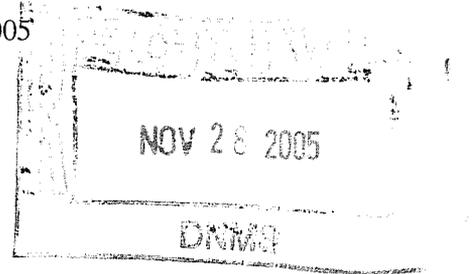




UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

Northwest Fisheries Science Center
2725 Montlake Boulevard, East
Seattle, WA 98112-2097

November 21, 2005



Nuclear Materials Licensing Section
U.S. Nuclear Regulatory Commission, Region IV
611 Ryan Plaza Drive, Suite 400
Arlington, Texas 76011-8064

Re: License Amendment Requests for NRC Materials License, License number 46-06377-04, Docket number 030-08203

NOAA's Northwest Fisheries Science Center is requesting the following four changes to the above-referenced license:

- 1) Although the Northwest Fisheries Science Center will retain the Mukilteo Research Station in support of its research mission, the Center would like to remove the Mukilteo Research Station as a location for radioactive material use as described in section 10 of the license. No future use of radioactive material is anticipated at the Mukilteo location. To this end, a "Radiological Decommissioning Survey and Report" has been prepared by Mike Simmons, from Pacific Health Physics, Inc. This document is attached.
- 2) The Center would like to remove Nickel 63 from our license (in sections 6A, 7A, and 8A). All three Nickel 63 foils or plated sources in Electron Capture Detectors (ECD's) for gas chromatographs have been transferred to C. J. Bruyn & Company (State of Washington Department of Health License # WN-10523-1). One ECD (S/N L9144) was transferred on 5/7/02, and two ECD's (S/N F3143, S/N F3144) on October 13, 2003.
- 3) The Center would like to remove the following as authorized users in section 11.A. of the license: Donald W. Brown, Walton W. Dickhoff, and Tracy K. Collier.
- 4) Under the current license, section 11.B. lists the Radiation Safety Officer (RSO) as William Reichert, PhD. We request that the RSO be designated as Ann Byar, M.S. C.I.H., who is presently the Safety and Environmental Compliance Officer for the Center. A biography is attached for your review. Dr. Reichert will continue as an Assistant Radiation Safety Officer.

If you have any questions or need additional information, please contact Ann Byar at (206) 499-6618 or Dr. William Reichert at (206) 860-3344.

Sincerely,

Usha Varanasi, Ph.D.
Science and Research Director



Radiological Decommissioning Survey and Report

Prepared for:

U.S. Department of Commerce / NOAA

November 30, 2004

Pacific Health Physics, Inc. 14603 SE 173rd Street, Renton, WA 98058
425.228.2932 - Office
425.271.6698 - Fax

h 4 7 0 8 6 3

Section A – Decommissioning Survey Narrative

U.S. Department of Commerce / NOAA

SECTION A

LABORATORY HISTORICAL SITE ASSESSMENT AND DECOMMISSIONING SURVEY

1. INTRODUCTION AND SITE HISTORY

The U.S. Department of Commerce / NOAA operates a research facility authorized by NRC license number 46-06377-04, docket number 030-08203, for two locations; one located at the Montlake address in Seattle, Washington, and another located at Park and Front Streets in Mukilteo, Washington. This survey report concerns the radioactive materials use activities at the Mukilteo location only.

The Historical Site Assessment information for this report was provided through interview with one of the NOAA scientists who worked and had knowledge of the research conducted at the Mukilteo location. During the time period 1976 until 1987, certain radioactive materials were used at the Mukilteo location for fish toxicity in-vitro research. The research experiments were conducted in the Mukilteo laboratories approved for this use. Field studies were not performed and there were no on-site holding tanks or septic tanks at the Mukilteo location. The radioactive materials authorized and used, physical forms, use totals from historical records, and the year when use ceased are listed in the table below. Actual radioactive materials use was confined to specific laboratories within the Mukilteo research building, and a small shed adjacent to the research building. The NOAA scientist stated the radioactive materials were used by or under the direct supervision of scientists listed on the license as authorized users. The Radiation Safety Officer (RSO) provided necessary oversight for radioactive materials use at this location.

Isotope	Physical Form	Total use amounts (from records)	Last Use Date
¹⁰⁹ Cd	Liquid	100 uCi	1978
²¹⁰ Pb	Liquid	100 uCi	1978
³ H	Liquid	35 mCi	1987
¹⁴ C	Liquid	4 mCi	1987

t_{1/2} - 462.6 d
t_{1/2} - 22.3 y
t_{1/2} - 12.33 y
t_{1/2} - 5,730 y

Radioactive wastes were transferred to a licensed radioactive waste broker. Unused radioactive materials were transferred to the Montlake address location of use. Radioactive materials have not been used at this location since 1987, and none were present when the decommissioning surveys were performed.

The Mukilteo location was kept on the license until the last renewal at which time a decision was made by executive management to confine radioactive materials use to the Montlake location.

Note: The U.S. Department of Commerce is not terminating its license nor releasing ownership of the Mukilteo location. The purpose of the decommissioning survey is to ensure compliance with 10 CFR 30.36 (d) (2), where the licensee (U.S. Department of Commerce / NOAA) has decided to cease principal activities at the Mukilteo location.

2. RADIATION SAFETY PROGRAM CONTROL OPERATIONS

The research laboratories where radioactive materials were used were surveyed for contamination on a regular, (weekly/monthly) basis per license procedures by the scientific staff while radioactive materials were being used. The RSO reviewed survey results and maintained summary reports. The above surveys were largely negative for removable or fixed contamination. There were no major spills of radioactive material that may have resulted in contamination of inaccessible areas or remained as fixed contamination. There were no sealed sources used or stored at the Mukilteo location.

Decommissioning survey activities included exposure rate measurements, scanning surveys for beta surface activity and composite wipe sampling for removable activity from all work surfaces, storage locations, and fume hoods. The composite wipes were obtained as individually numbered wipe samples. All surveyed areas were keyed to locations indicated on the laboratory area grid block diagrams, (Section B). Additional judgemental sampling was performed in historical areas of use. The wipe survey sampling pattern ensured nearly 100% coverage of all known use surfaces and fixtures within the laboratory.

3. SITE DESCRIPTION

The research laboratories identified for decommissioning are located in the research building and an adjacent shed at the Mukilteo location of use address. Laboratory fixtures are of modern construction and include impermeable surface workbenches, fume hoods, stainless steel sinks, ceiling vents, and resilient vinyl floor surfaces. Although areas of radioactive materials use were confined to designated workbenches, the decommissioning surveys included other possible areas where radioactive contamination could occur such as under stationary equipment, backsplashes, ventilation ductwork, and lower walls.

4. SURVEY OBJECTIVES

The objectives of the decommissioning survey were to develop independent radiological data to support the conclusion that all fixtures, equipment, work surfaces, and floors within the research laboratories and shed formerly used for radio-analytical work are beneath the regulatory release limits for fixed or removable radioactive contamination prior to release of the research laboratories for unrestricted use, and removal from the license by amendment.

5. PROCEDURES

Pacific Health Physics, Inc., a licensed health physics contractor, (agreement state license WN-L0167-01) performed the decommissioning surveys of the research laboratories and the shed. The surveys included exposure rate measurements, scanning surveys, and composite wipes of all work surfaces in the research laboratories and the shed. Wipe survey results are contained in the original assay data printouts that are appended to this report. Please note grid reference and sample number 221 was taken from the building lobby to establish a representative background sample.

6. SURVEY METHODS

A. Reference Grid

For most areas, PHP established a 3 ft² (approximating a m²) grid system for floors, and 2 ft² grid system for countertops in each room for referencing measurements and sampling locations. Irregularly shaped surfaces were sampled separately. Measurements and sampling locations on sinks, equipment, drainboards, backsplashes, lower walls, and fume hoods, were assigned separate grid coordinates.

