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HEALTH PHYSICS ACTIVITIES IN CONNECTION WITH THE DISESTABLISHMENT OF NRDL: DISPOSAL OF RADIOACTIVE MATERIAL AND TERMINATION OF AEC LICENSES

31 December 1969

by

E. Tochilin
L.D. Miller

SAN FRANCISCO BAY NAVAL SHIPYARD, NRDL DISESTABLISHMENT GROUP
San Francisco, California 94135

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I. INTRODUCTION

On April 25, 1969 the Navy announced the disestablishment of NRDL with a closure date of about December 31, 1969. At that time the radioactive material on board and at outside activities was authorized by the Atomic Energy Commission (AEC) under the following licenses:

1. Byproduct Material License No. 04-00487-03 allowing possession of 5000 curies cobalt-60, 2000 curies cesium-137, 500 curies hydrogen-3 (tritium) plus up to an additional 500 curies of various isotopes of atomic number 4 to 82. Of this total 3,500 curies of cobalt 60 was located at the Camp Parks range, with the remainder at the Laboratory.

2. Byproduct Material License No. 04-00487-09 allowing possession of 66,000 curies of strontium 90 encapsulated and contained in two SNAP-21 fuel capsules. This license authorized exposure of the fuel capsules at an underwater location adjacent to San Clemente Island off the coast of California. The two sources were stored at the NRDL facility at San Clemente rather than at the Laboratory.

3. Source Material License No. SMB-376 allowing possession natural uranium and thorium up to a maximum of 560 pounds.

4. Special Nuclear Material License No. SNM-35 allowing possession of 2000 grams plutonium 10 grams uranium-233 and 1000 grams uranium-235.

Termination of the AEC licenses required the transfer of all licensed sources to other activities and disposal of sources no longer needed. Termination of the Byproduct Material License required the further decontamination of all radioactive areas occupied by NRDL at the San Francisco Bay Naval Shipyard. Final clearance of building areas was made by the AEC

on the basis of an independent survey conducted by a team of inspectors from the Division of Compliance.

Health Physics activities were carried out under the direction of Mr. A. Smith until November 3, the official disestablishment date of NRDL. On November 4 an NRDL Disestablishment Group, San Francisco Bay Naval Shipyard, was formed. At this time Mr. E. Tochilin was placed in charge of a six-man group responsible for Health Physics operations leading to final AEC clearance of all buildings and termination of all AEC licenses.

This report describes the Health Physics activities carried out during the period from about August 15 to December 31, 1969. The goal of this decontamination effort was to reduce all radioactivity to negligible levels, so that buildings and laboratory facilities could be returned to the Shipyard in a radiologically safe condition.

II. DECONTAMINATION OF NRDL AND OUTLYING BUILDINGS

A. Decontamination Procedures

The Health Physics Division of NRDL was responsible for the general surveillance of all radiation activities conducted in the laboratory and outlying areas. A continuous program of personnel monitoring, together with overall supervision and inspection of all radioactive material, went into effect prior to the Laboratory's move into building 815. Because of these protective measures no serious radiological problems were anticipated in Building 815 and the adjoining buildings 816 and 820.

Unfortunately, Health Physics practices in the early years of the Laboratory were considerably less stringent. Some Shipyard buildings

previously occupied by NRDL still had significant radioactive contamination; namely, buildings 506, 364 and 707. These areas had not been turned back to the Shipyard. Instead, they were used as NRDL experimental areas for various radiological studies.

Decontamination activities in the building areas occupied by NRDL may be summarized as follows:

1. Removal of all radioactive source material.

2. Measurement of external radiation levels with an open-window G-M instrument for beta-gamma contamination and with a thin-window proportional counter for alpha contamination.

3. Swipes of all radiation areas to determine the presence of removable contamination. A swipe count is made by rubbing a piece of absorbent tissue or filter paper over a 100 cm^2 area and counting the activity with an appropriate instrument.

4. Swipes of hoods, hood filters, sinks, drain lines, vacuum lines and work areas wherever radioactive material was used.

5. Decontamination of radioactive surfaces where the level of activity was sufficiently low to warrant such procedures. Decontamination methods mostly included washing or scrubbing with detergents, dilute complexing agents or mild acids, or with combinations of the above. In more extreme cases chipping, sand-blasting, vacuuming and high pressure steam cleaning was required. Special protective clothing and face masks were issued to personnel engaged in these operations.

6. Dismantling of radioactive equipment that could not be readily decontaminated (hoods, bench tops, floor tiles, filter banks, storage tanks, etc.) and crating it for removal as radioactive waste.

7. Final inspection of all monitored and decontaminated areas by the AEC Division of Compliance.

Decontamination procedures used during the cleanup operation at NRDL were successful in removing detectable radiation in all but a few locations. Although it is highly desirable to remove all traces of radioactive contamination, the AEC recognizes that small quantities of residual contamination can be tolerated in special cases. A certain amount of alpha and beta-gamma contamination is permissible if the contamination can be demonstrated to be fixed as determined by swipe count.

The AEC has specified that a localized radioactive area may be considered to be decontaminated when the beta-gamma dose rate at one cm averages less than 0.2 mr/hr and the removable activity per 100 cm^2 of surface is less than 1,000 disintegrations per min (dpm). For alpha contamination the fixed activity should be less than 500 dpm per 100 cm^2 while the removable activity should be less than 100 dpm.

While most areas, including Bldgs 815, 816, 820 and 707 were decontaminated to background levels, a small amount of localized radioactivity in and around Building 364 and 506 could not be removed. These residual levels were inspected by the AEC and determined to be below AEC minimum permissible requirements. The areas are identified in the last section of the report "Final Condition of NRDL Buildings."

B. Radiation Monitoring and Decontamination

1. Building 815

The critical areas in Building 815 were the sixth floor occupied by the Nuclear Technology Division, the fifth floor occupied

by the Biological and Medical Sciences Division and Room 1109, the Isotope Storage Room. These were the principal areas where unsealed liquid and solid radioactive sources were used and from which serious radioactive contamination could result. Radiation surveys and subsequent decontamination efforts began on the sixth floor and proceeded downward to the first. The following is a brief description of initial radiation surveys performed on each floor and subsequent decontamination procedures.

Sixth Floor

There was widespread use of transuranic sources on this floor, particularly plutonium. Since many sources were in liquid form there existed a potential hazard from alpha particles. Surveys were made in all rooms with both a beta-gamma G-M survey instrument and an alpha proportional counter type survey meter. All bench tops, sinks, hoods, desks and floors were monitored. Hoods were monitored up to the back side of the filter banks. All hood filters were removed and disposed of as radioactive waste. A total of ten swipes were made in each laboratory area and counted for gross alpha and beta-gamma activity. A total of five swipes were made in each office area (this included the floor and each wall). All vacuum lines and sink drains were opened and swiped for possible radioactivity. The same procedure was followed on all other floors where there were vacuum lines and sink drains.

Contaminated areas were found in the eight rooms listed below. Most of the radioactive components were physically removed and disposed

of. No radioactive contamination could be detected following completion of the decontamination effort.

ROOM	CONTAMINATED AREAS	ALPHA or BETA	ACTION TAKEN
631	Floor tiles	B	Removed
634	Floor tiles	A	Removed
	Bench top	A	Removed
658	Sink and drain lines	A	Removed drain
670	Cabinet drawers	B	Removed
	Floor tiles	B	Removed
679	Hoods (2)	A	Decontaminated
680	Hoods (2)	A	Removed
	Cabinets	A	Removed
	Bench top	A	Removed
	Floor tiles	A - B	Removed
	Floor under tiles	B	Decontaminated concrete floor
682	Floor tiles	A	Removed
683	Mercury in hood		Removed mercury

Fifth Floor

The two sources most widely used on the fifth floor were carbon-14 and tritium, both of which are low energy beta emitters. Radiation surveys were made with a thin-walled G-M survey meter which could detect the presence of carbon-14 but not tritium. Extensive swipes were made in all laboratories where tritium was used. The swipes were analyzed for tritium contamination with both a gas-flow proportional counter and with a tritium scintillation detector. All swipes were further counted for gross alpha and beta-gamma activity. Except for some low level activity concentrated in the filter hoods there was no detectable radioactive contamination on the fifth floor.

Fourth Floor

Radioactive sources located on the fourth floor were mainly sealed gamma emitters which normally would not produce any radioactive contamination. A radiation survey was made of all rooms with a beta-gamma survey meter. Five swipes were made in each laboratory room and two swipes in each office area. All swipes were counted for gross alpha and beta-gamma activity.

Several low-level radiation check sources were found during the radiation survey. No detectable radioactive contamination was found by the radiation survey. All swipe counts were negative.

Third and Second Floors

Except for rooms 218, 222, 255 and 2153 occupied by the Health Physics Division all remaining areas were used primarily by administrative personnel. The probability of radioactive contamination on these two floors was, therefore, extremely small. All rooms were surveyed with a beta-gamma survey instrument and a minimum of two swipes taken in all rooms.

All radiation measurements (swipes and meter readings) on the second floor were negative, including Health Physics rooms 218, 222 and 255. Room 2153 contained a filter housing connected to a blower which maintained a negative pressure in Room 1109, the Radiosotope Storage Room. Filters removed from the housing were found to be slightly radioactive. Radiation levels in the housing ahead of the filters ranged from 0.05 to 0.2 mr/hr; this was mostly contained in a thin layer of dust which was removed with a vacuum cleaner. Final radiation levels in the filter housing averaged 0.05 mr/hr approximately two times background.

First Floor

Radioactive surveys and swipe tests were made of all rooms. Except for Room 1109 there was no detectable radioactive contamination on the first floor.

Six radioactive areas were found in the Radiosotope Storage Room, 1109. These were primarily around the bottom of the hood and included the drain pipes and adjoining bench top. The door and drain pipe below the hood was removed and disposed of as radioactive waste. The adjoining bench and portions of the wall were also removed in order to dismantle the drain pipe leading into the wall. Contaminated floor tiles in front of the hood and at the back exit were also removed. The vent ducts leading from the hood to the filter bank in Room 2153 were found to be contaminated. They were removed and discarded as radioactive waste. Upon completion of these decontamination efforts Room 1109 was remonitored and found free of all radioactive contamination.

Waste Tanks

All Laboratory sinks and drains in Bldg 815 emptied into two radioactive waste tanks located on the west end of the buildings. During normal operation a daily water sample was obtained from each tank and analyzed for gross beta-gamma and gross alpha activity. In this way the release of radioactivity into the city sewage system was controlled to conform with AEC regulations.

The drain tanks were periodically cleaned by removing the water and then washing out the remaining sludge with a firehose. Both tanks were given a final cleaning in November. On December 9 waste tank No. 1 was

filled and sampled. A 100 ml sample was concentrated to dryness and counted for both beta-gamma and alpha activity. Both counts gave rates below background (28 cpm for beta-gamma and 0.5 cpm for alpha counting). With both counts negative the sample was considered to contain no detectable activity.

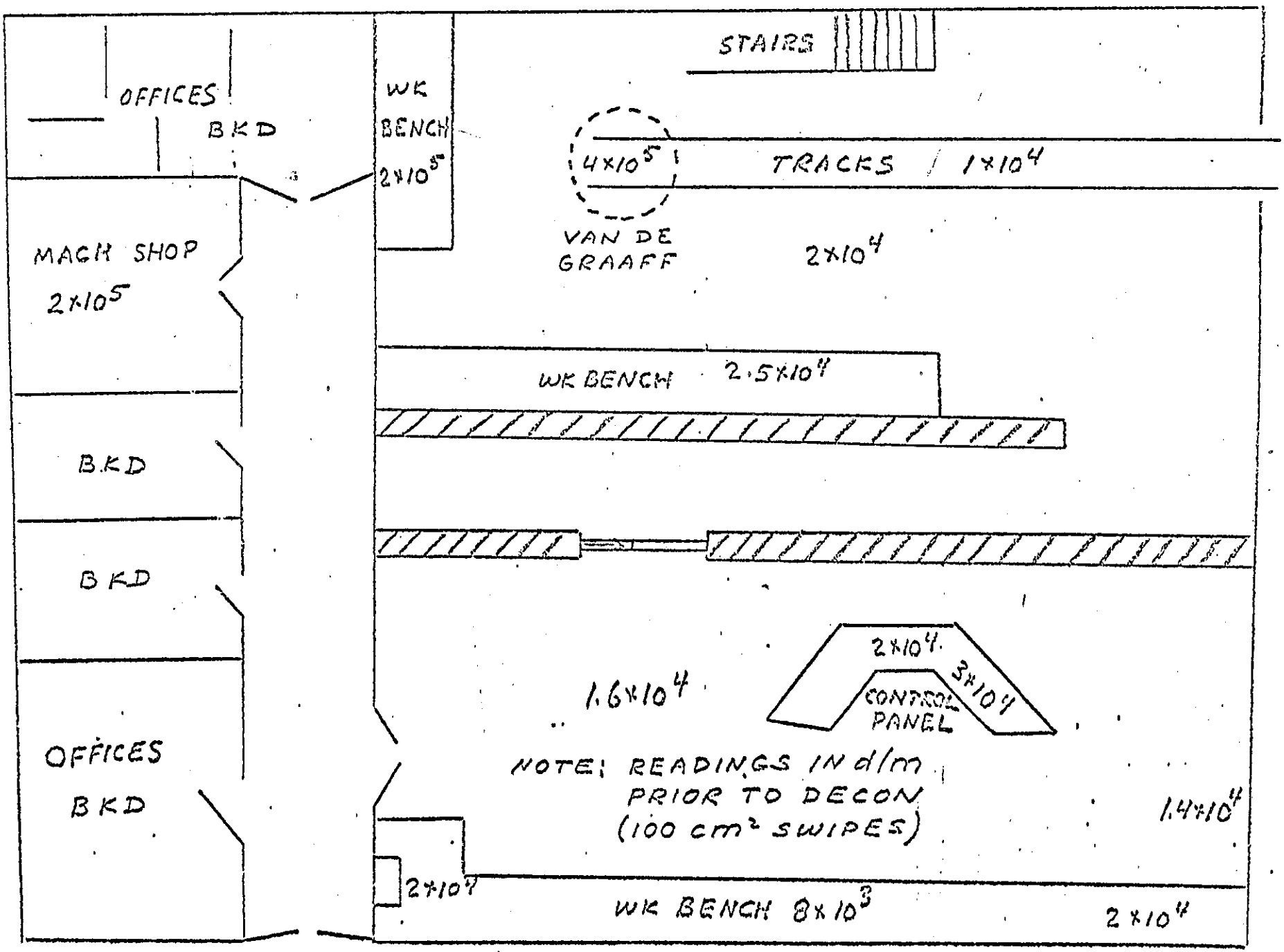
The water in tank No. 1 was pumped into tank No. 2. A 100 milliliter sample was taken from tank No. 2, evaporated to dryness and counted for one hour as before. The net counts above background gave the following concentrations:

TYPE OF COUNT	NET cpm	MICROCURIES PER cc
Beta-gamma	1.4	0.95×10^{-7}
Alpha	0.23	4.4×10^{-9}

These levels were acceptable to Mr. R. Fish, Division of Compliance, AEC.

