 2.8

GCPM = 2.8 + 0.3

GCPM = 3.1 or 3

CONVERSION FACTOR, NCPM TO dpm/100cm^2 FOR HOT SPOT IN GRID OR FOR GRID AVERAGE READING:

$$\frac{NCPM}{.247} \times \frac{100\ cm^2}{11.25\ cm^2} = dpm$$

NCPM (36) = dpm/100cm^2

SUPERVISOR OF SHIPBUILDING, CONVERSION AND REPAIR
SAN FRANCISCO, CALIFORNIA

REPORT OF MONITORING AND DECONTAMINATION
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HUNTER'S POINT SHIPYARD,
SAN FRANCISCO, CALIFORNIA

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ENCLOSURE (2)

TABLE OF CONTENTS

I. INTRODUCTION

A cursory radiation survey of potentially contaminated facilities formerly occupied by the Naval Radiological Defense Laboratory was made by personnel from the Naval Nuclear Power Unit, Port Hueneme, California during the period 30 September through 1 October 1978 and reported in Naval Nuclear Power Unit letter 40:RHS:sdr 3256 Ser 1235 of 12 October 1979.

Buildings surveyed showed less than minimum detectable activities except for Building 364, where levels in a number of locations exceeded established NRC and BUMED limits. Accordingly, decontamination and resurvey efforts were recommended for Building 364.

Building 816 surveys indicated no measurable contamination with the instrumentation used. The building had a history of tritium usage, which the instrumentation was not capable of measuring. Accordingly, a resurvey by appropriate detection methods was recommended.

II. DISCUSSION

The cursory survey at Building 364 and environs showed contamination levels up to 63,000 dpm/100cm^2 in room 108, 800,000 dpm/100cm^2 in the Hot Cell and 32,000 dpm/100cm^2 in the pipe trench and waste tank east of Building 364. All other rooms and areas of the building showed no activity above minimum detectable (MDA).

Beta absorption measurements were made at several locations at maximum activity to determine beta energies and to identify the contaminent. These measurements indicated a beta energy at approximately 0.65 MEV. Gamma spectra measurements identified Cs-137 as the major contaminant. Accordingly, the clearance limits for the class of radionuclides including Cs-137 were applied. As per NRC Regulatory Guide 1.86 these limits are:

a. 5000 dpm/100cm^2 averaged over 1m^2 or less
b. 15,000 dpm/100cm^2 maximum over 100cm^2 or less
c. 1,000 dpm/100cm^2 removable
d. 0.2 mrad/hr average radiation level
e. 1.0 mrad/hr maximum radiation level

Although there was no history of usage of alpha emitters in Building 364 alpha survey measurements were made, with negative results.

III. INSTRUMENTATION

The basic instrumentation used for building 364 survey was the Eberline Model E-140N count rate meter with a DT-304/PDR detector probe in conjunction with a Radiac Counter-Timer (Model 2) for timed digital measurement read-out. Instrument performance data was:

Average background - 32.4 cpm

Efficiency (CS-137 beta) - 19.6%

Probe Sensitive area - 20 cm^2

Minimum Detectable Activity (MDA) - 17.1cpm net, 50 cpm gross cpm or 435 dpm/100cm^2 for Cs-137 beta

The detection method for Building 816 survey was smearing with metrical filter paper and sending to the Naval Research Laboratory, Washington, D.C. for liquid scintillation counting.

IV. DECONTAMINATION AND FINAL SURVEY

Decontamination was accomplished by the Survey - Clean - Survey method. In general decontamination was done by paint removal and by concrete chipping.

Final post-decontamination survey was done by HMC G. M. Jones and HM1 R. J. Franks of RASO.

Areas of known or suspected contamination were surveyed by counting for one minute at the centers and corners of a one-foot grid over the area. Smears were taken at each corner and in the center of a three-foot grid over the area.

Areas of low contamination potential were surveyed as above, using one-meter grids for direct reading and smear survey.

In Building 816 smear samples were taken throughout the building with an average of one smear for each 50 square feet of floor and wall space.

V. SURVEY RESULTS AFTER DECONTAMINATION

In all spaces surveyed the maximum surface reading found was less than the limit for average levels of contamination.

Maximum and average (over the entire surface) are presented as:

AREA	MAXIMUM (dpm/100cm^2)	AVERAGE (dmp/100cm^2)
Room 108 (North Laboratory):		
East Wall	3500	460
South Wall, East Section	1600	MDA
South Wall, West Section	1450	MDA
North Wall, East Section	2300	MDA
North Wall, West Section	900	MDA
West Wall	MDA	MDA
Floor	MDA	MDA
Ceiling	1050	MDA
Hot Cell:		
West Wall	1400	500
North Wall	1500	600
East Wall	2200	750
South Wall	2150	750
Floor	4300	1550
Ceiling	MDA	MDA
Pit East Wall	4500	2800
Pit West Wall	2100	1200
Pit North Wall	2800	1650
Pit South Wall	4000	2200
Room 104 (SE Laboratory)	MDA	MDA
Room 105 (Center Laboratory)	MDA	MDA
Room 1 (SW Laboratory)	MDA	MDA
Entry Hall	MDA	MDA
Balcony	MDA	MDA
Pipe Trench	MDA	MDA
Tank Pit	MDA	MDA

Navy publication "Principles of Radiation and Contamination Control" NAVSHIPS 250-341-3, Volume 2, page 201, states that a surface beta contamination level of 35,000 dpm/100cm^2 will produce a surface dose rate of 1 mrad/hr. Based on this relationship the maximum radiation level encountered during the final survey did not exceed 0.13 mrad/hr.

Building 364 smear sample counting results indicated no removable contamination approaching the limit of 1000 dpm/100 cm^2.

Building 816 smear sample counting results received from NRL were negative. These results are shown in Appendix A.

V. CONCLUSIONS AND RECOMMENDATIONS

Survey results indicate no fixed or removable contamination or surface radiation level exceeds BUMED, (NAVMED P-5055) limits or NRC Regulatory Guide 1.86 guidelines. Accordingly, it is recommended that Buildings 364, 816 and environs be released for unrestricted occupancy and use.