B. Scanning Surveys

Scanning surveys for beta/gamma activity were performed on accessible floors, lab equipment, furnishings, sinks, sink drains, fume hoods, and lower walls using a thin window (1.7 +/- 0.3 mg/cm² mica) GM pancake detector coupled to a survey instrument with an audible indicator. The detector was passed slowly back and forth over 100% of the work surface at a distance of less than one centimeter and at a speed of one detector width per second. *Scanning survey results did not exceed background for all areas, (35 CPM or 700 dpm / 16 cm² for the area of the detector).*

C. Removable Surface Activity Measurement

Wipe surveys to determine removable beta/gamma activity were performed on each indicated grid block and where indicated on cupboard shelving, drawers, cabinets, sinks, and equipment. Sampling locations were keyed to specific locations identified on the survey maps furnished with Section B. Representative background wipe samples were obtained from non-impacted areas.

D. Dose Equivalent Rate Measurements

Radiation dose equivalent rate measurements were made using a energy compensated thin wall GM detector coupled to a portable survey meter with an audible indicator. Exposure rate measurements for each survey location were taken at a distance of 1 meter from and/or above work surfaces to provide a good estimate of potential external radiation exposure.

7. SAMPLE ANALYSIS AND DATA INTERPRETATION

Wipe samples were analyzed using a liquid scintillation counting system with three channel counting capability. The system was calibrated using NIST traceable standards with counting windows set from 0-18 keV, 18-156 keV, and 0-2000 keV. Additional information concerning major instrumentation, sampling equipment, and analytical procedures is provided in Section C. *Wipe sample assay results are as follows: the background measurements were 11-36 CPM, or 29 dpm, (range within the three channels), using the LSC system efficiencies of 62 % for ^3H and 95.2 % for ^{14}C . All sample results are per 100 cm².* Sample assay results were compared to NRC guidelines for fixed and removable activity, which are listed below.

8. FINDINGS AND RESULTS

A. DECOMMISSIONING SURVEY

1. Surface Activity Levels

The exposure rate, wipe, and scanning survey results for the research laboratories and waste shed did not locate any radioactive contamination in excess of natural background radioactivity.

9. COMPARISON OF RESULTS WITH RELEASE LIMITS

The release limits for acceptable surface contamination levels that are published in Table Q.2 of NUREG 1556 Volume 7, are summarized below.

The applicable radionuclide release limits are:

Beta-Gamma Emitters

Total Activity

5,000 dpm/100 cm² (average per 100 cm²)

15,000 dpm/100 cm² (maximum per 100 cm²)

Removable Activity

1000 dpm/100 cm²

10. CONCLUSION

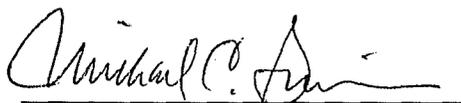
Decommissioning surveys conducted in the research laboratories and shed included exposure rate, scanning, and composite wipe sample survey measurements. Analytical assay results verify the absence of residual, fixed, or removable radioactivity in excess of natural background radioactivity.

*Can't reach
the same
conclusion yet!*

Survey Certification

U.S. Department of Commerce / NOAA

The survey sample assay results contained herein certify that radioactive materials use and storage areas located at the licensee's above location of use address were determined to be free of removable and fixed radiological contamination at the conclusion of the decommissioning surveys described in this report.



Date: November 30, 2004

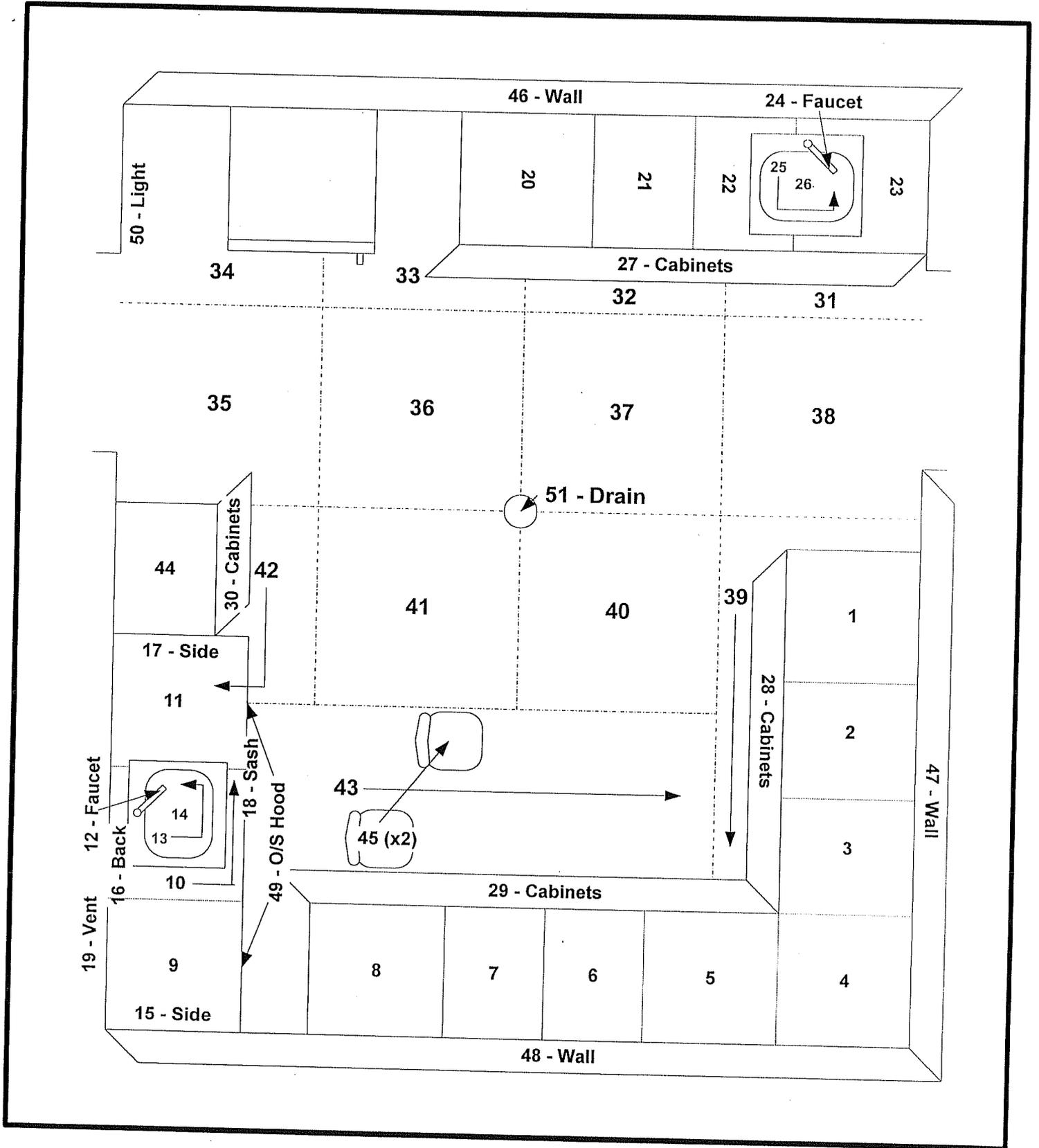
Michael C. Simmons
Health Physicist

Section B – Locator Maps and Grid Coordinates

U.S. Department of Commerce / NOAA

Pacific Health Physics, Inc. 14603 SE 173rd Street, Renton, WA 98058
425.228.2932 - Office
425.271.6698 - Fax