2. Building 816

This building contained the 2-MeV Van de Graaff (VDG) accelerator which was used to accelerate either electrons or positive ions. No radiation sources other than sealed Pu-Be neutron standards were used in this building. The primary source of radiation contamination was from tritium targets used to produce neutrons when bombarded with protons or deuterons. Radiation surveys were initially made with a portable G-M survey instrument. No radioactive contamination was detected by this method. However, swipes counted with a tritium-carbon (TRICARB) scintillation detector showed extensive tritium contamination. The counts generally ranged from 10^4 to 10^5 disintegrations per minute. Figures 1


OFFICES
BKD
WK BENCH 2×10^5
STAIRS
4×10^5
TRACKS
1×10^4
VAN DE GRAAFF
2×10^4
MACH SHOP 2×10^5
WK BENCH 2.5×10^4
BKD
BKD
2×10^4
3×10^4
CONTROL PANEL
1.6×10^4
OFFICES
BKD
NOTE: READINGS IN d/m PRIOR TO DECON (100 cm² SWIPES)
1.4×10^4
2×10^4
WK BENCH 8×10^3
2×10^4

and 2 give the results of swipe tests made on the first and second floor. Additional swipes were made in the Butler Building Annex which contained a large open pit that was used to provide a scatter-free environment for neutron experiments. Beam pipes were used to extend the VDG beam over the pit. Readings of up to 10^5 dpm were obtained from swipes taken on the metal grating directly below the neutron target. Readings up to 3×10^4 dpm were obtained on the pit floor. Swipes taken in the remainder of the building read background.

The Van de Graaff accelerator was found to be contaminated with approximately 200 millicuries of tritium. The accelerator was disassembled and shipped as radioactive material to USNAD Crane, Indiana where it will be decontaminated and put back into operation.

Following removal of the VDG accelerator and auxilliary equipment the building was steam cleaned for removal of tritium in the concrete walls and floors. Tritium is readily absorbed on porous surfaces and can be driven off into the atmosphere by a combination of heat and high humidity. Swipes were made after the steam cleaning operation in all contaminated areas of Fig. 1 and 2. and in the remainder of the building, including the annex. All counts registered background indicating that the tritium had been successfully removed. An AEC inspection made on Nov 19 indicated no detectable tritium contamination.

3. Buildings 506 and 529

Building 506 was one of the original buildings occupied by NRDL. Most of the earlier radiochemical analyses were carried out here. The building was decontaminated after the move to Bldg 815. However, a stainless steel holding tank for radioactive waste was not removed. In addition, a radiochemical hood and connecting filter-blower system was never

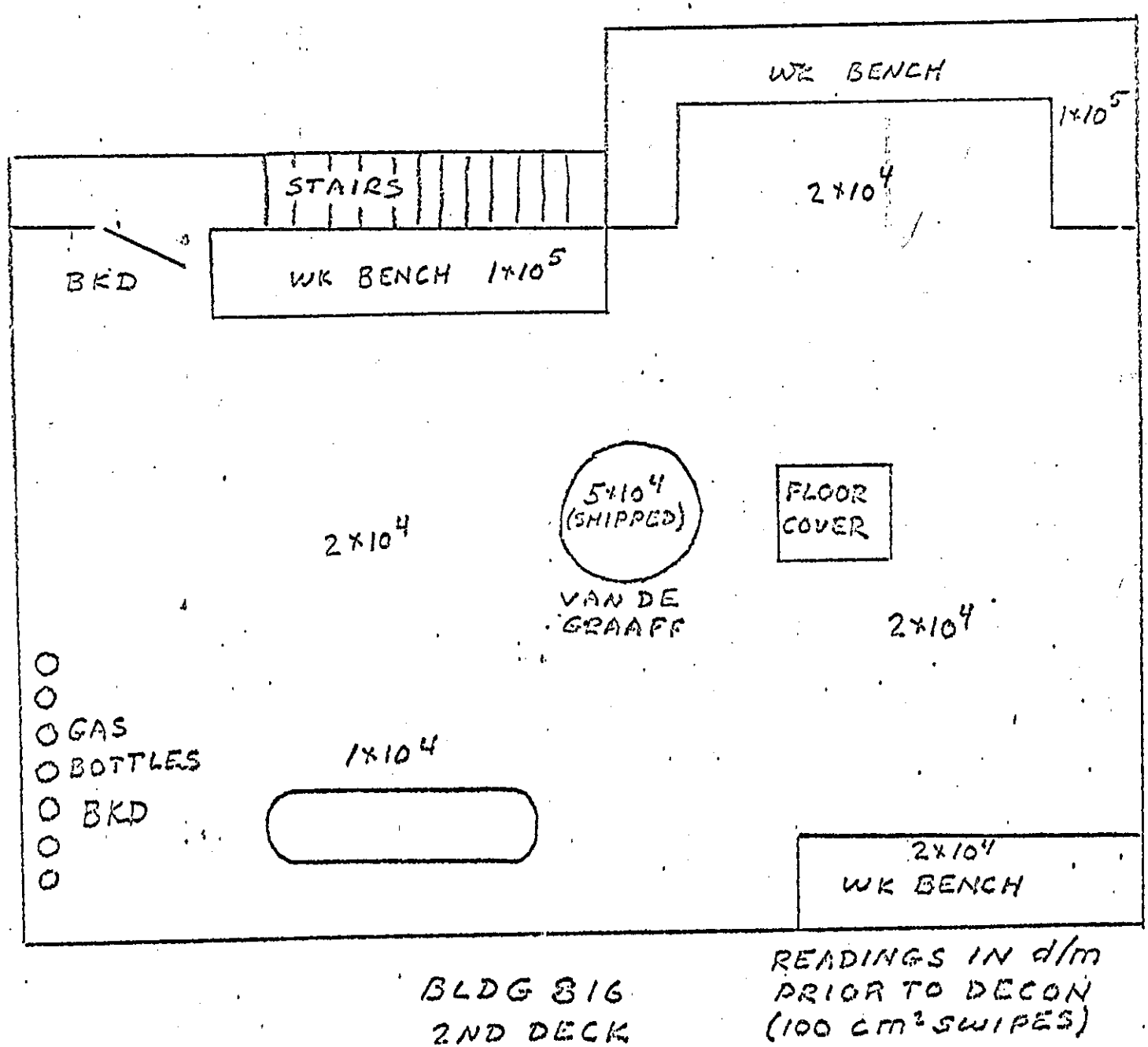


FIGURE 2: TRITIUM SWIPES BLDG 816, 2ND DECK

completely decontaminated.

The western end of Bldg 506, which contained the radiochemical hood, remained occupied by NRDL. The building was used mainly to house the controls of a low voltage neutron generator. Building 529, initially used as an isotope storage building was modified to house the neutron generator and provide necessary shielding. Tritium targets were used to produce neutrons. The targets were vented so as to minimize the possibility of radioactive contamination.

Rooms 35 and 35A located on the north side of Bldg 506 were used for storing tritium targets. Wipe tests indicated considerable tritium contamination in these two rooms and to the equipment stored inside. Counting levels generally ranged from 10^4 to a maximum of 10^5 dpm.

Initial cleanup consisted of washing down all equipment and room areas with hot water and detergent. This procedure reduced the removable activity approximately tenfold but still left many areas above maximum permissible tolerance levels. All contaminated equipment located in these rooms was either disposed of as radioactive waste or crated and shipped as radioactive material to its new destination. Following removal of all equipment, the two rooms were steam-cleaned.

There was no detectable radiation in the hood located in Room 33. However, the filter bank located in a penthouse on the roof of the building was contaminated. Radiation levels of mrad/hr beta-gamma were detected. Decontamination consisted of removing the filter housing as radioactive waste. One wall of the penthouse had to be torn down in order to remove the unit.

Rooms 33 and 33A located on the south side of the building were used as laboratory and office space. No detectable radiation was measured

with a G-M survey instrument. Several localized areas of tritium contamination were detected with swipes. These were scrubbed down with detergent.

Radiation surveys were made in Bldg 529 with a G-M survey meter and with swipes: There was no detectable radiation.

The stainless steel holding tank on the north side of the building has been cleaned approximately 10 years ago but was still contaminated. Beta-gamma readings of 0.5 mr/hr were obtained with a G-M survey instrument. The tank was cleaned two additional times before acceptable radiation levels were obtained. The final beta-gamma readings were 0.11 mr/hr average and 0.16 mr/hr maximum. Swipes taken at ten locations inside the tank measured less than 100 dpm everwhere except on the bottom of the sump which read 570 dpm. The tank was removed from the concrete pit by the Shipyard in December 1969 to be used for boiler feed water storage.

4. Building 364

There was extensive radioactive contamination in the yard area directly behind Bldg. 364. The main contamination areas were the two holding tanks housed below ground in a concrete tank pit and the pump shed from which liquid waste was pumped into the holding tanks. All pipes leading from the pump shed and from Bldg 364 into the holding tanks were also contaminated.

Radioactive liquids in the holding tanks were pumped into a tank car supplied by Nuclear Engineering Co. and removed from the shipyard. The two tanks were then lifted out of the pit and crated for disposal as radioactive waste.

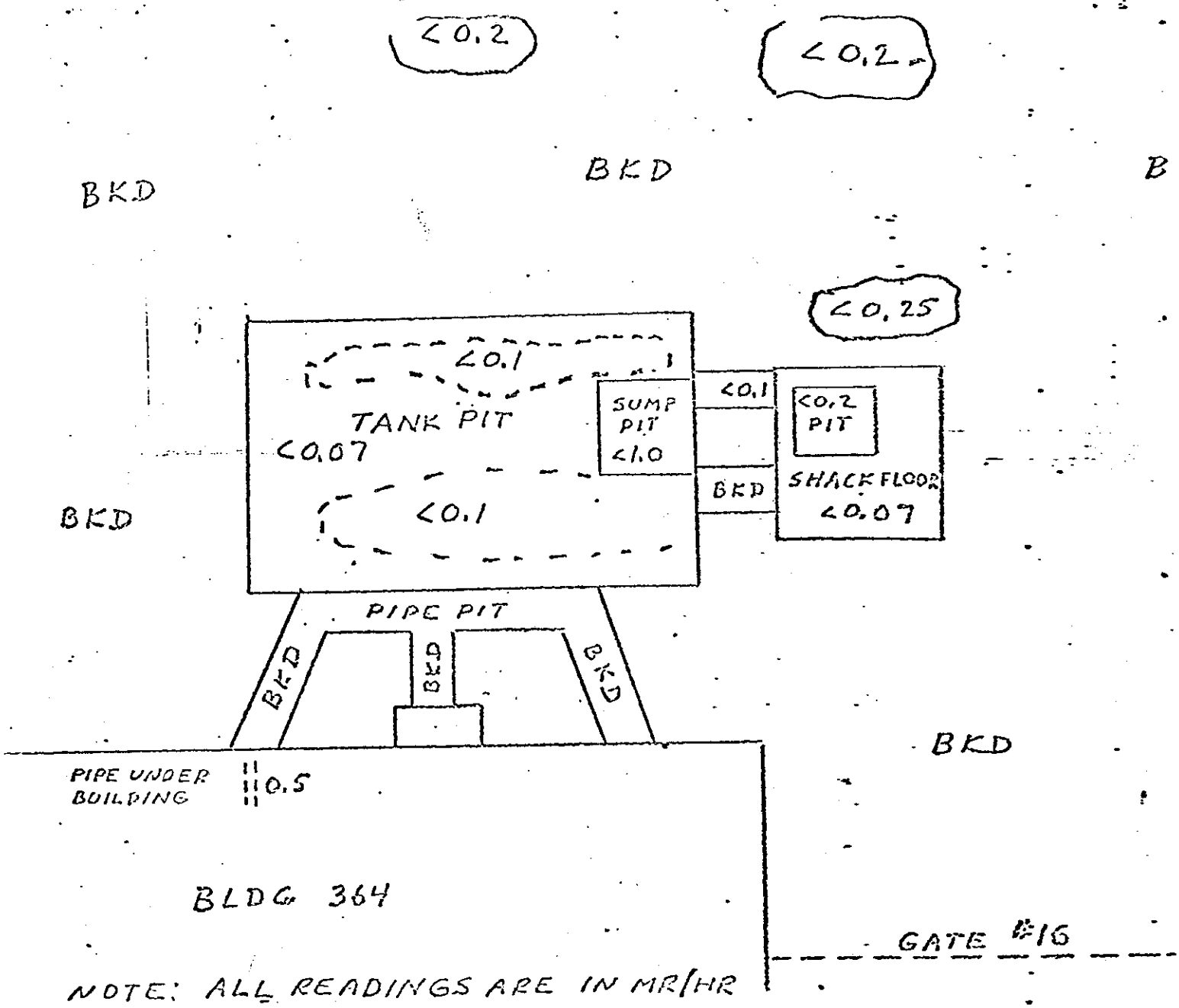
Radiation levels on the floor and lower walls of the tank pit averaged greater than one mr/hr, while readings in the sump pit were as high as 5 mr/hr. The pit was decontaminated by chipping the surface concrete until radiation levels and swipe counts decreased below permissible AEC levels. Figure 3 gives the radiation levels outside of Bldg. 364 upon completion of decontamination activities. These averaged less than 0.1 mr/hr on the tank pit floor and less than 1 mr/hr in the sump pit.