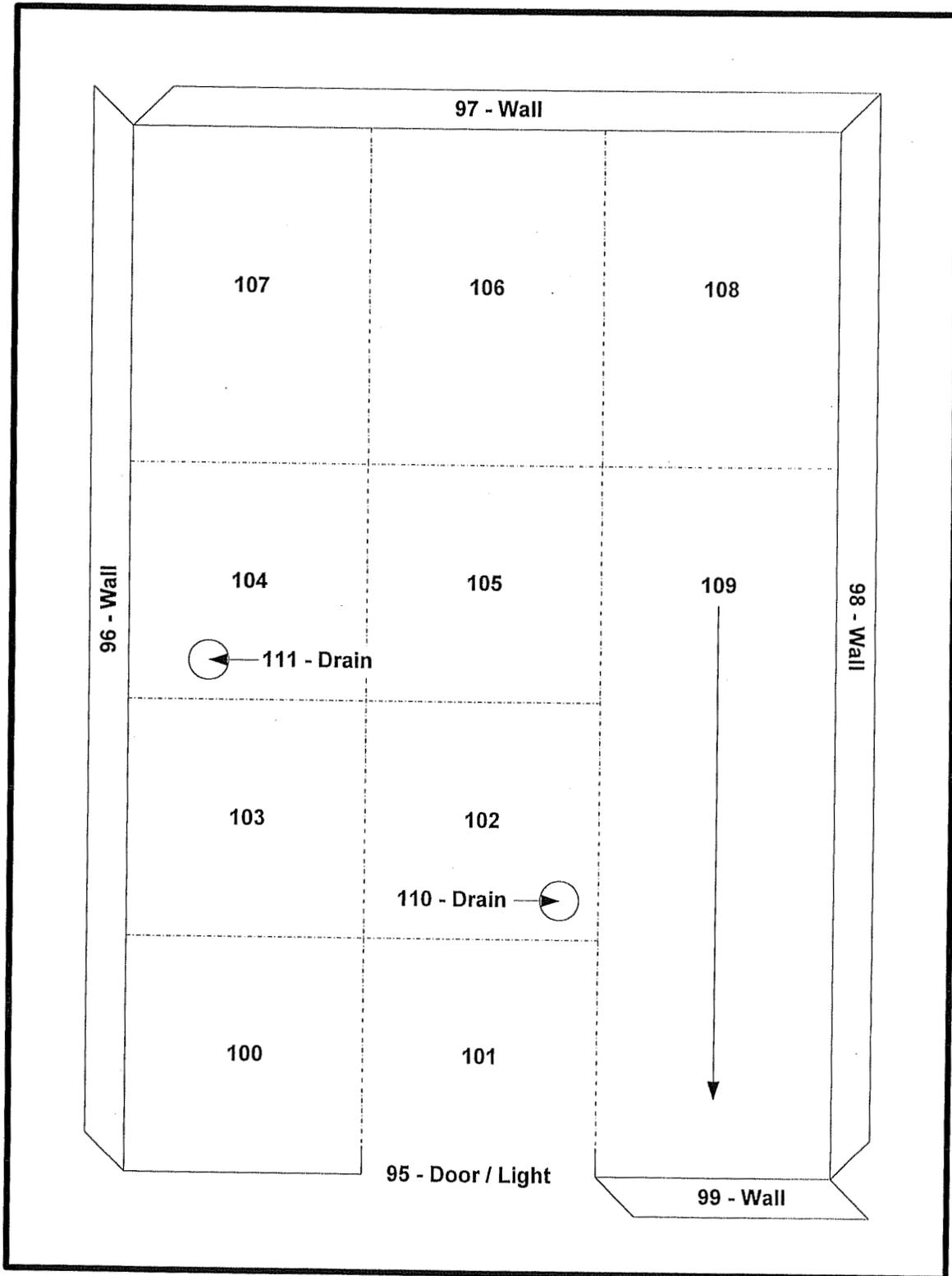
Pacific Health Physics, Inc.
 Decommissioning Survey
 Facility - N.O.A.A./Mukilteo
 Location - Room 110
 Date of Survey: 11/16/04



Scale 1/2" = 1 Foot

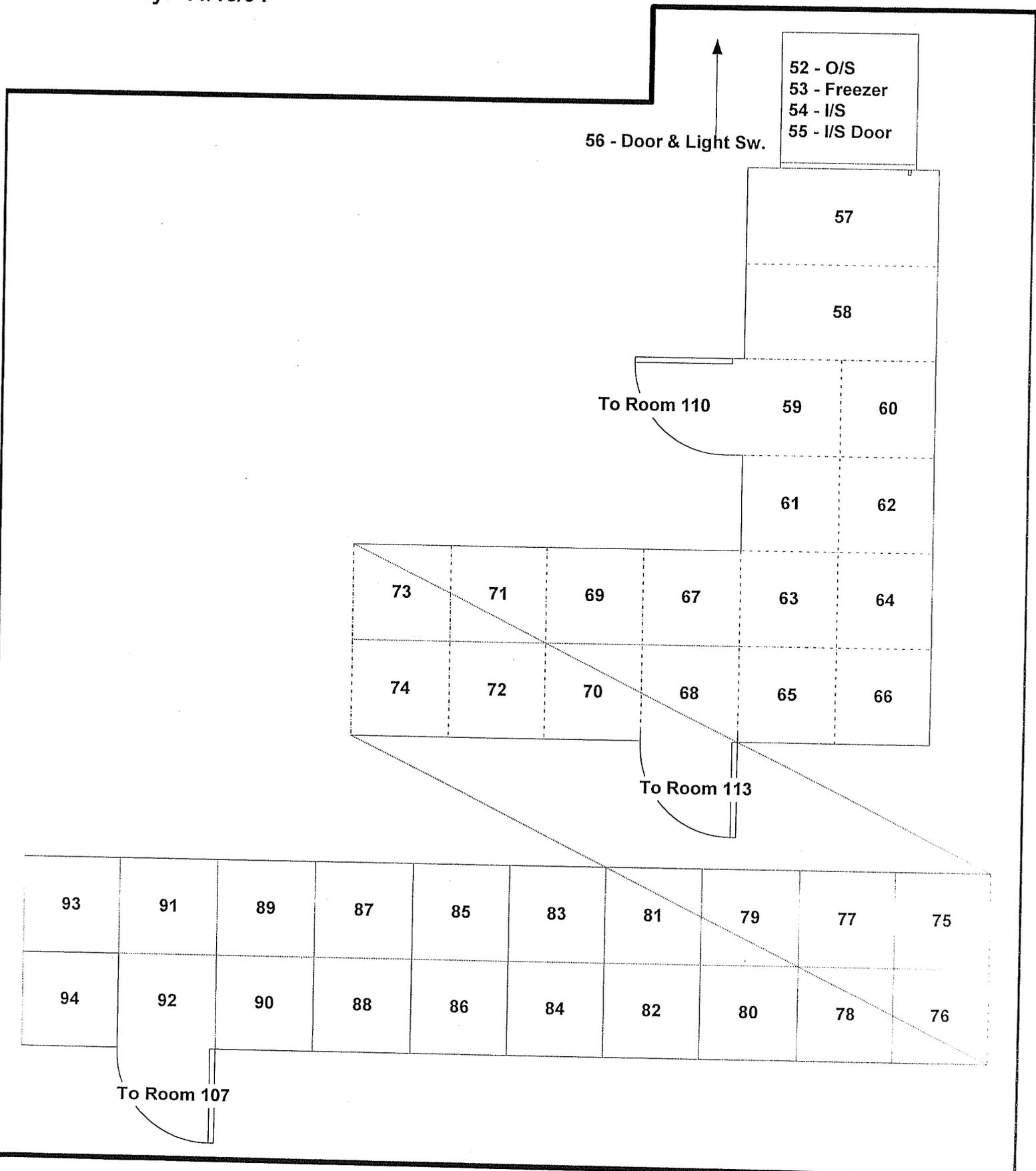
M 470863

Pacific Health Physics, Inc.
Decommissioning Survey
Facility - N.O.A.A./Mukilteo
Location - Room 113
Date of Survey: 11/16/04



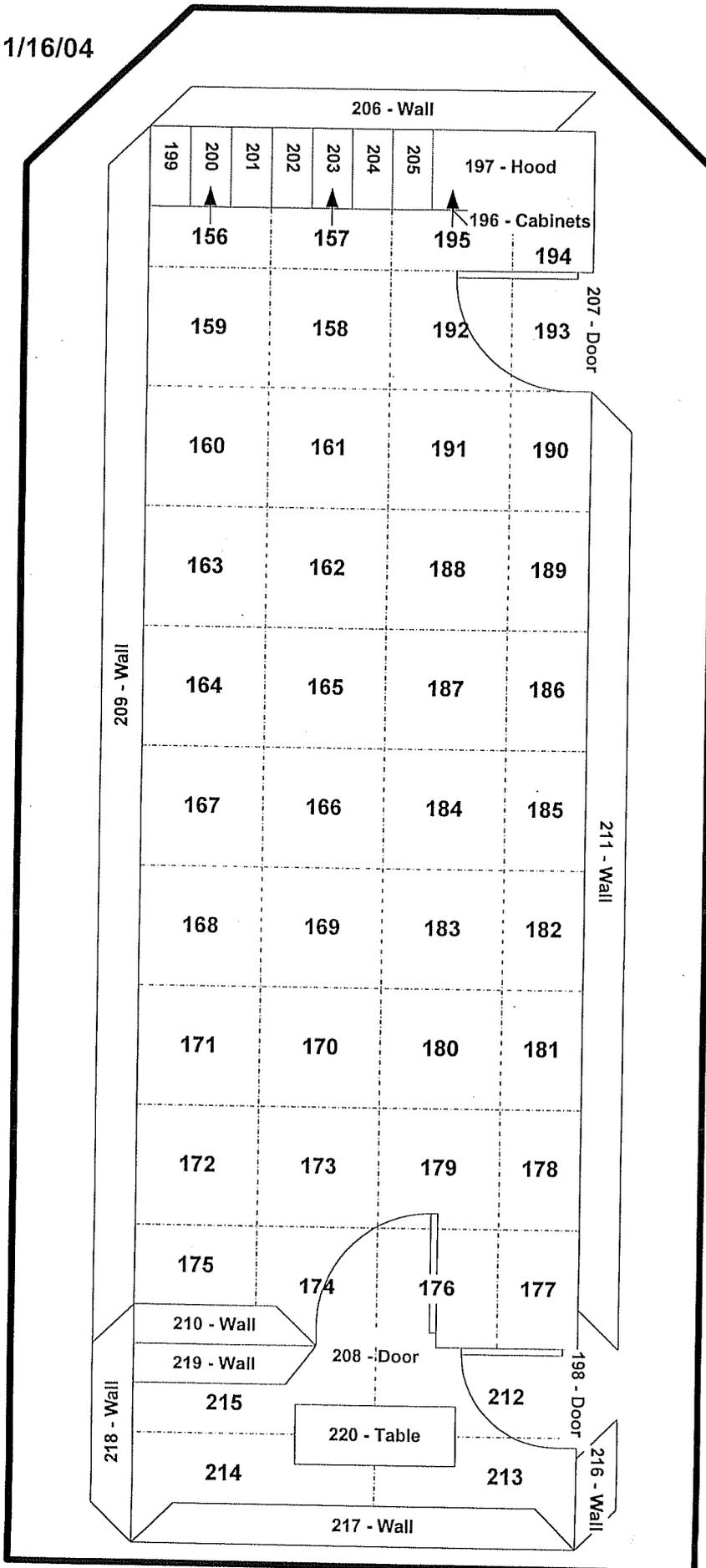
Scale 1/2" = 1 Foot

Pacific Health Physics, Inc.
 Decommissioning Survey
 Facility - N.O.A.A./Mukilteo
 Location - Hallway Outside of Rooms 107, 110, and 113
 Date of Survey: 11/16/04



Scale 1/4" = 1 Foot

Pacific Health Physics, Inc.
 Decommissioning Survey
 Facility - N.O.A.A./Mukilteo
 Location - Shed
 Date of Survey: 11/16/04



Scale 1/4" = 1 Foot

Section C – Radiological Survey Instrumentation and Sensitivity

U.S. Department of Commerce / NOAA

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470863

SECTION C

SURVEY AND ANALYTICAL PROCEDURES

SURVEY PROCEDURES

Surface Scans

Scanning surveys were performed with 100 % coverage of areas within the survey locations by passing the detector slowly over the surface at a speed of 1 detector width per second. The distance between the detector and the surface was maintained at a minimum - nominally about 1 centimeter. A thin window halogen quenched GM pancake detector coupled to a portable survey meter with an audible indicator was used to scan the laboratory portable storage module, floors, cabinets, shelves, walls, backsplashes, sinks, and sink drains of the surveyed areas. Identification of elevated levels was based on increases in the audible signal from the survey instrument. For survey locations with elevated (>two times background) fixed radioactivity, one minute direct measurements were completed. The initial survey map was adjusted, as needed, to identify any locations with elevated fixed radioactivity.

Removable Activity Measurements

Removable activity levels were determined using pre-numbered thin soft absorbant paper squares, approximately 2 x 2 cm in size. Moderate pressure was applied to the smear with two or three fingers during surface wipe sampling. Wipe sampling occurred as a repeated "S" pattern over the entire grid area. The smears were then placed in individual counting vials with 7 ml of counting solution and identified with the numbered location or other pertinent information. One smear sample for removable contamination was obtained from each measurement location.

Dose Equivalent Rate Measurements

Radiation dose equivalent rate measurements were made using a energy compensated thin wall GM detector coupled to a portable survey meter with an audible indicator. Exposure rate measurements for each survey location were taken at a distance of 1 meter from and/or above work surfaces to provide a good estimate of potential external radiation exposure.

Miscellaneous Samples

Micellaneous sampling was made in the sink drains, drainboards, and fume hood ventilation ducts as noted in the maps in section B. Moderate pressure was applied to the swab on the interior surfaces of drainpipes and ventilation ducts. The swab samples were placed in individually labeled plastic containers with the location and other pertinent information recorded, then analyzed in the three channel scintillation counting system. Please note sample location number 221 was a representative background sample taken from the building lobby.

ANALYTICAL PROCEDURES

Removable Activity

Gross Beta Counting by Liquid Scintillation

Smear samples were counted in a three channel liquid scintillation counter to quantitate sample beta/gamma activity. A quench curve using ten ¹⁴C standards of varying quench factors was applied to any samples that exhibited counts per minute in amounts that were greater than the representative background samples.

LIQUID SCINTILLATION COUNTER DETECTION LIMITS

The analytical data presented in the tables of this report represent the 99 % confidence level for that data. These data were calculated based on gross sample count levels and the associated background count levels. When the net sample count was less than $2.71 + 4.66$ multiplied by the statistical deviation of the background count [$2.71 + (4.66 * \text{background CPM})^{1/2} / \text{total instrument efficiency}$], the sample concentration was reported as less than the detection limit of the detection system. Because of variations in background levels and measurement efficiencies, the detection limits may differ from sample to sample and instrument to instrument.

Beckman LS 5801 SN 7013898
 Counting Instrument Sensitivity

	CPM1	CPM2	CPM3
Bkg	11	28	36
H-3	51692	52764	52770
C-14	7664	44261	44690
H-3 eff=	0.62		
C-14, S-35 eff=	0.952		
I-125		0.50	

C-14, S-35,
 MDC=
 MDA=

29 dpm
 1.3E-05 uCi

H-3
 MDC=
 MDA=

29 dpm
 1.3 0E-05 uCi

I-125

55 dpm
 2.47E-5 uCi

highest sample on Channel 3 was
 location 121 @ 77cpm

$$2.71 + \frac{(4.66 \times 36)^{1/2}}{12.95} / \text{instr. eff.} = 15.66$$

Channel 2 - 71cpm
 Channel 1 - 52cpm

$$= 4.83e-1 Bq$$

based on one channel?

based on one channel?