Radiation levels on the shack floor of the pump shed ranged from 4-6 mr/hr and in the sump pit from 15-20 mr/hr. Decontamination consisted of tearing down the pump shed and all associated plumbing, including the pipes leading to the tank pit. Chipping operations were then performed on the concrete floor and sump pit. Final radiation levels were less than 0.07 mr/hr on the floor and less than 0.2 mr/hr in the sump. Low level activity of less than 0.2 mr/hr was also found in several locations

throughout the yard (see Fig. 3) where radioactive waste had been stored.

All plumbing from Bldg 364 to the tank pit was removed. One piece of pipe going into a concrete slab under the building read 0.5 mr/hr. The other end of the pipe connected to Room 108, originally the decontamination room. The drain which was several feet below floor level had been covered up with sand and a top layer of concrete. In order to determine radiation levels on this end of the pipe, the floor was broken and the sand removed from the drain sump. Location of the drain is shown in Figure 4. Radiation levels on the bottom of the drains were a maximum of 0.07 mr/hr. Following discussions with the AEC it was decided to leave the pipe in the concrete slab. However, their recommendation was that the hole be filled in. This presented no problem since the shipyard had already stated that the concrete floor was to be restored. Some contamination was also detected on the walls of Room 108; this was readily removed by washing down with detergent and water.

Radiation surveys and swipes were made in the remaining rooms of the first floor and mezzanine (see Figure 4). No detectable radiation was found.

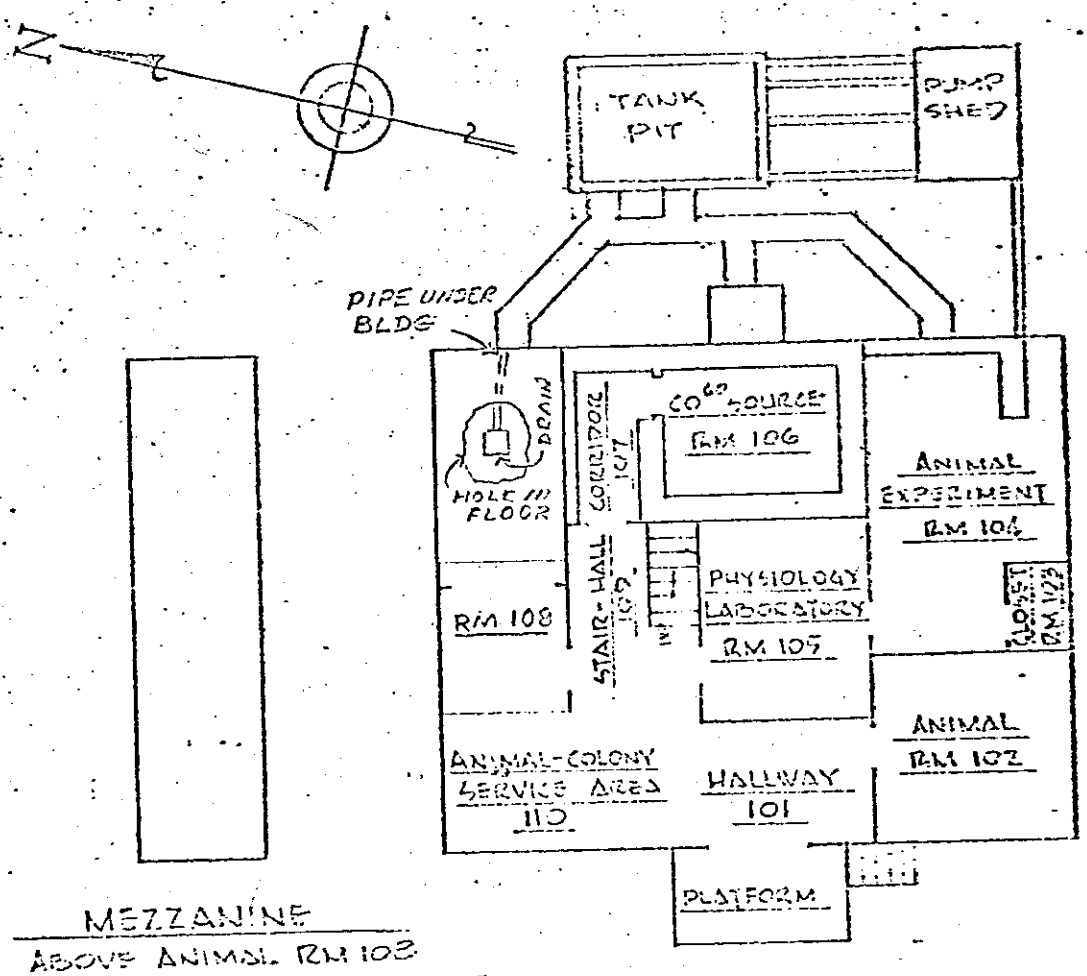


NOTE: ALL READINGS ARE IN MR/HR
ALL SWIPES WERE NEGATIVE

FIGURE 3

FINAL RADIATION LEVELS OUTSIDE OF BLDG 364

U.S. NAVAL RADIOLOGICAL DEFENSE LABORATORY SAN FRANCISCO 24, CALIFORNIA	SCALE $\frac{1}{16}$" = 1'-0"	5-25-65	PROJECT NO.
BLDG. 364	DRAWING NO. S-50-260		ALTERATION
DRAWN BY FJA	CHECKED BY	APPROVED BY	SATISFACTORY TO J. L. Kennedy	DATE



MEZZANINE

ABOVE ANIMAL RM 108 & ANIMAL-COLONY SERVICE AREA 110

FLOOR PLAN

SCALE: $\frac{1}{16}$" = 1'-0"

FIGURE 4

BLDG 364 FLOOR PLAN

C. Disposal of Radioactive Sources

In August 1969 there were in excess of 300 individual radioactive sources at NRDL. Approximately 200 of these were transferred to other activities while the remainder were disposed of as radioactive waste.

The three largest transfers involved: 3,500 curies of cobalt-60 located at the Camp Parks Range, transferred to Stanford Research Institute, Menlo Park, California; 800 curies of cobalt-60 in a gamma-ray irradiator transferred to the Naval Ordnance Laboratory, White Oak, Maryland; and 66,000 curies of strontium-90 located at San Clemente Island, Calif., transferred to the Naval Undersea Research and Development Center (NURDC), San Diego, Calif.

In the transfer of sources, first priority was given to investigators with active programs assigned to other naval activities. These were primarily the Naval Ordnance Laboratory and NURDC. Second priority was given to NRDL programs transferring to other government laboratories or non-profit laboratories and universities. A list of remaining sources was prepared and made available to various government agencies, together with laboratories and universities in the immediate geographical area. This procedure allowed the utilization of essentially all radioactive sources of any value.

III. FINAL RADIOLOGICAL CLEARANCE BY AEC

A. Clearance of NRDL Buildings

AEC clearance was obtained through the Division of Compliance, 2111 Bancroft Way, Berkeley, California. Mr. Raymond Fish conducted the

AEC inspection which consisted of spot checks for radioactivity in areas previously cleared by Health Physics. Readings made by the AEC were with alpha and beta-gamma survey meters together with swipes which were counted in their Laboratory.

In Bldg 815 final clearance was given for the 4th, 5th and 6th floors prior to November 3. Final clearance was given for the 3rd floor on Nov 19 and for the 2nd floor on Dec 23, except for three rooms still occupied by Health Physics. Rooms 1109 and 165 were also given final clearance on Dec 23. Mr. Fish plans to inspect the remainder of the first floor in mid-January 1970, at which time most of the rooms will be vacated. Since the first floor has been given a thorough Health Physics inspection by NRDL personnel, Mr. Fish is reasonably satisfied that there is no remaining activity in the building.

Clearance dates for the remaining buildings are given below:

BLDG	DATE OF AEC CLEARANCE
816	November 24
820	Not required
821	Not required
364 - 365	December 24
506 - 529	December 24

Buildings 820 (Cyclotron Building) and 821 (1 MeV X-ray Facility) contained no radioactive material, and therefore did not require AEC clearance.

B. Termination of AEC Licenses

The table below gives the AEC licenses held by NRDL, the dates when request for their termination was made, and the date they were terminated.

LICENSE	NO	REQUEST FOR TERMINATION	DATE TERMINATED
Biproduct Material	04-00487-3	10/27/69	10/29/69
Biproduct Material	04-13488-01	12/31/69	
Biproduct Material	04-00487-09	*	11/3/69
Source Material	SMB-376	11/24/69	
Special Nuclear Material	SNM-35	To be made by NAVELEX	

* Terminated on request of Naval Facilities Engineering Command following transfer of material to Naval Undersea Research and Development Center, San Diego, California.

Request for termination of Biproduct Material License 04-13488-01 was made on Dec 31 following the radioactive waste shipment of Dec 30. At this time there was no known radioactive biproduct material or contamination remaining in previously occupied NRDL areas, except for the two locations described in the next section. This remaining residual activity was certified by AEC inspectors to be within allowable limits for AEC clearance.

The final shipment of special nuclear material held under License SNM-35 left NRDL by December 31, 1969. Mr. George Mahaffey, Naval

Electronics Systems C mand, pointed out that signed copies of all shipping papers are required from the receiving activities before the AEC will terminate a Special Nuclear Material License. All receiving activities have been notified to forward the necessary papers to Mr. Mahaffey who will act as the Navy coordinator in this matter.

IV. RESIDUAL RADIOACTIVITY

Following completion of decontamination procedures there were still isolated areas of low level radioactivity. These levels are well below the maximum permissible concentrations specified by the AEC. Although these radioactive areas have been previously described in this report, it was considered advisable to list them once more in the final section. All levels greater than 0.05 mr/hr (approximately 2.5 times normal background) have been included.

Bldg 815

There is no detectable radioactive material remaining in this building.

Bldg 816

There is no detectable radioactive material remaining in this building.

Bldg 364

Small amounts of radioactive contamination remain in the yard area behind Bldg 364. These are primarily on the floor of the concrete tank pit and on the shack floor slab. Location of the remaining beta-gamma activity in the yard area may be found in Figure 3.

One pipe under Bldg 364 read 0.5 mr/hr (see Fig. 3). There is no detectable radioactive material remaining in the building.

Bldg 506

There is no detectable radioactive material remaining in Bldg 506 and the adjoining Bldg 529. The stainless steel holding tank on the front of the building was slightly radioactive, but below AEC clearance levels. The final beta-gamma readings were 0.11 mr/hr average and 0.16 mr/hr maximum. Swipes taken at ten locations inside the tank measured less than 100 dpm everywhere except at the bottom of the sump which read 570 dpm. The tank has since been removed and relocated elsewhere in the shipyard for boiler feed water storage.

55C-9000 469-5000

529 1810 Mike Trent

892/30 min BKg - 29.96 cpm

Ludlam x1 scale 2 min counts no planchet

BKG 19 = 62/2 min = 31 cpm MDA 16.8 cpm = 47.8 cpm

495A Floor	58 = 29	≤ MDA	
Exhaust on Roof	85 = 42.5	≤ MDA	
631 -1	167 = 83.5 cpm		✓
667 under vent	61 = 30.5	≤ MDA	
670 - 4	67 = 33.5	≤ MDA	
670 - 1 wet	73 = 36.5	≤ MDA	
670 - 2 wet	59 = 29.5	≤ MDA	
473 in coord vent outside	69 = 34.5	≤ MDA	
670 - 3	53 = 26.5	≤ MDA	
473-2 Rusty tiles	69 = 34.5	≤ MDA	
473-1 under vent	150 = 75 cpm		✓
471-2	159 = 79.5 cpm		✓
471-1	686 = 343 cpm		✓
218-1	355 = 177.5 cpm		✓
135-2 vent	66 = 33	≤ MDA	
135-1 A scraping Desk	80 = 40	≤ MDA	
1109-3	3664 = 1832 cpm		✓
1109-2	10131 = 5065.5		
1109-1	219 = 109.5		

591 has 593-595 & 597 inside. appears 591 has 3/8" Pb shielding.

6th floor may be greatest prob unsealed PU room?

1st floor 1109 storage room

56 DT304 $\bar{c}$ sealer RO-2

low Sa smear paper

Contact → Mr. Steve Lascoe

phone comm 415 - 556 - 3252

31st Floor 525 Market st.

Keys & Bldg. motel??

one body

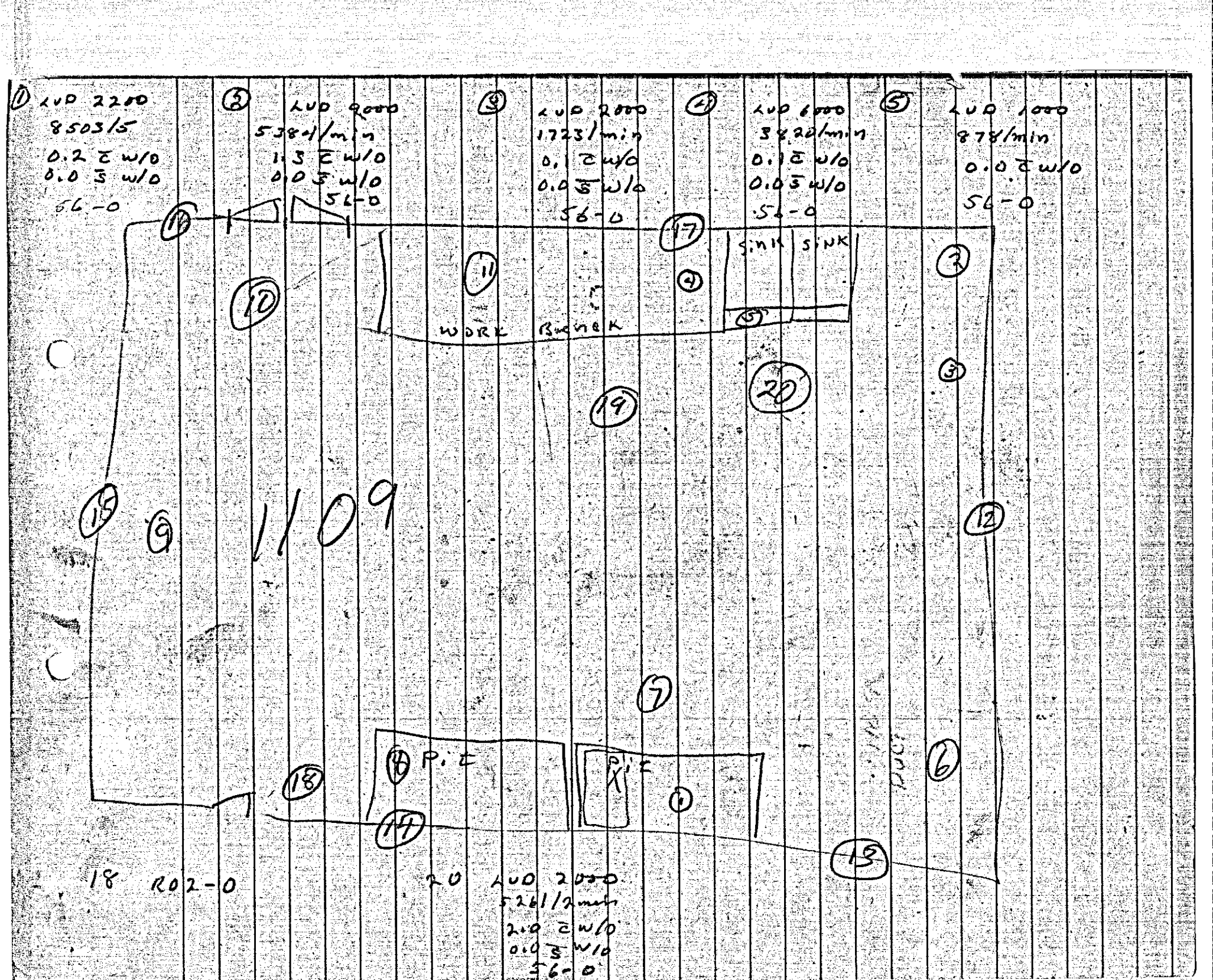
Copy of Rpt

LEO KLANTZ DOL

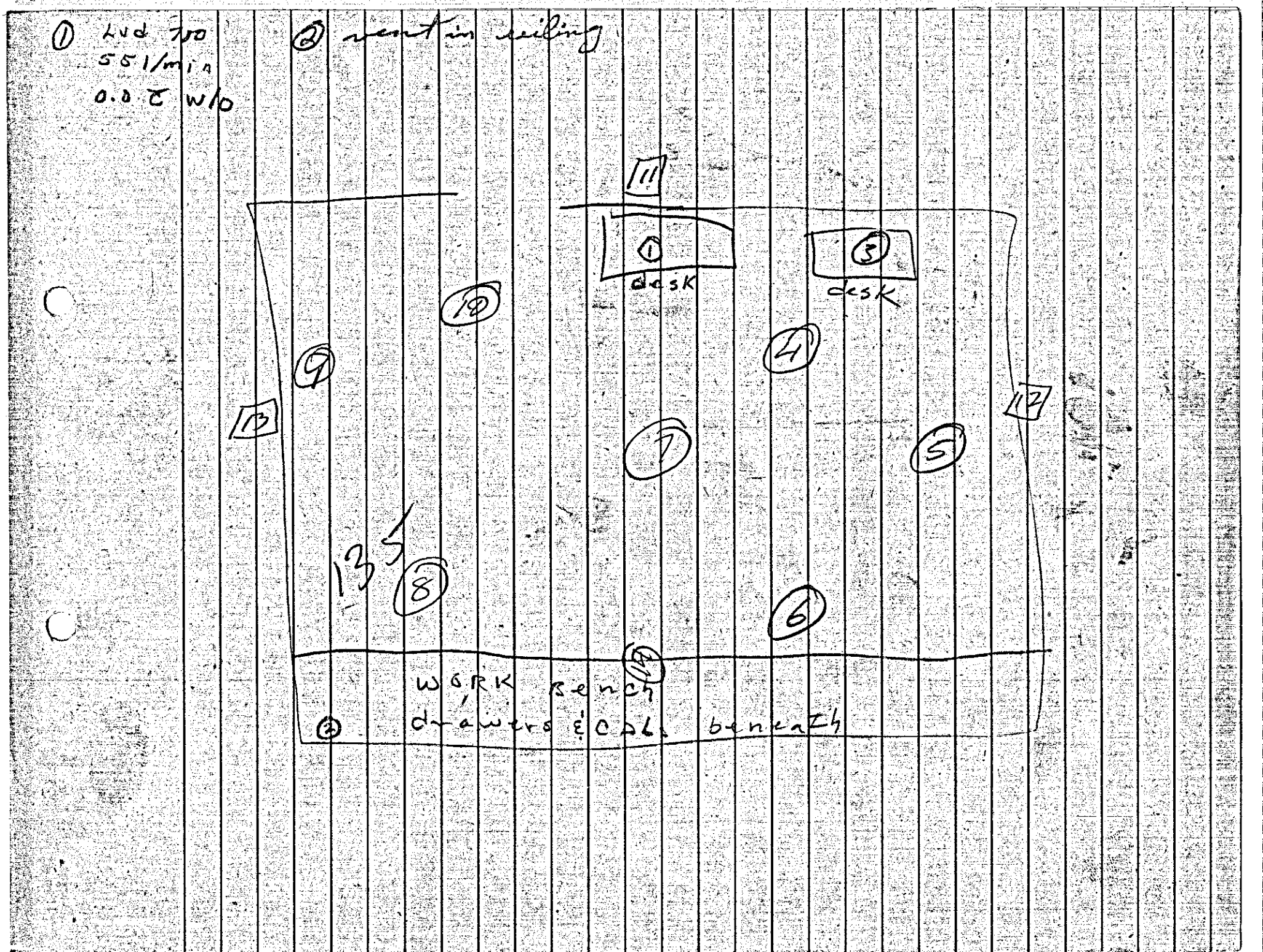
95% leased Triple A Metal works

navy retained sup ships

Navy excess & GSA



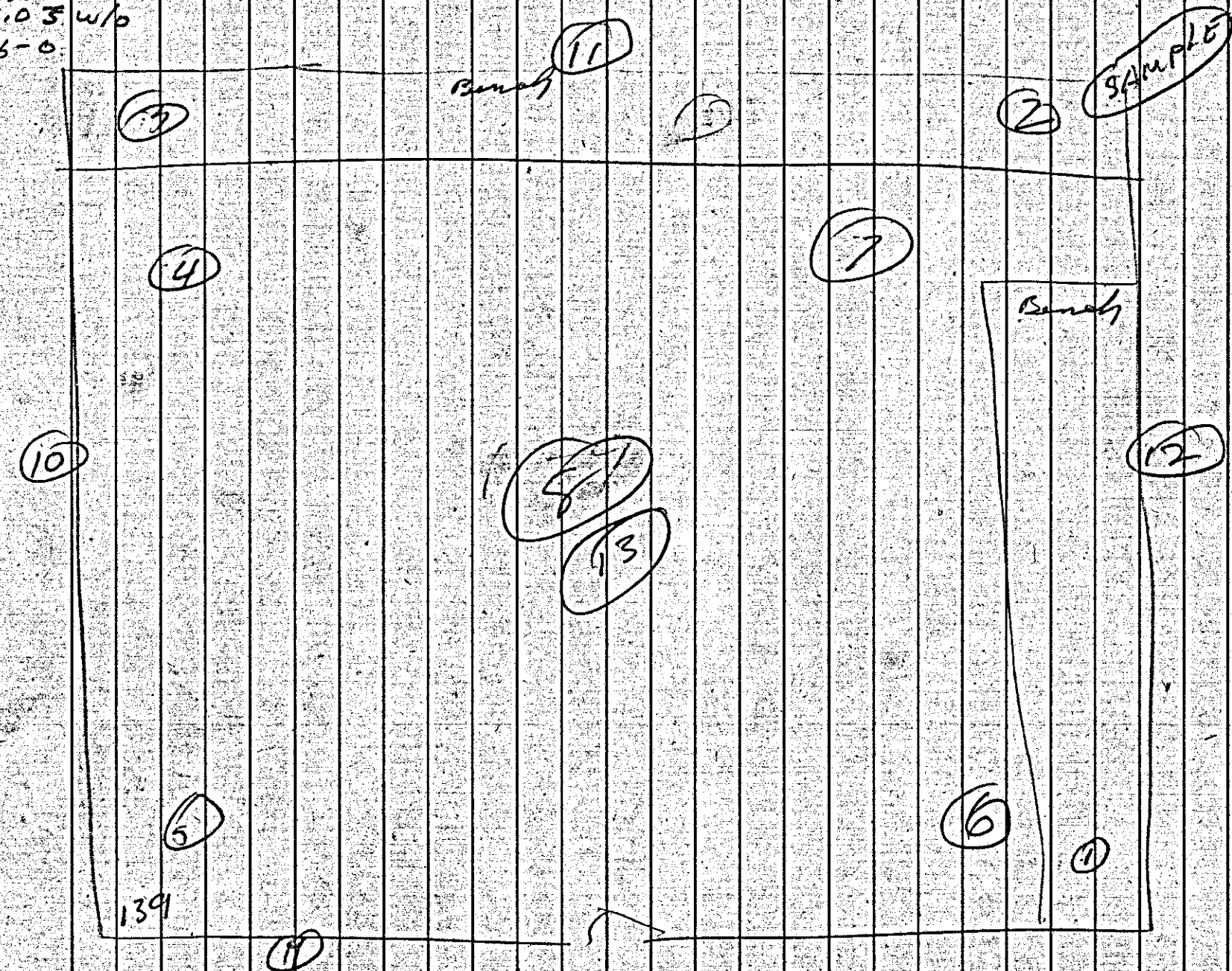
1 LUD 2200
8503/5
0.2 C̄ w/o
0.0 S̄ w/o
56-0
2 LUD 9000
5384/min
1.3 C̄ w/o
0.0 S̄ w/o
56-0
3 LUD 2000
1723/min
0.1 C̄ w/o
0.0 S̄ w/o
56-0
4 LUD 6000
3820/min
0.1 C̄ w/o
0.0 S̄ w/o
56-0
5 LUD 1000
878/min
0.0 C̄ w/o
56-0
SINK
SINK
WORK BENCH
1109
PIT
PIT
18 R02-0
20 LUD 2000
5261/2 min
2.0 C̄ w/o
0.0 S̄ w/o
56-0