CALIBRATION AND QUALITY ASSURANCE

Field survey equipment is calibrated on an annual frequency. The liquid scintillation counter was calibrated on November 3, 2004. Survey instrument calibration documents are appended to this section.

Calibration of field and laboratory instrumentation is based on standards and sources traceable to the National Institute of Standards and Traceability.

PHP quality control procedures include:

- Daily or each time used instrument background and constancy check-source/NIST source measurements to confirm that equipment operation is within acceptable limits,
- Documents review to ensure agreement between survey findings and report data,
- Training and certification of individuals supervising or performing the survey procedures.

NOAA / Mukilteo
Decommissioning Survey
Instrument Sensitivity Information

1. The following calculations are for surveys in a research location of use. The survey instrument is a Ludlum meter with a Ludlum Model 44-9 pancake detector. The calibration data for the survey instrument are for a model 44-9 pancake detector.
2. NUREG 1556, Volume 11, Table S.5, has release criteria for the radionuclides commonly used in research. A Historical Site Analysis or appropriate surveys results should be used to determine the % contribution for each radionuclide. A typical % contribution for three radionuclides is shown in the table below. Since the radiation safety practices for the three radionuclides are equivalent, one method for surveys in research is to use results for ^{14}C as a basis to conclude whether the other two radionuclides are likely to exceed a limit.

Radionuclide	Release Limit Maximum (dpm/100 cm ²)	% Contribution
^{14}C	15,000	35 %
^3H	15,000	40 %
^{35}S	15,000	25 %

3. The sample calculations below are based on NUREG-1575, "Multi-Agency Radiation Survey and Site Investigation Manual."
4. The survey instrument used for surface scans for fixed radioactivity (either scanning or direct measurement surveys) must be sufficiently sensitive to detect the radionuclides present. The total efficiency for a survey instrument is the sum of the efficiencies for individual radionuclides. The total efficiency was calculated using the manufacturer's calibration data.

$$\text{Efficiency}_{\text{total}} = (0.05) (0.25) = \underline{0.012} \text{ or about 1\% total efficiency.}$$

Where 5 % is the 2π ^{14}C efficiency and 25 % is the β energy efficiency in ISO 7503

5. The $\text{MDC}_{\text{static}}$ for a survey instrument should be less than 50% of the RLw. The expression for $\text{MDC}_{\text{static}}$ is below where b is the usual background counting rate (e.g., 35 cpm for the survey instrument):

$$\text{MDC}_{\text{static}} = \frac{3 + 4.65 \sqrt{b}}{\text{Efficiency}_{\text{total}}} = 435 \text{ dpm}$$

$$\text{and } 435 \text{ dpm} / 15,000 \text{ dpm} = \underline{\leq 3\% \text{ of the RLw}}$$

6. The minimum detectable count rate (MDCR) and scan MDC are calculated as follows.

NOAA / Mukilteo
Decommissioning Survey
Instrument Sensitivity Information

$$MDCR = d' \frac{\sqrt{b_i}}{i \sqrt{P}}$$

Where

b_i = Background counts in the observations interval (35 cpm X 2 s ÷ 60 s = 1.16 counts)

d' = Detectability index (2.32 from MARSSIM)

P = Surveyor efficiency relative to the ideal observer (0.5 from MARSSIM)

i = Survey observation interval of 2 seconds¹

$$MDCR = (2.32) (\sqrt{1.16}) / (\sqrt{0.5}) (2s) = 1.75 \text{ cps}$$

$$(1.75 \text{ cps}) (60 \text{ s / m}) = 105 \text{ cpm}$$

$$\text{Scan MDC} = MDCR / \text{Efficiency}_{\text{total}} = \text{dpm} / 100 \text{ cm}^2$$

$$\text{Scan MDC} = 105 \text{ cpm} / 0.012 = \underline{8750 \text{ dpm} / 100 \text{ cm}^2}$$

8. Conclusion: The model 44-9 pancake detector is adequate to use for surface scans for fixed radioactivity for a typical research survey scenario as described above. Surface scan results that do not exceed 105 cpm using acceptable methods and techniques are less than the weighted release limits.



Designer and Manufacturer
of
Scientific and Industrial
Instruments

CERTIFICATE OF CALIBRATION

LUDLUM MEASUREMENTS, INC.
POST OFFICE BOX 810 PH. 325-235-5494
501 OAK STREET FAX NO. 325-235-4672
SWEETWATER, TEXAS 79556, U.S.A.

CUSTOMER PACIFIC HEALTH PHYSICS INC ORDER NO. 214442 / 280902

Mfg. Ludlum Measurements, Inc. Model 14C Serial No. 122277

Mfg. Ludlum Measurements, Inc. Model 44-6 Serial No. PR090371

Cal. Date 19-Apr-04 Cal Due Date 19-Apr-05 Cal. Interval 1 Year Meterface 202-241

Check mark applies to applicable Instr. and/or detector IAW mfg. spec. T. 74 °F RH 50 % Alt 702.8 mm Hg

New Instrument Instrument Received Within Toler. +/-10% 10-20% Out of Tol. Requiring Repair Other-See comments

Mechanical ck. Meter Zeroed Background Subtract Input Sens. Linearity

F/S Resp. ck. Reset ck. Window Operation Geotroplsm

Audio ck. Alarm Setting ck. Batt. ck. (Min. Volt) 2.2 VDC

Calibrated in accordance with LMI SOP 14.8 rev 12/05/89. Calibrated in accordance with LMI SOP 14.9 rev 02/07/97.

Instrument Volt Set 900 V Input Sens. 35 mV Def. Oper. 900 V at _____ mV Threshold Dial Ratio _____ = _____ mV

HV Readout (2 points) Ref./Inst. _____ / _____ V Ref./Inst. _____ / _____ V

COMMENTS:

Cs-137 ≈ 1 µCi check source SN 4531 reads ≈ 0.8 mr/hr with detector flat against source with door open.

Cal with coiled cable

Gamma Calibration: GM detectors positioned perpendicular to source except for M 44-9 in which the front of probe faces source.

RANGE/MULTIPLIER	REFERENCE CAL. POINT	INSTRUMENT REC'D "AS FOUND READING"	INSTRUMENT METER READING*
X 1000	1500 mR/hr	1.5	1.5
X 1000	500 mR/hr	0.5	0.5
X 100	150 mR/hr	1.4	1.5
X 100	50 mR/hr	0.4	0.5
X 10	15 mR/hr	1.7	1.5
X 10	5 mR/hr	0.5	0.5
X 1	1.5 mR/hr = 1600 cpm	1.4	1.5
X 1	1.0 mR/hr	1.2	1.0
X 0.1	160 cpm	1.4	1.5
X 0.1	53 cpm	0.4	0.5

*Uncertainty within ± 10% C.F. within ± 20% X 0.1 Range(s) Calibrated Electronically

REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*	REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*
Digital Readout			Log Scale		

Ludlum Measurements, Inc. certifies that the above instrument has been calibrated by standards traceable to the National Institute of Standards and Technology, or to the calibration facilities of other International Standards Organization members, or have been derived from accepted values of natural physical constants or have been derived by the ratio type of calibration techniques. The calibration system conforms to the requirements of ANSI/NCCL Z540-1-1994 and ANSI N323-1978. State of Texas Calibration License No. LO-1963

Reference Instruments and/or Sources:

Cs-137 Gamma S/N 1162 G112 M565 5105 T1008 T879 E552 E551 720 734 1616 Neutron Am-241 Be S/N T-304