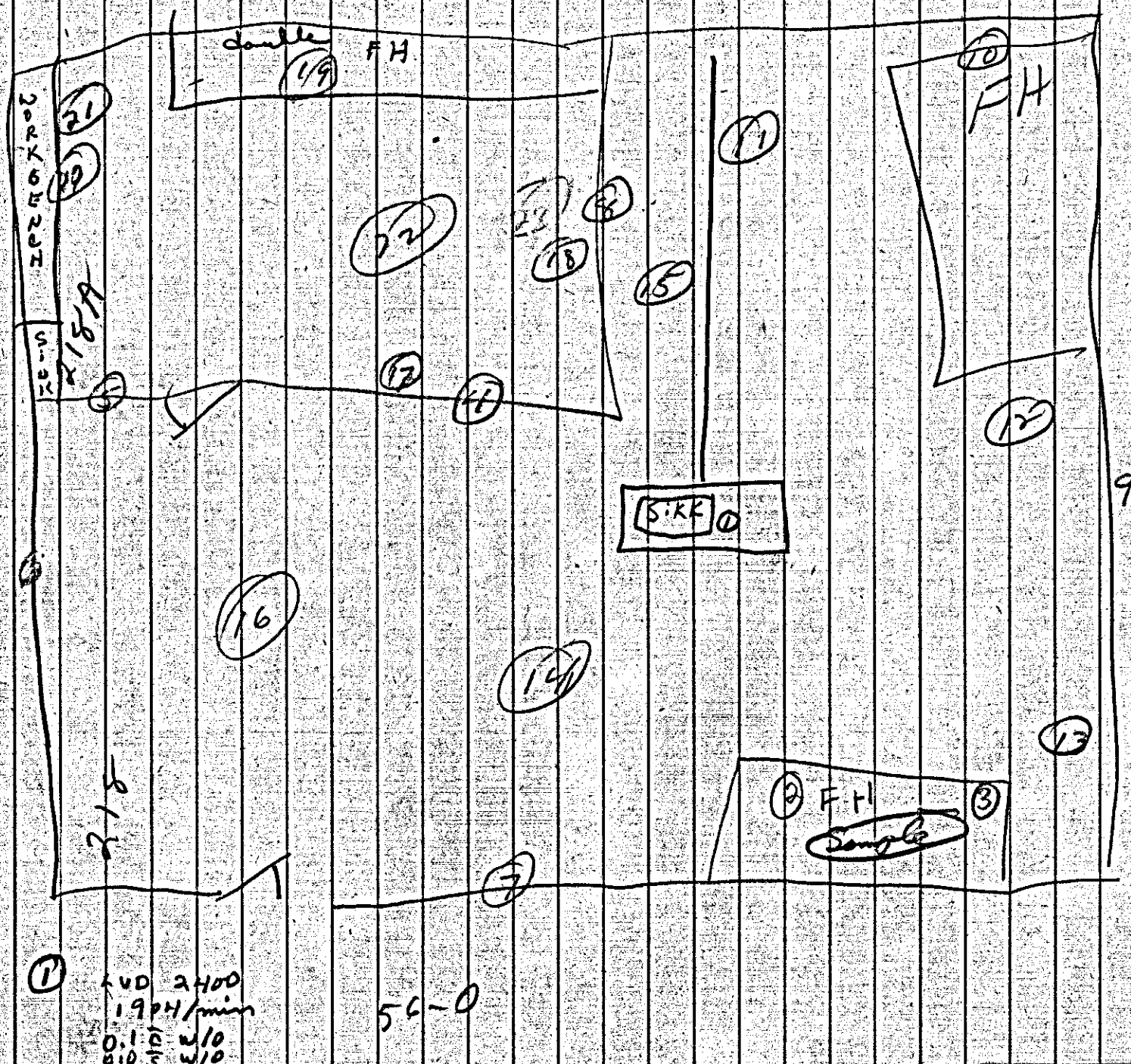


① Lvd 700
55 l/min
0.0 c̄ w/o
② vent in ceiling
11
1
desk
3
desk
10
4
9
13
12
7
5
135
8
6
19
WORK bench
② drawers & cabs beneath