Alpha S/N _____ Beta S/N _____ Other _____

m 500 S/N 189483 Oscilloscope S/N _____ Multimeter S/N 83630190

Calibrated By: Margaret Henley Date 19 APR 04

Reviewed By: LPJ Date 19 APR 04

ACTIVITY CALIBRATION AND ERROR ANALYSIS

The ^{14}C and ^3H standards have been assayed for activity by comparison with the National Institute of Standards and Technology (NIST) carbon-14 solution standard, Standard Reference Material (SRM) No. 438 tartaric acid in 2M HCl, and tritium solution standard SRM No. 391-B-5, tritiated water in water. The H-Number method of calibration was used with secondary standards prepared from the NIST standards. The estimated activities for the activity standards and the reference dates for all standards are as follows:

H3	DPMs : 102,020	REF DATE : 10/03/2000
C14	DPMs : 46,501	REF DATE : 10/03/2000
BKG	DPMs : N/A	REF DATE : 10/03/2000

THE PRODUCTION LOT NO.s FOR THE 3 STANDARDS ARE AS FOLLOWS :



H3 - HN0010067
C14 - CN0010067
BKG - BN0010067

The overall uncertainties associated with the activity values are estimated to be less than $\pm 3.5\%$ for the ^3H and $\pm 3.5\%$ for the ^{14}C . These estimates are determined in accordance with error analysis procedures recommended by the International Commission on Radiation Units and Measurements (ICRU Report 12). The limits are calculated by arithmetically summing the uncertainty due to random errors at the 99% confidence level with the assessable systematic errors. Random errors arise from production and assay procedures such as dispensing, weighing and counting. Systematic errors consist of uncertainty in the activity of the NIST-based secondary standards, overall uncertainty of the NIST SRM No. 391-B-5 as a function of time (assuming a half-life of 12.43 years and a half-life uncertainty of 0.5%); uncertainties in the standard weights used for calibrating the balances used in gravimetric determinations, losses of activity by evaporation and uncertainties in corrections applied for the effects of impurities on the scintillation process.

RECOMMENDATIONS FOR USE

Unquenched standards can be used to:

1. Calibrate the instrument. Only one of these standards, ^{14}C or ^3H , can be used for calibration of your instrument. Refer to your Operator's Manual for proper calibration standard. Use of any other standard from this set or another set requires the construction of new quench curves.
2. Measure day-to-day ^3H and ^{14}C counting efficiencies for comparison with original factory specifications and for verifying stable system performance.
3. Measure E^2/B ratios for low-level activity counting.
4. Measure ^3H and ^{14}C "spillover" in dual-label counting channels.

The instrument Operator's Manual should be consulted for specific instructions on use of these standards.

LIMITATIONS ON USE

Unquenched standards should not be used to construct quench correction curves for calibration of quenched samples.

PRECAUTIONS ON STORAGE AND USE

These standards are prepared taking great care to exclude moisture, oxygen, and organic impurities which might affect their long-term stability. The fluors which they contain, however, are susceptible to photochemical degradation, and excessive exposure to sunlight or fluorescent lighting may result in their deterioration.

Samples should be stored in the dark at room temperature and, when in use, exposed only to incandescent lighting. This treatment will improve long-term stability—at least five years—and is highly recommended.

PRECAUTIONS AND THE SAFE USE OF EXEMPT QUANTITY RADIOACTIVE MATERIALS

1. The low quantity radioactive materials in these standards are exempt from U.S. Nuclear Regulatory Commission and state licensing requirements.
2. These radioactive materials are not for human use. Introduction into foods, beverages, cosmetics, drugs, or medicinals, or into products manufactured for commercial distribution is prohibited—exempt quantities should not be combined.

SECTION D

US NRC

ACCEPTABLE SURFACE CONTAMINATION LEVELS FOR UNCONTROLLED RELEASE OF FACILITIES AND EQUIPMENT *

Nuclide [A]	Average [B,C]	Maximum [B,D]	Removable [B,E]
U-nat, U-235, U-238 and associated decay products	5,000 dpm /100 cm ²	15,000 dpm /100 cm ²	1,000 dpm /100 cm ²
Transuranics, Ra-226 Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129	100 dpm /100 cm ²	300 dpm /100 cm ²	20 dpm /100 cm ²
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	1,000 dpm /100 cm ²	3,000 dpm /100 cm ²	200 dpm /100 cm ²
Beta-gamma emitters (nuclides with decay modes by other than alpha emission or spontaneous fission) except Sr-90 and others noted above.	5,000 dpm /100 cm ²	15,000 dpm /100 cm ²	1,000 dpm /100 cm ²

*Also Regulatory Guide 8.23 and 1.86.

- [A] Where surface contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for alpha- and beta-gamma- emitting nuclides should apply independently.
- [B] As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.
- [C] Measurements of average contaminate should not be averaged over more than 1 square meter. For objects of less surface area, the average should be derived for each such object.
- [D] The maximum contamination level applies to an area of not more than 100 cm².
- [E] The amount of removable radioactive material per 100 cm² of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionately and the entire surface should be wiped.

Pacific Health Physics, Inc.
Facility: NOAA / Mukilteo
Decommissioning Survey

Section E

References

1. US Nuclear Regulatory Commission, NUREG 1575, "Multi-Agency Radiological Survey and Site Investigation Manual, (MARSSIM)" December 1997.
2. US Nuclear Regulatory Commission, Office of Nuclear Regulatory Research, "Draft Branch Technical Position on Site Characterization for Decommissioning", unpublished addendum to NUREG/CR-1505
3. US Nuclear Regulatory Commission, Division of Industrial and Medical Nuclear Safety, "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material", August 1987.
4. US Nuclear Regulatory Commission, Office of Nuclear Material Safety and Safeguards, NUREG/BR-0241, "NMSS Handbook for Decommissioning Fuel Cycle and Materials Licensees", December, 1996.
5. Oak Ridge Associated Universities, NUREG/CR-5849, ORAU-92/C57, "Manual for Conducting Radiological Surveys in Support of License Termination", December 1993
6. Federal Register Final Rule effective date 8/20/97, pages 39058-39092, revisions to 10 CFR 20.1402 and 1404, "Overall license termination approach and criteria for unrestricted use", July 1997.
7. US Nuclear Regulatory Commission, Office of Nuclear Material Safety and Safeguards, NRC Inspection Manual Chapter 2605, "Decommissioning Procedures for Fuel Cycle and Materials Licensees", Nov. 12, 1996.
8. US Nuclear Regulatory Commission, NUREG 1757 Vol's 1 and 2, "Consolidated NMSS Decommissioning Guidance – Decommissioning Process for Materials Licensees, and Characterization, Survey, and Determination of Radiological Criteria"

USER: 7 ID:PHP PRESET TIME: 1.00 WED 17 NOV 2004 10:23
 SAMPLE REPEAT: 0 CYCLE REPEAT: 1 SCR:N RS232:N
 H#: 1 ADC:N QCF:N RCM:N 2 PHASE MONITOR:N
 CHANNEL 1-LL: 0 UL: 400 2SIGMA: 0.50 BKG SUB: 0.00 BKG 2SIG: 0.00 LSR: 0
 CHANNEL 2-LL: 0 UL: 670 2SIGMA: 0.50 BKG SUB: 0.00 BKG 2SIG: 0.00 LSR: 0
 CHANNEL 3-LL: 0 UL: 1000 2SIGMA: 0.50 BKG SUB: 0.00 BKG 2SIG: 0.00 LSR: 0
 DATA CALC: CPM UNKNOWN REPLICATES: 1 NORM FACTOR: 0 1.00000
 HALF LIFE (DAYS): N

bkgd not subtracted

SAM POS	TIME	CPM1	CPM2	CPM3	AVG H#	ERR
1 **- 1	1.00	24.00✓	35.00✓	42.00✓	180.0	
2 **- 2	1.00	23.00✓	43.00✓	46.00✓	181.0	
3 **- 3	1.00	12.00	21.00	31.00	157.0	

35cpm - 11cpm *28cpm* *36cpm*

4 ***- 4	1.00	17.00	28.00	31.00	137.0
5 ***- 5	1.00	17.00	26.00	31.00	156.0
6 ***- 6	1.00	15.00	26.00	33.00	159.0
7 ***- 7	1.00	15.00	29.00	32.00	186.0
8 ***- 8	1.00	13.00	23.00	33.00	151.0
9 ***- 9	1.00	7.00	18.00	19.00	197.0
10 ***-10	1.00	13.00	18.00	22.00	154.0
11 ***-11	1.00	15.00	24.00	30.00	174.0
12 ***-12	1.00	11.00	17.00	23.00	114.0
13 ***-13	1.00	12.00	22.00	26.00	157.0
14 ***-14	1.00	18.00	29.00	42.00	88.0
15 ***-15	1.00	18.00	26.00	32.00	207.0
16 ***-16	1.00	10.00	18.00	20.00	172.0
17 ***-17	1.00	13.00	30.00	35.00	160.0
18 ***-18	1.00	16.00	21.00	29.00	182.0
19 ***- 1	1.00	13.00	21.00	28.00	140.0
20 ***- 2	1.00	12.00	16.00	24.00	133.0
21 ***- 3	1.00	13.00	22.00	29.00	146.0
22 ***- 4	1.00	13.00	20.00	31.00	130.0
23 ***- 5	1.00	9.00	18.00	27.00	109.0
24 ***- 6	1.00	11.00	27.00	33.00	143.0
25 ***- 7	1.00	9.00	15.00	23.00	139.0
26 ***- 8	1.00	14.00	20.00	26.00	85.0
27 ***- 9	1.00	10.00	15.00	27.00	118.0
28 ***-10	1.00	19.00	30.00	38.00	126.0
29 ***-11	1.00	22.00	30.00	39.00	122.0
30 ***-12	1.00	24.00	34.00	39.00	139.0
31 ***-13	1.00	5.00	14.00	21.00	146.0
32 ***-14	1.00	9.00	17.00	23.00	137.0
33 ***-15	1.00	14.00	27.00	33.00	143.0
34 ***-16	1.00	16.00	34.00	37.00	136.0
35 ***-17	1.00	15.00	24.00	31.00	144.0
36 ***-18	1.00	20.00	28.00	37.00	157.0
37 ***- 1	1.00	15.00	24.00	29.00	97.0
38 ***- 2	1.00	13.00	21.00	23.00	147.0
39 ***- 3	1.00	15.00	25.00	33.00	130.0
40 ***- 4	1.00	20.00	30.00	40.00	176.0
41 ***- 5	1.00	16.00	27.00	33.00	145.0
42 ***- 6	1.00	17.00	22.00	31.00	165.0
43 ***- 7	1.00	11.00	25.00	29.00	108.0
44 ***- 8	1.00	9.00	21.00	27.00	133.0

PAGE: 2

SAM POS	TIME	CPM1	CPM2	CPM3	AVG H#	ERF
45 ***- 9	1.00	20.00	33.00	36.00	164.0	
46 ***-10	1.00	20.00	27.00	33.00	141.0	
47 ***-11	1.00	16.00	21.00	29.00	126.0	
48 ***-12	1.00	13.00	22.00	25.00	141.0	
49 ***-13	1.00	16.00	30.00	37.00	117.0	
50 ***-14	1.00	18.00	28.00	39.00	81.0	
51 ***-15	1.00	12.00	19.00	29.00	90.0	
52 ***-16	1.00	19.00	22.00	23.00	151.0	
53 ***-17	1.00	20.00	29.00	33.00	125.0	
54 ***-18	1.00	14.00	27.00	34.00	115.0	
55 ***- 1	1.00	16.00	31.00	35.00	109.0	

57 **- 3	1.00	17.00	29.00	33.00	154.0
58 **- 4	1.00	16.00	22.00	31.00	155.0
59 **- 5	1.00	11.00	17.00	24.00	180.0
60 **- 6	1.00	12.00	20.00	28.00	145.0
61 **- 7	1.00	16.00	26.00	30.00	159.0
62 **- 8	1.00	8.00	15.00	18.00	145.0
63 **- 9	1.00	10.00	20.00	23.00	162.0
64 **-10	1.00	17.00	23.00	30.00	143.0
65 **-11	1.00	13.00	18.00	24.00	165.0
66 **-12	1.00	14.00	24.00	31.00	149.0
67 **-13	1.00	16.00	24.00	30.00	144.0
68 **-14	1.00	11.00	20.00	27.00	118.0
69 **-15	1.00	9.00	19.00	24.00	118.0
70 **-16	1.00	20.00	32.00	40.00	118.0
71 **-17	1.00	17.00	27.00	34.00	132.0
72 **-18	1.00	11.00	14.00	20.00	102.0
73 **- 1	1.00	14.00	25.00	32.00	124.0
74 **- 2	1.00	11.00	23.00	30.00	121.0
75 **- 3	1.00	20.00	30.00	36.00	134.0
76 **- 4	1.00	13.00	20.00	24.00	128.0
77 **- 5	1.00	17.00	30.00	39.00	142.0
78 **- 6	1.00	11.00	28.00	36.00	137.0
79 **- 7	1.00	17.00	29.00	37.00	122.0
80 **- 8	1.00	17.00	27.00	40.00	117.0
81 **- 9	1.00	13.00	21.00	29.00	139.0
82 **-10	1.00	12.00	17.00	28.00	140.0
83 **-11	1.00	11.00	23.00	35.00	131.0
84 **-12	1.00	16.00	27.00	33.00	145.0
85 **-13	1.00	19.00	28.00	39.00	152.0
86 **-14	1.00	13.00	22.00	29.00	144.0
87 **-15	1.00	7.00	15.00	22.00	161.0
88 **-16	1.00	16.00	24.00	30.00	158.0
89 **-17	1.00	17.00	35.00	45.00	145.0
90 **-18	1.00	16.00	23.00	28.00	168.0
91 **- 1	1.00	19.00	25.00	32.00	176.0
92 **- 2	1.00	14.00	25.00	30.00	149.0
93 **- 3	1.00	14.00	27.00	37.00	154.0
94 **- 4	1.00	14.00	20.00	24.00	173.0
95 **- 5	1.00	23.00	38.00	42.00	152.0
96 **- 6	1.00	22.00	29.00	32.00	155.0
97 **- 7	1.00	17.00	27.00	34.00	122.0

PAGE: 3

SAM POS	TIME	CPM1	CPM2	CPM3	AVG H#	ERF
98 **- 8	1.00	17.00	28.00	36.00	152.0	
99 **- 9	1.00	12.00	21.00	33.00	122.0	
100 **-10	1.00	20.00	25.00	28.00	110.0	
101 **-11	1.00	14.00	23.00	24.00	167.0	
102 **-12	1.00	16.00	27.00	34.00	119.0	
103 **-13	1.00	14.00	23.00	26.00	119.0	
104 **-14	1.00	11.00	21.00	32.00	117.0	
105 **-15	1.00	14.00	25.00	37.00	150.0	
106 **-16	1.00	20.00	28.00	32.00	146.0	
107 **-17	1.00	10.00	19.00	23.00	142.0	
108 **-18	1.00	14.00	24.00	29.00	152.0	