③ LUD 120
180/2
0.1 C w/o
0.03 w/o
56-0

point ③ smear = 68/2 min

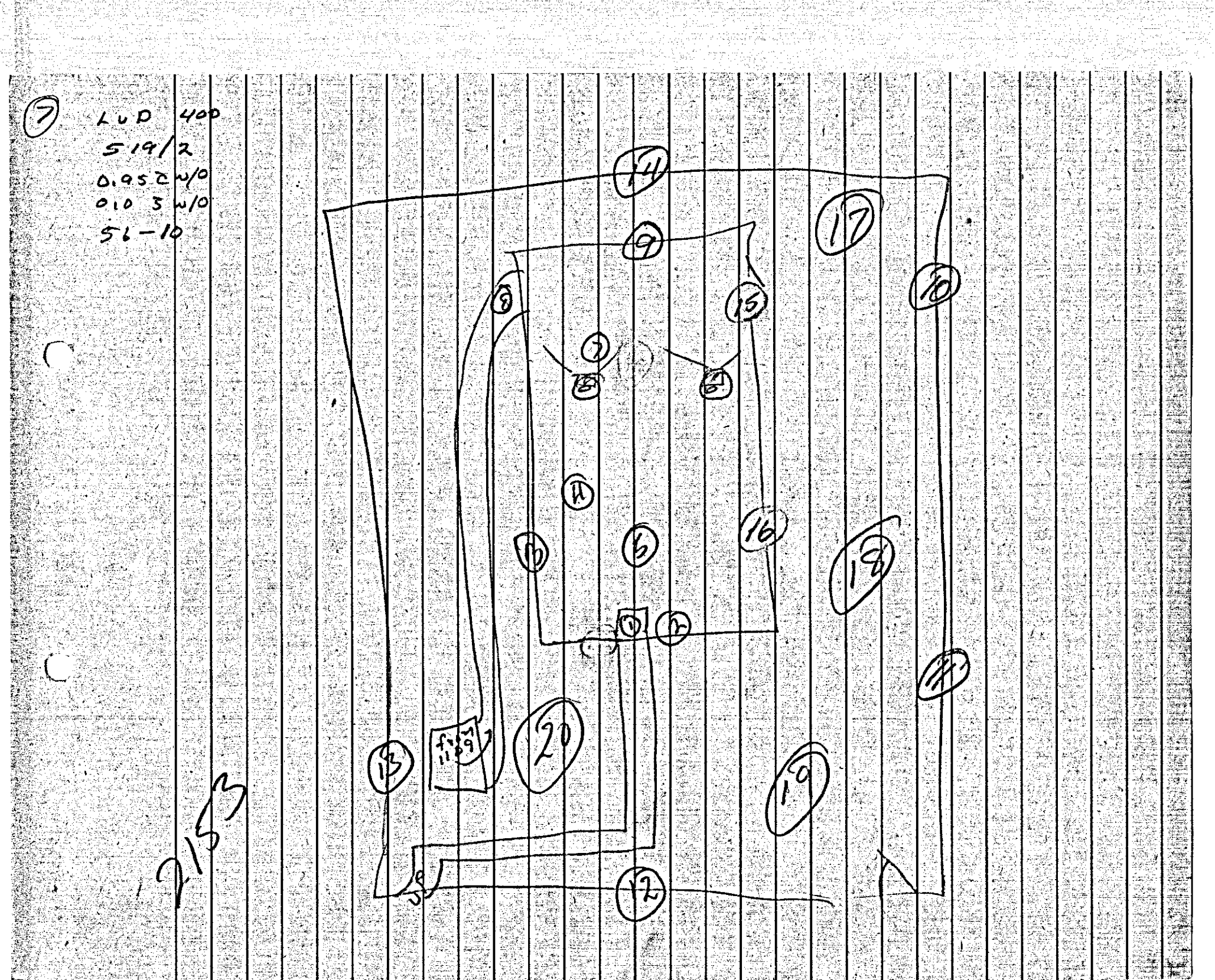


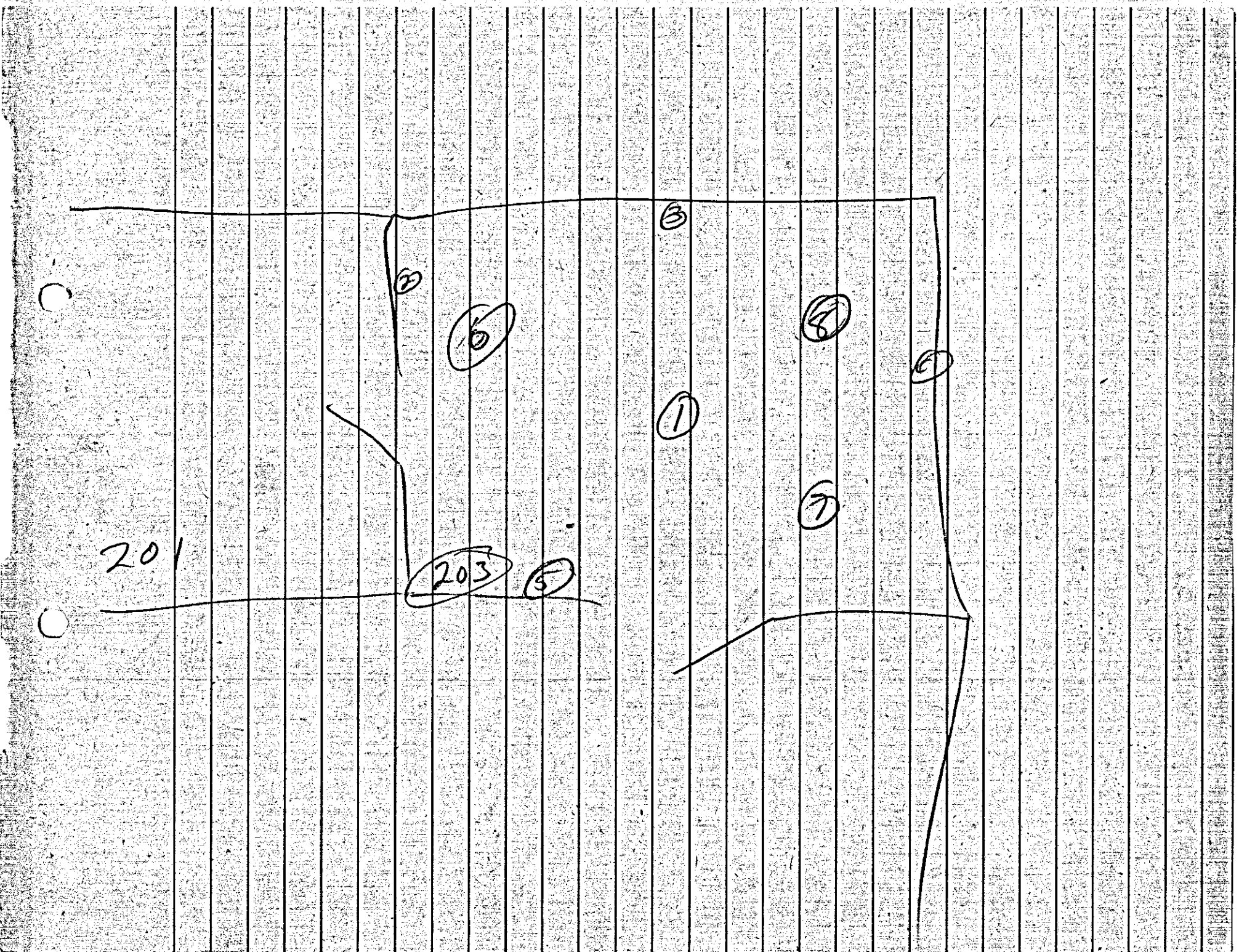


1 LVD 2400
1904/min
0.1 c̄ w/o
0.10 s̄ w/o

56-0

(7) LUD 400
5 19/2
0.952 W/O
0.10 3 W/O
5L-10

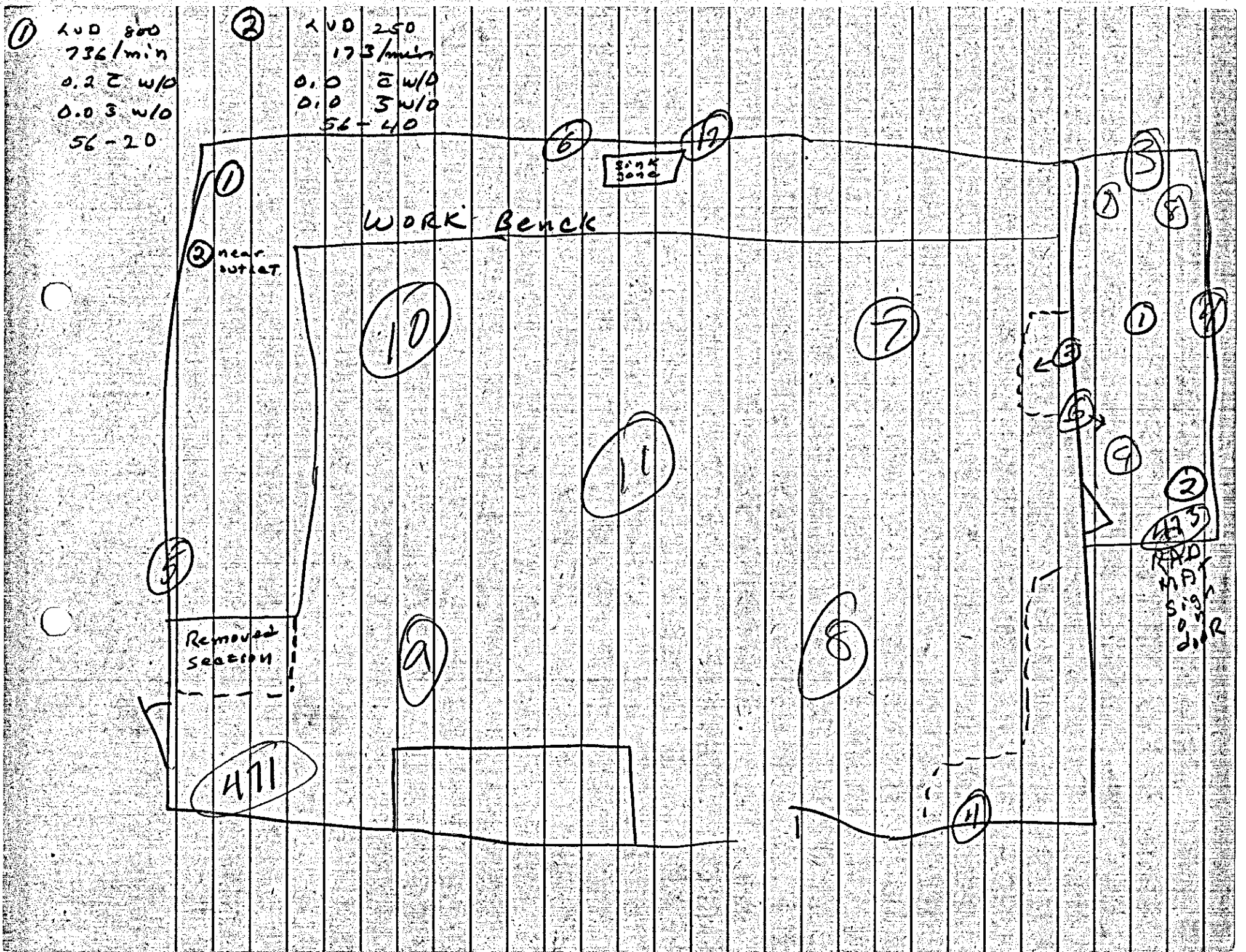




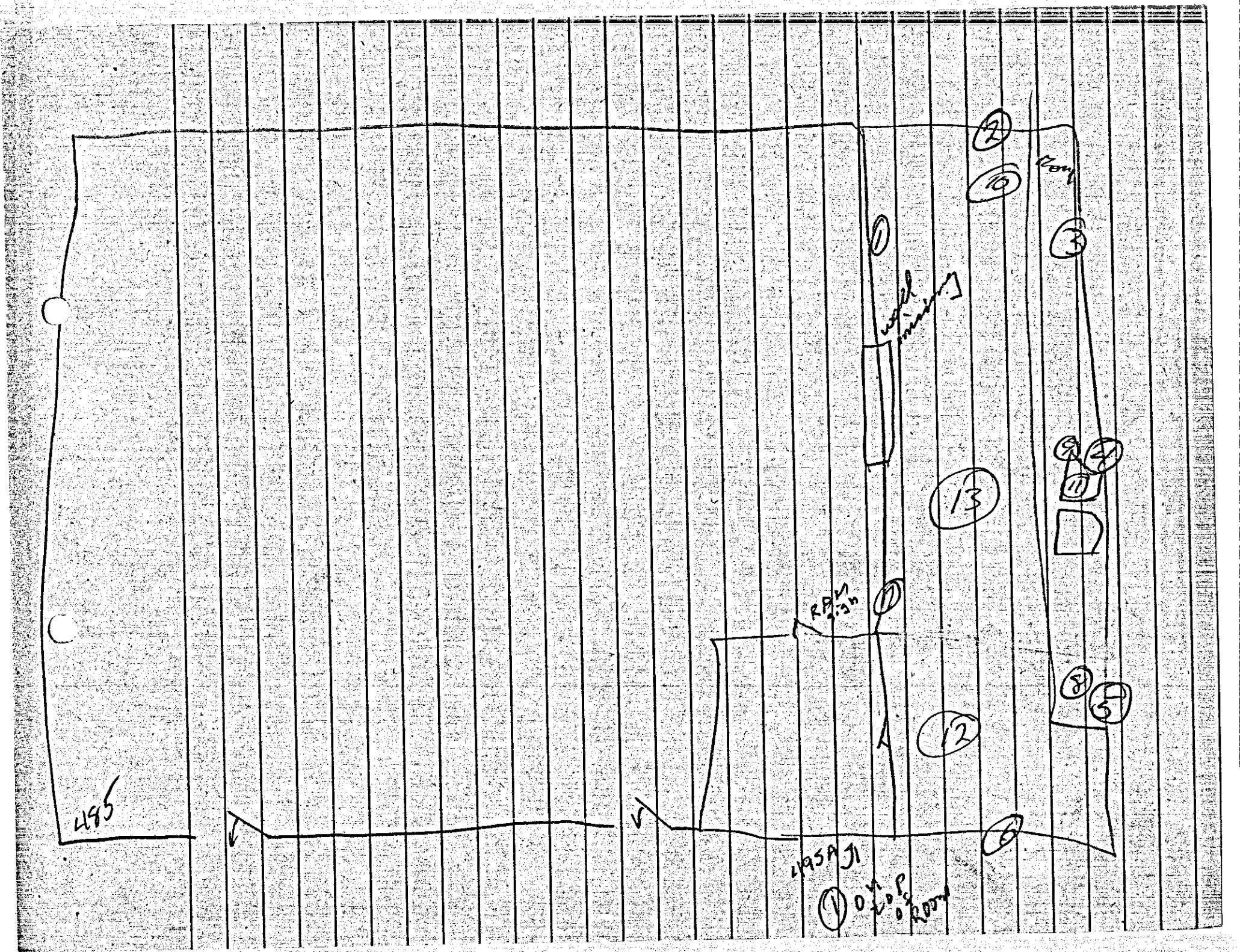
201
203
5
2
6
3
8
1
7

285

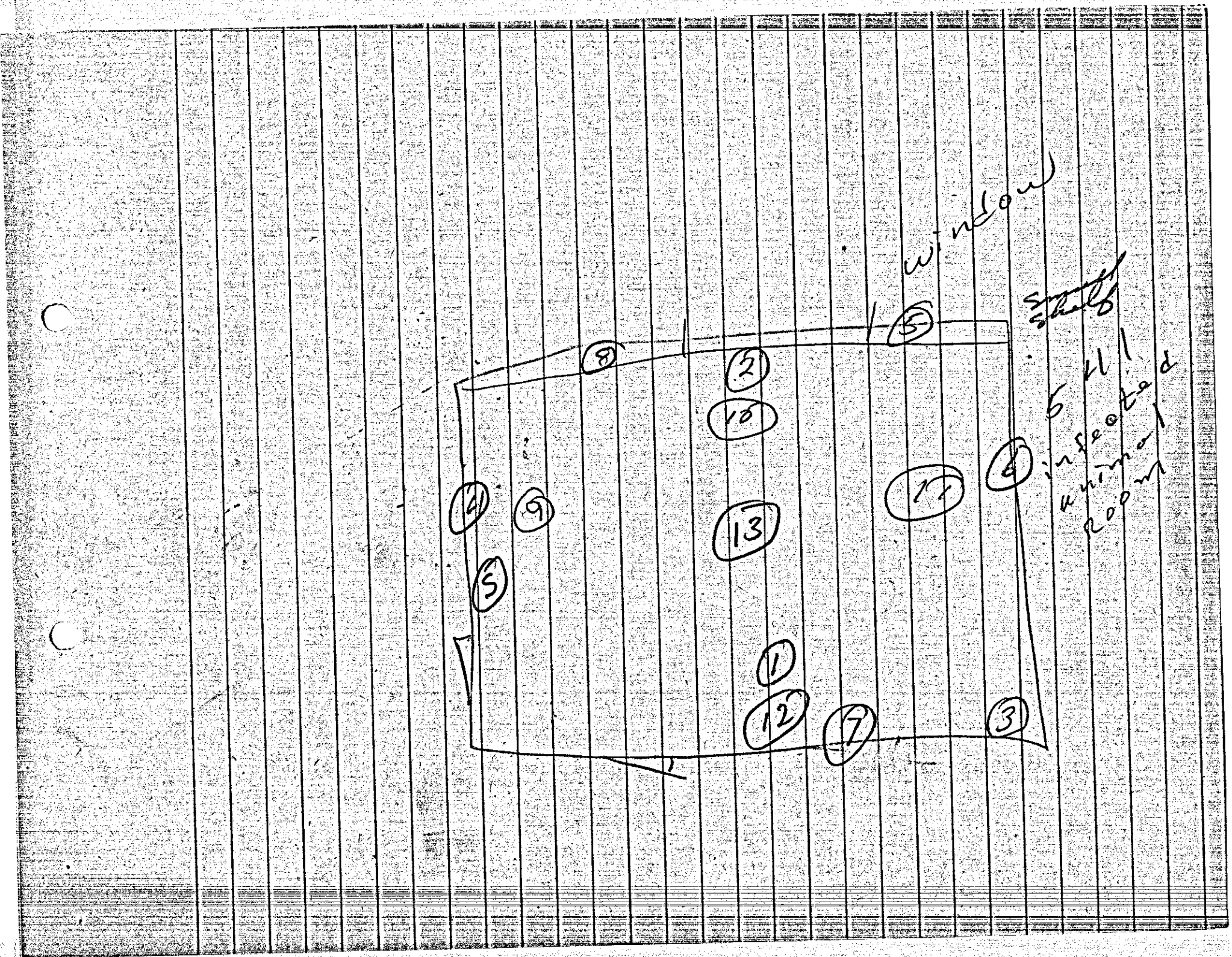
25,2
1
2
3
4
5
6
7
8
9
10
11



① LVD 800
736/min
0.2 c̄ w/o
0.0 3̄ w/o
56-20
② LVD 250
173/min
0.0 c̄ w/o
0.0 3̄ w/o
56-40
WORK Benck
sink gone
② near outlet
Removed section
471
473
RAD MAT sign on door



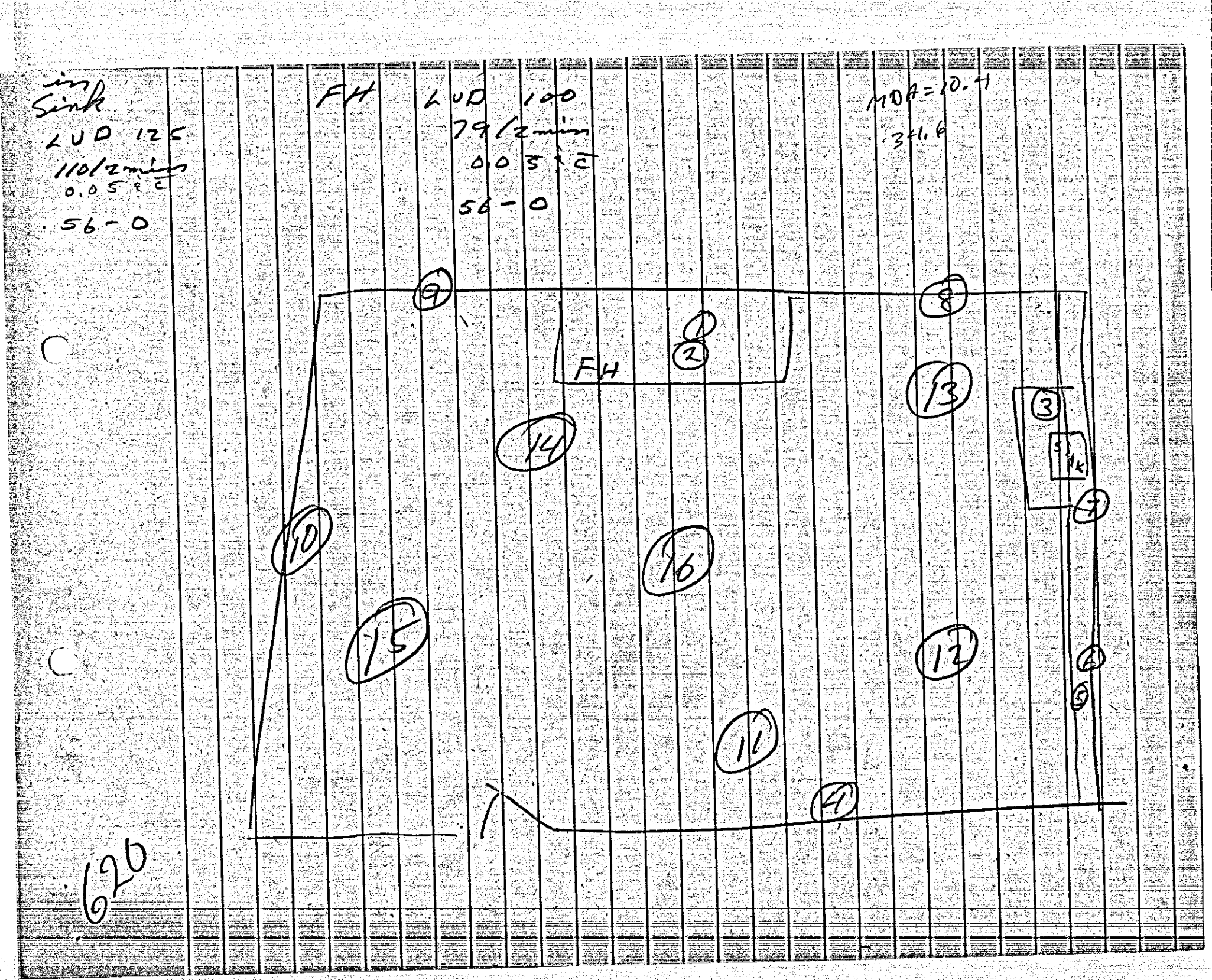
485
1
2
3
4
5
6
8
9
10
11
12
13
Room
well
RAM sign
495A
1 on top of Room


window
small shelf
5 ft
infected animal room
8
2
10
5
4
9
13
11
6
5
1
12
7
3

in Sink
LUD 125
110 l/2 mins
0.05 °C
56-0

FH LUD 100
79 l/2 mins
0.05 °C
56-0

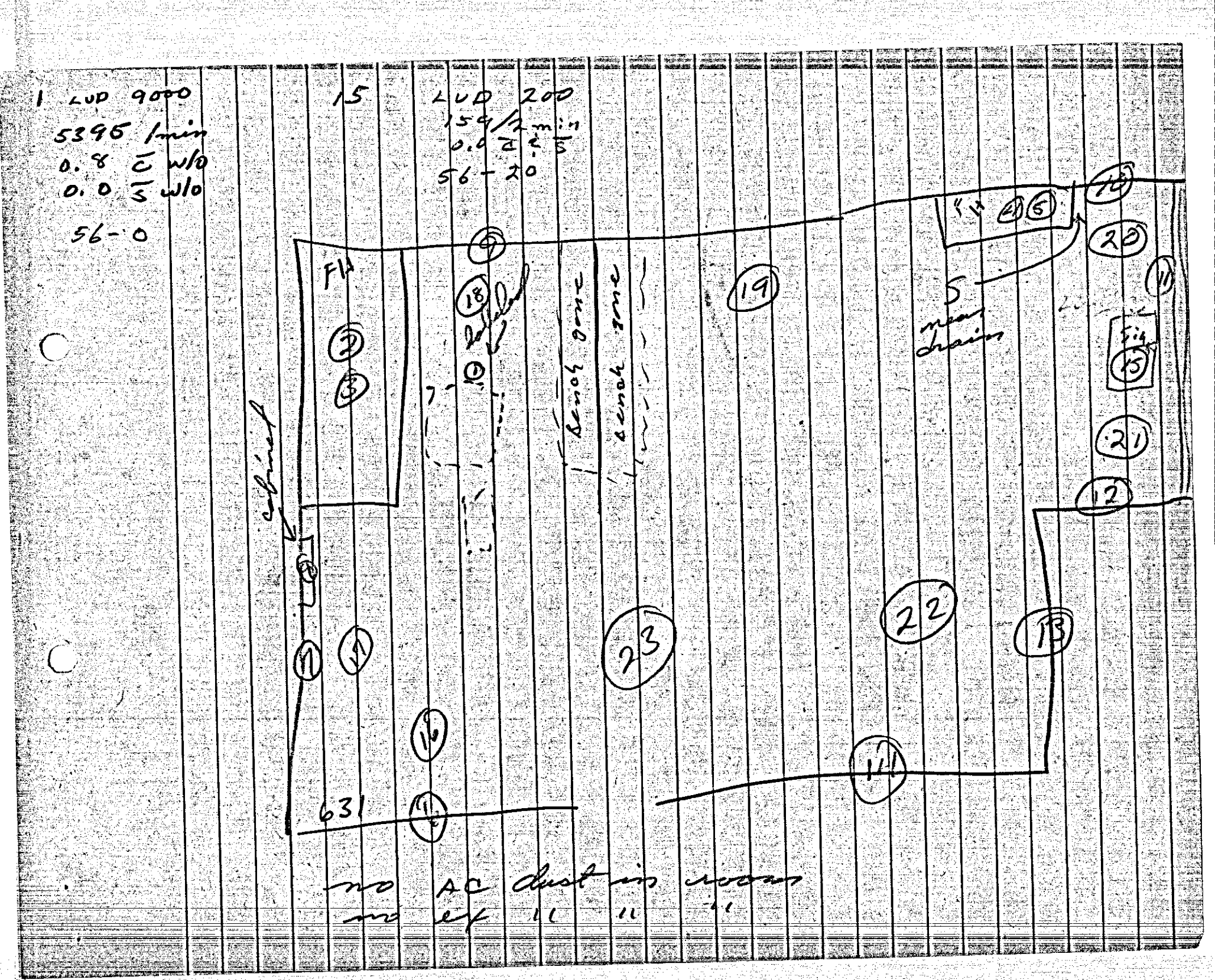
MDA = 10.4
341.6

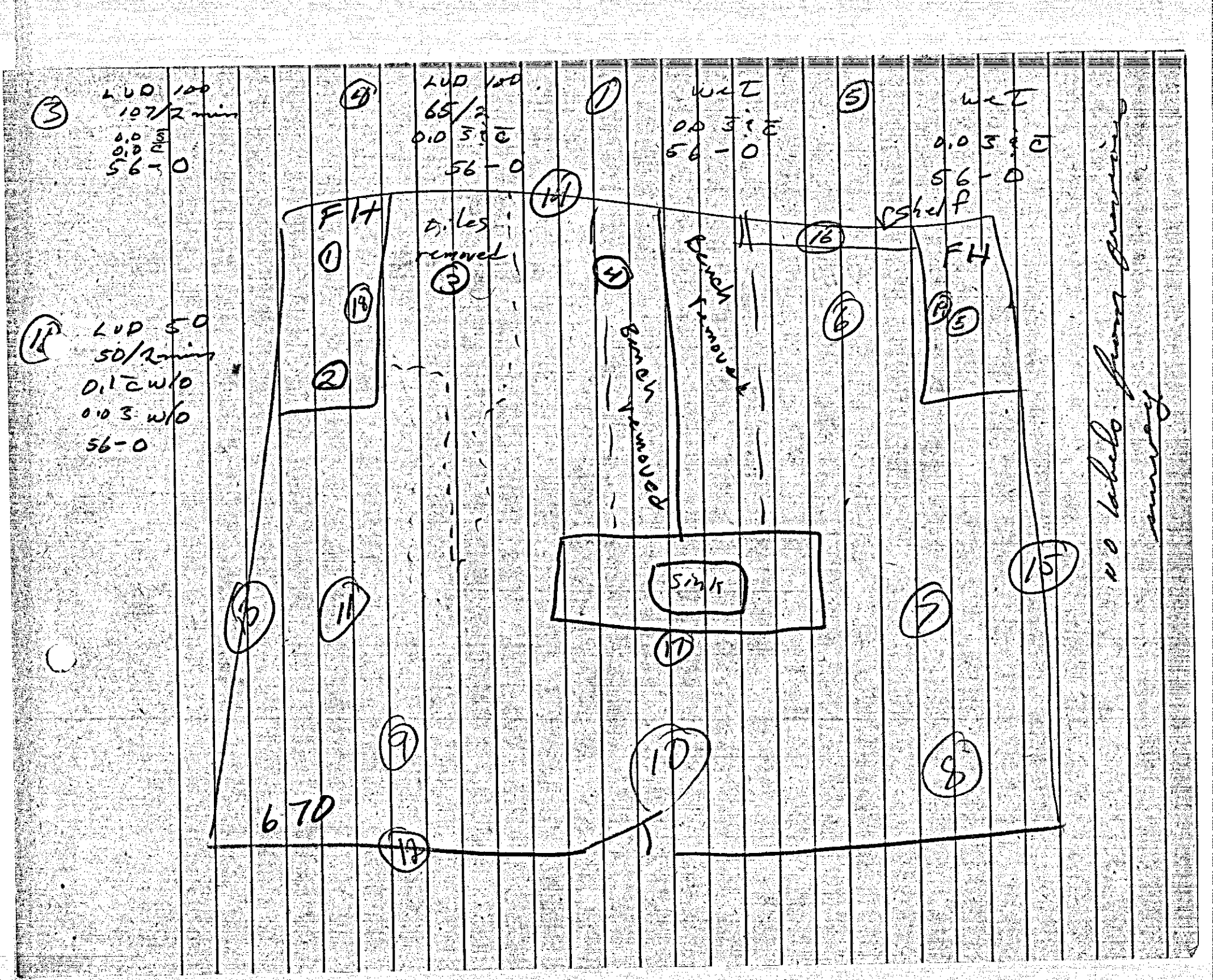


620

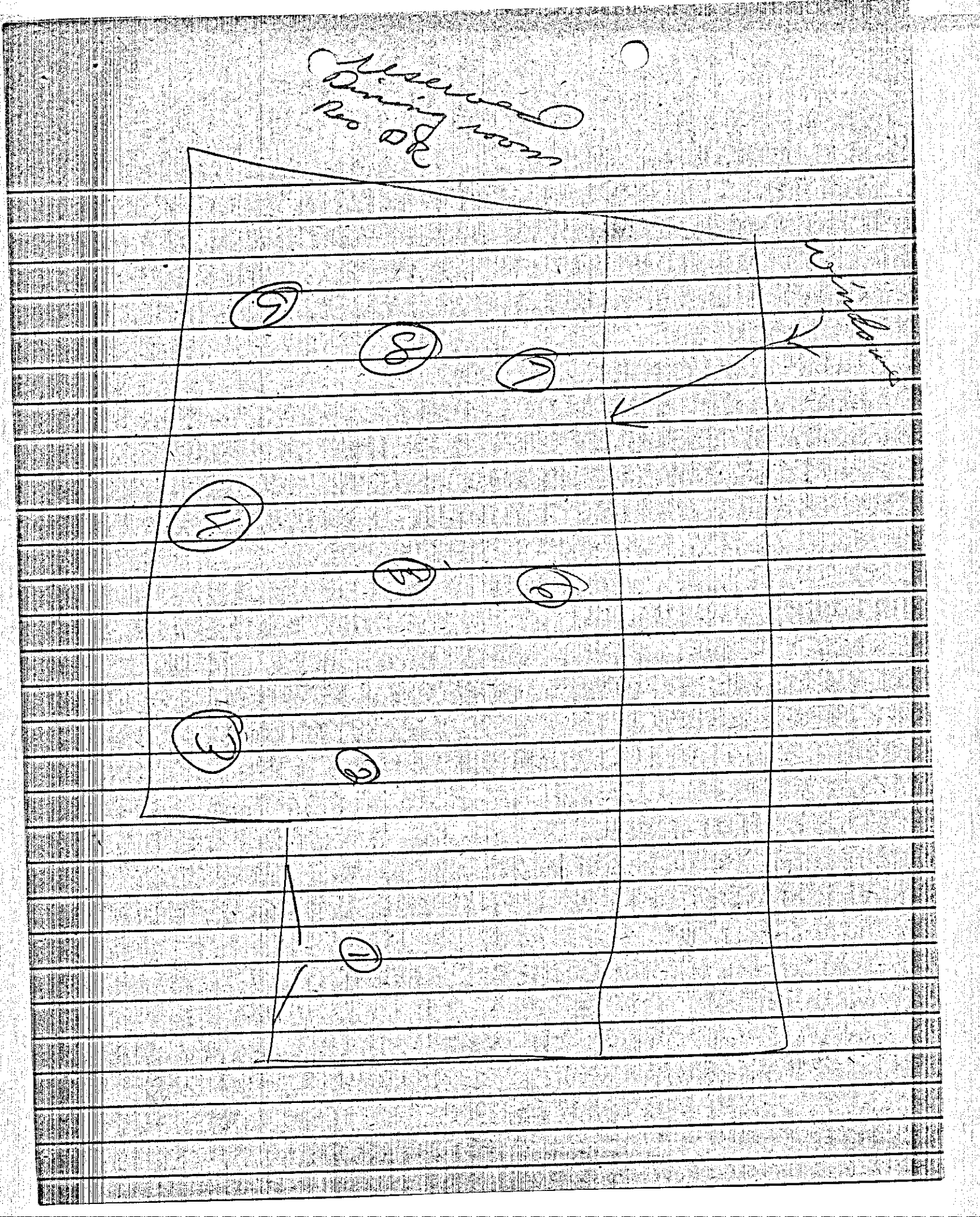
1 LUD 9000
5395 l/min
0.8 C w/o
0.0 S w/o
56-0

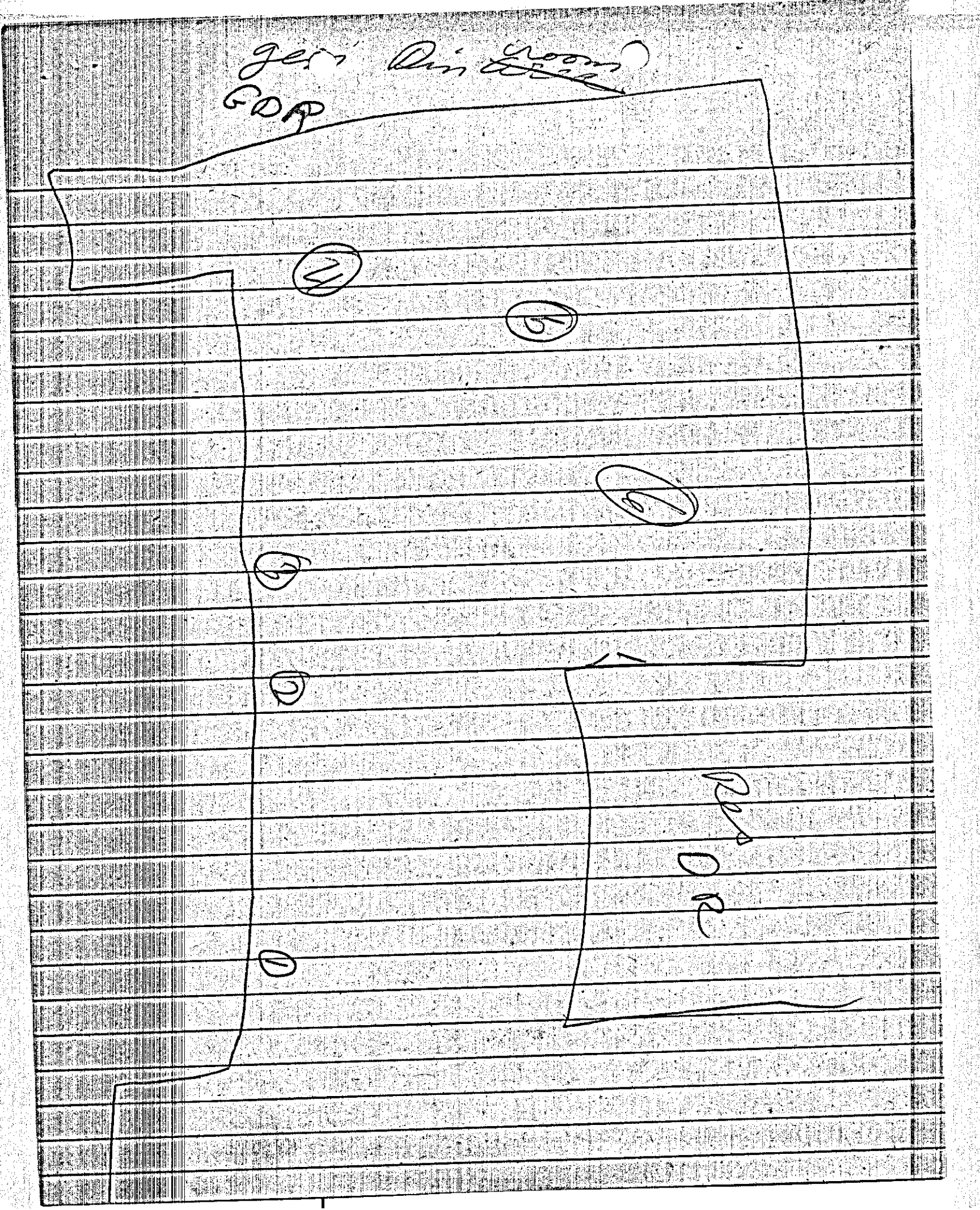
15 LUD 200
154 l/min
0.0 C w/o
56-20





3
LUD 100
107/2 min
0.0 S̄
0.0 C̄
56-0
4
LUD 100
65/2
0.0 S̄ & C̄
56-0
1
wet
0.0 S̄ & C̄
56-0
5
wet
0.0 S̄ & C̄
56-0
FH
1
2
18
Oiles removed
3
14
4
Bench removed
Bench removed
16
shelf
FH
6
19
5
15
sink
17
7
8
10
9
11
13
670
12
LUD 50
50/2 min
0.1 C̄ w/o
0.0 S̄ w/o
56-0
no labels from grouping


Reserved
Dining room
Rec Dr
Window
9
8
7
4
5
6
3
2
1


GDP
Red
DR

∝ BKG 0 RO-2 zeroed

L 2-12/10 BKG

#		LUD	RO-2	56
1	Entry to Bldg 815	59/2	0	0

Fred STYVENDER
Resident Pure Administrator
Robert Soares
Asst. Resident Pure Adm.