110	**	2	1.00	14.00	22.00	32.00	76.0
111	**	3	1.00	13.00	19.00	26.00	97.0
112	**	4	1.00	11.00	23.00	30.00	160.0
113	**	5	1.00	11.00	21.00	33.00	132.0
114	**	6	1.00	14.00	23.00	30.00	142.0
115	**	7	1.00	19.00	33.00	40.00	166.0
116	**	8	1.00	25.00	36.00	44.00	127.0
117	**	9	1.00	11.00	16.00	27.00	101.0
118	**	10	1.00	15.00	26.00	30.00	102.0
119	**	11	1.00	12.00	20.00	26.00	161.0
120	**	12	1.00	14.00	26.00	34.00	152.0
121	**	13	1.00	52.00	71.00	77.00	114.0
122	**	14	1.00	16.00	25.00	33.00	112.0
123	**	15	1.00	15.00	25.00	32.00	131.0
124	**	16	1.00	13.00	20.00	24.00	134.0
125	**	17	1.00	9.00	21.00	30.00	148.0
126	**	18	1.00	13.00	23.00	30.00	116.0
127	**	1	1.00	11.00	16.00	18.00	135.0
128	**	2	1.00	15.00	30.00	38.00	132.0
129	**	3	1.00	11.00	17.00	26.00	114.0
130	**	4	1.00	12.00	24.00	29.00	146.0
131	**	5	1.00	12.00	22.00	28.00	127.0
132	**	6	1.00	19.00	29.00	41.00	116.0
133	**	7	1.00	16.00	22.00	32.00	136.0
134	**	8	1.00	18.00	22.00	33.00	106.0
135	**	9	1.00	16.00	25.00	35.00	115.0
136	**	10	1.00	11.00	19.00	24.00	135.0
137	**	11	1.00	17.00	26.00	35.00	114.0
138	**	12	1.00	14.00	21.00	30.00	107.0
139	**	13	1.00	18.00	29.00	39.00	118.0
140	**	14	1.00	17.00	27.00	33.00	113.0
141	**	15	1.00	12.00	15.00	25.00	115.0
142	**	16	1.00	13.00	20.00	25.00	110.0
143	**	17	1.00	20.00	29.00	40.00	119.0
144	**	18	1.00	18.00	27.00	37.00	105.0
145	**	1	1.00	9.00	17.00	26.00	120.0
146	**	2	1.00	11.00	21.00	29.00	114.0
147	**	3	1.00	9.00	19.00	23.00	132.0
148	**	4	1.00	19.00	30.00	41.00	134.0
149	**	5	1.00	18.00	27.00	37.00	120.0
150	**	6	1.00	9.00	21.00	25.00	125.0

PAGE: 4

SAM POS	TIME	CPM1	CPM2	CPM3	AVG H#	ERF	
151	**	7	1.00	10.00	19.00	26.00	136.0
152	**	8	1.00	16.00	25.00	32.00	127.0
153	**	9	1.00	17.00	30.00	39.00	91.0
154	**	10	1.00	9.00	21.00	29.00	85.0
155	**	11	1.00	15.00	22.00	33.00	96.0
156	**	12	1.00	11.00	17.00	25.00	126.0
157	**	13	1.00	10.00	18.00	27.00	141.0
158	**	14	1.00	17.00	23.00	31.00	115.0
159	**	15	1.00	18.00	26.00	34.00	146.0
160	**	16	1.00	18.00	29.00	41.00	128.0
161	**	17	1.00	13.00	21.00	29.00	111.0

163 **-	1	1.00	9.00	17.00	23.00	98.0
164 **-	2	1.00	12.00	21.00	27.00	142.0
165 **-	3	1.00	12.00	22.00	29.00	104.0
166 **-	4	1.00	9.00	19.00	25.00	129.0
167 **-	5	1.00	10.00	21.00	35.00	98.0
168 **-	6	1.00	15.00	24.00	30.00	161.0
169 **-	7	1.00	13.00	21.00	27.00	102.0
170 **-	8	1.00	15.00	32.00	37.00	106.0
171 **-	9	1.00	19.00	29.00	37.00	117.0
172 **-	10	1.00	15.00	24.00	39.00	120.0
173 **-	11	1.00	20.00	27.00	33.00	104.0
174 **-	12	1.00	13.00	26.00	38.00	100.0
175 **-	13	1.00	19.00	28.00	31.00	117.0
176 **-	14	1.00	23.00	30.00	34.00	103.0
177 **-	15	1.00	11.00	18.00	28.00	102.0
178 **-	16	1.00	21.00	31.00	37.00	103.0
179 **-	17	1.00	10.00	17.00	30.00	111.0
180 **-	18	1.00	18.00	29.00	34.00	112.0
181 **-	1	1.00	11.00	21.00	32.00	106.0
182 **-	2	1.00	14.00	25.00	33.00	103.0
183 **-	3	1.00	13.00	19.00	25.00	125.0
184 **-	4	1.00	20.00	27.00	38.00	140.0
185 **-	5	1.00	10.00	16.00	24.00	90.0
186 **-	6	1.00	12.00	19.00	30.00	105.0
187 **-	7	1.00	14.00	22.00	29.00	157.0
188 **-	8	1.00	8.00	16.00	28.00	155.0
189 **-	9	1.00	9.00	18.00	25.00	124.0
190 **-	10	1.00	12.00	18.00	25.00	107.0
191 **-	11	1.00	13.00	22.00	27.00	143.0
192 **-	12	1.00	9.00	18.00	22.00	116.0
193 **-	13	1.00	15.00	23.00	28.00	144.0
194 **-	14	1.00	14.00	18.00	25.00	107.0
195 **-	15	1.00	13.00	21.00	29.00	94.0
196 **-	16	1.00	15.00	20.00	25.00	133.0
197 **-	17	1.00	13.00	26.00	31.00	121.0
198 **-	18	1.00	18.00	26.00	34.00	134.0
199 **-	1	1.00	12.00	19.00	28.00	139.0
200 **-	2	1.00	9.00	19.00	25.00	128.0
201 **-	3	1.00	15.00	25.00	29.00	111.0
202 **-	4	1.00	13.00	26.00	35.00	117.0
203 **-	5	1.00	16.00	23.00	28.00	113.0

PAGE: 5

SAM POS	TIME	CPM1	CPM2	CPM3	AVG H#	ERF
204 **-	6	1.00	22.00	33.00	41.00	123.0
205 **-	7	1.00	11.00	23.00	26.00	111.0
206 **-	8	1.00	20.00	29.00	38.00	114.0
207 **-	9	1.00	13.00	19.00	27.00	119.0
208 **-	10	1.00	14.00	26.00	37.00	97.0
209 **-	11	1.00	12.00	18.00	21.00	114.0
210 **-	12	1.00	15.00	28.00	38.00	144.0
211 **-	13	1.00	17.00	28.00	37.00	128.0
212 **-	14	1.00	10.00	21.00	29.00	191.0
213 **-	15	1.00	13.00	23.00	31.00	134.0
214 **-	16	1.00	22.00	37.00	39.00	170.0

216	**	18	1.00	13.00	25.00	28.00	127.0
217	**	1	1.00	15.00	21.00	26.00	127.0
218	**	2	1.00	17.00	26.00	35.00	156.0
219	**	3	1.00	11.00	17.00	23.00	114.0
220	**	4	1.00	12.00	20.00	31.00	163.0
221	**	5	1.00	11.00	20.00	21.00	132.0
235	**	1	0.95	173631.58	176487.38	176503.16	0.0
236	**	2	1.00	22443.00	121614.00	122300.00	1.0
237	**	3	1.00	17.00	31.00	68.00	-1.0

3H
MC
BKG } stills used
for consistency

(FOR LFMS USE)
INFORMATION FROM LTS

Program Code: 03620
Status Code: 0
Fee Category: EX 3M
Exp. Date: 20131130
Fee Comments: V
Decom Fin Assur Req'd: N

BETWEEN:

License Fee Management Branch, ARM
and
Regional Licensing Sections

LICENSE FEE TRANSMITTAL

A. REGION

1. APPLICATION ATTACHED
Applicant/Licensee: COMMERCE, DEPARTMENT OF
Received Date: 20060131
Docket No.: 3008203
Control No.: 470863
License No.: 46-06377-04
Action Type: Decommissioning

2. FEE ATTACHED
Amount: _____
Check No.: _____

3. COMMENTS
Signed _____
Date 3/15/16

B. LICENSE FEE MANAGEMENT BRANCH (Check when milestone 03 is entered /_/)

1. Fee Category and Amount: _____

2. Correct Fee Paid. Application may be processed for:
Amendment _____
Renewal _____
License _____

3. OTHER _____
Signed _____
Date _____