Only two navy.

only other in Sup Ship

Navy still own shipyard

MSA owns building - no administers
lease. Navy owns Bldg.

NRDL report on clearance of NRDL

1. GSA Ltr of 17MAY78. LFG survey report as attachment. Recommending bldg 815 be surveyed and decomned

Phone con Leo GANTZ (DOL) and CDR 'J' 29 JUL 78
Bldg 815. DOL wants bldg, NAVY may do a complete survey

Phone con CDR 'J' and Fred JONES (WESTDIV) 29 JUL 78
hunters point bldg 815 custody

LTR NAVELEX TO NNPU
NRC files for NRDL, See HMC JONES for files

LTR WESTDIV TO NNPU
Enclosures are ltrs on disestablishment of Hunters point

2. NNPU LTR TO NAVFAC
RASO Report #208 as enclosure

NNPU ltr to NAVFAC
RASO Addendum to report #208, contract docs for Decon of New Brunswick lab and survey methodology as
See HMC Jones for New Brunswick encl.

3. PhoneCON Neil Kinsinger and Roy Smith 19 Sep 78

Explain to Neil need for use history before estimating survey time.

Ltr NNPU to NAVSEA (code 07) 12 oct 78

Bldg 364 Cursory survey results

Phonecon Kinsinger to CDR Crane 26 oct 78

Press paper no longe of concern, Al Smith will be TemDu to SUPSHIP SFRAN, CDR Brannes at supships to be ACO for Smiths contracts with nscoakland.

Ltr NAVFAC to NAVSEA

approval of tech assist request at hunters point. NAVSEA ltr with request is attached

4. Ltr SUPSHIP to NAVSEA (07014) 11 DEC 78

Al's history of NRDL. See HMC JONES for extra copies

5. Ltr NAVSEA to NAVFAC 24 JAN 79

action concerning evaluation of Hunters Point facilities

Ltr NAVFAC to NNPU 7 MAR 79

re-surveying of hunters point.

Memo 40T to file 3256 9 MAR 79

Status of 364-815 and recommendations for completion

NAVCOMP 140 transfering funds to NNPU 12 APR 79

LTR SUPSHIPS to NAUSEA (07014) 27 APR 79

Status of monitoring and decon at NRDL

$6,600

Larry Brauch A/V 297-2232

NAVAL RESEARCH LABORATORY

RON LUERSON Technical P.O.C.

2-5 hrs/sample

$2000 Highest (#1) 1 wk counting time

Determine Separate activities

TOTAL 2 weeks

Transportation of Smears

Membrane

Cloth Filter 1K but no

BEST (1) Send 1000 vials w/ COCKTAIL TO NRL and load smears

(2) 1000 empty vials load on site

(3) Smears in envelope
cross contamination

No DATA W SHIPMENT

3/15/79

Naval Research Laboratory
RON LUERSON
A/V 297-2232

High estimate $2000

(1) BEST METHOD
NRL ship 1000 vials filled w/cocktail
Membrane filters installed in vial onsite
Shipped to NRL

SECOND BEST METHOD
GET 1000 vials
LOAD SWABS IN EMPTY VIAL
SHIP TO NRL

WORST METHOD
SWABS IN ENVELOPE
SHIP TO NRL

TABULAR REPORT AVAILABLE 2 WKS after
receipt of samples

SOME LEAD TIME INVOLVED IN PURCHASING SUPPLIES

3/15/79

Naval Research Laboratory

Ron Luerson

A/V 297-2232

High estimate - $2000

(1) Best method

NRL ship 1000 vials filled w/cocktail

Membrane filters installed in vial onsite

shipped to NRL

Second best method

Get 1000 vials

Load smear in empty vial

Ship to NRL

Worst method

Smears in envelope

Ship to NRL

Tabular report available 2 wks after receipt of samples

Some lead time involved in purchasing supplies

LESTER SLABACK OUT UNTIL 3/20

A/V 295-1285

WILLIAM ~~MORRIS~~ WEBER

~~[illegible]~~ LABORATORY HEALTH Physicist

2950482

WILLIAM WEBER ~~5083~~ 2950483

EST

COUNT IN 3 DAYS +1 day

RESULTS 7 DAYS AFTER RECEIPT 50 hrs of count time ~~300 min~~

2 min each

(1) NUMBER 1 method < $100 i.e. FREE ~~[illegible]~~

NNPU buys material

vials

cocktail

~~[illegible]~~ smears

loads on site

BUILDING 815 SURVEY METHODOLOGY
HIGH POTENTIAL ROOMS
BETA-GAMMA

-FLOORS-

--SCAN x $1m^2$ GRIDS x 1 MIN.
--RECORD GROSS CPM.
--COUNT HIGH SPOT x 1 MIN. & RECORD
--SMEAR ONLY IF ≥1000 DPM ON MAX OR AVE.

Suggested $2m^2$
why would different.

-WALLS-

--SCAN x $2m^2$ GRID x 1 MIN. TO HEIGHT OF $2m^2$ ONLY.

--RECORD GROSS CPM
-- COUNT HIGH SPOT x 1 MIN & RECORD
--SMEAR ONLY IF ≥1000 DPM ON MAX OR AVE.
--USE SAME RATIONALE FOR OTHER VERTICAL SURFACES.

-FUME HOODS, BENCH TOPS-

--SCAN x $1/2m^2$ GRID x 1 MIN.
--RECORD GROSS CPM.
--COUNT HIGH SPOT x 1 MIN. & RECORD.
--SMEAR ONLY IF ≥1000 DPM ON MAX OR AVE.

-CEILINGS-

--NO ACTION REQUIRED.

-FUME HOOD & ROOM EXHAUST DUCTS-

why not reading -
How about air sources.

1 SMEAR/DUCT - AS FAR IN AS REACH PERMITS (AT A ACCUMULATION PT IF FOUND).

-ROOF EXHAUST FANS-

--1 SMEAR ON EXHAUST HOUSING OUTLET.

-SINKS-

--SCAN AS FLOOR.
--SMEAR DRAIN ONLY IF ≥1000 DPM.

-INTERIOR DRAWER SURFACES-

--METHODOLOGY - SAME AS FLOORS - CONTINUOUS SCAN OF A NUMBER OF DRAWERS REQUIRED TO MAKE $1m^2$.

-INTERIOR CABINET SURFACES-

--METHODOLOGY - SAME AS FLOORS - TREAT EACH CABINET AS A UNIT SURFACE.

****

SR-90

--DETERMINATION BY ANALYZING SMEARS TAKEN AT HOT SPOTS ≥ 1000 DPM.

--IF REMOVABLE > 200 DPM, SPOT WILL BE DECONED AND RE-SMEARED.

Count smears there as less time consuming.

****

INSTRUMENT FOR BETA-GAMMA SURVEY IS E140 WITH DT 304 AND A SCALER.

****

****

ALPHA

--SCAN GRIDS AS IN BETA-GAMMA USING AN/PDR-56 AND EARPHONES.
--LOCATIONS WHERE ALPHA DETECTED, TAKE 1 MIN READING WITH SCALER.

--SMEAR AS IN BETA-GAMMA.

How about Transuranics,

****

ALL SMEARS TO BE COUNTED AT NNPU. (Same)

****

Colbert 488-5560 ask for Donna

MDA
for Beta-Gamma
1 min Background = B (cpm)

at 95% confidence level (one tail)

$$\left(1.645\sqrt{2 \times B}\right)$$

this is net CPM (MDA)

To convert net cpm to DPM/100cm²

$$\frac{\text{Net CPM}}{\text{detector efficiency}} = \text{net DPM}$$

$$\frac{\text{net DPM}}{\text{Detector area (in cm}^2\text{)}} \times 100 = \frac{\text{net DPM}}{100\text{cm}^2}$$

Be sure to duplicate geometry

CDR KENZETH FAC 11N 182

BUILDING 815 SURVEY METHODOLOGY
LOW POTENTIAL AREAS

(Includes all areas except 1st, 2nd, 4th and 6th floor high potential areas)

Low Potential 1st, 2nd, 3rd, 4th, 5th, 6th and 7th floors

FLOORS

- - Estimate number of 1 m^2 grids which constitute 10% of floor.

- - Locate required 1 m^2 grids at locations most likely to be contaminated should contamination exist, i.e., near sinks, work benches, fume hoods, floor drains and for hallways near room entrances.

- - Scan grids with E140/DT304 using ear phones. If scan indicates generally background record as such. If grid scan indicates detectable take grid scan with scaler (one minute count), take one minute count at high spot in grid, complete alpha scan and one minute count where detected.

- - If any one minute count indicates gamma greater than 1000 dpm/100 cm^2 beta-gamma or 100 dpm/100 cm^2 alpha then survey entire room as high potential area.

WALLS

- - Estimate number of 2 m^2 grids which constitute 10% of wall area.

- - Locate required 2 m^2 grids at locations most likely to be contaminated should contamination exist, i.e., rear sinks, fume hoods, work benches.

- - Continue as with floors.

FOR RENZETTI FAC 11N 2082

FUME HOODS, BENCH TOPS, MOVEABLE EQUIPMENT

- - Scan with E140/DT304 using ear phones. If scan indicates generally background record as such. If scan indicates detectable survey as in beta-gamma and alpha high potential record results.

- - If any survey point indicates greater than 1000 dpm/100 cm^2 beta-gamma or 100 dpm/100 cm^2 alpha then survey entire room as high potential area.

For 41 rooms on fifth floor noted as C^{14} and H^3 use areas inaddition to above complete following:

FLOORS

- - Take one smear for each 1 m^2 grid. Record smear and location.

WALLS

- - Take one smear for 2 m^2 grid. Record smear location.

FUME HOODS, BENCH TOPS, CABINETS

(Including Interior Surfaces)

- - Take one smear per surface or 1 m^2 grid (lesser of the two). Record smear location.

All smears to be analyzed by NRL for C^{14} and H^3.

- See if more detailed survey data available at GSA or can be obtained by GSA.

Sufficient
Background R02
304 smear & fixed
56 smear & fixed

Look with R02 for hotspots.

Room 1109
Look with R02 for hot spots.
Take sufficient smears.

Air conditioning
Take several rooms.
Remove vent covers.
Take volume samples.
Take smears.
If possible take 304 & 56 at 1cm from surface.
Take volume from floor underneath.
Take smear from floor underneath.

Room 2153 Fume Hood Ducting
Take Smears
Take DT 304 + 56 readings @ 1 cm
Survey room for Hot spots.

make rapid check of fume Hoods in other rooms to see if access can be gained to the ducting system for survey purposes.

Other Areas

General Survey of Rooms 135, 218, 471, 631 + 670. Take smears of any hot spots.

Verify contamination of items listed in para 4. Make β/γ readings @ 1 cm and take smears of all hot spots.

RESULTS OF RADIOLOGIC SURVEY AT BUILDING 815, HUNTERS POINT

INTRODUCTION

This is to inform you of the results of the radiological survey conducted by LFE Environmental Analysis Laboratories at the main laboratory building, Building 815, Hunters Point Naval Shipyard. The survey was conducted from April 18, through April 21, 1978, by Michael Trent, Health Physicist and Radiation Safety Officer, and Gerry Gella, Technician, escorted by Mr. Styvendor of the Navy.

METHOD

A brief room-by-room survey was conducted using Technical Associates PUG-1 survey meters with P-11 Geiger-Mueller probes. This combination was primarily used to determine the location of beta-gamma radiation sources and as a qualitative indication of any elevation in the natural background. In addition, an Eberline PAC-ISAGA, with an alpha scintillation probe, was employed in the measurement of any suspected sources of alpha radiation.

Wipe tests were made at 76 locations in the building and returned to our Richmond, CA laboratory for analysis. The wipes were divided into those of known areas of contamination, as located by the survey meters, and those made as background checks. The techniques and prescribed values of surface contamination employed were those set forth in International Atomic Energy Agency, Technical Reports Series No. 120, "Monitoring of Radioactive Contamination on Surfaces" (1970).

RESULTS

The results of this cursory radiologic survey are unremarkable with the exceptions listed below. These exceptions were more extensively examined to result in some information on the amount of contamination, the isotopes present, whether fixed or removable, and to determine whether additional corrective action should be recommended.

1. ROOM 1109

This room, used as a storage area, showed hot spots of beta-gamma. Contamination ranging up to approximately 20,000 cpm/20 cm^2 was observed. Taking into account the most probable isotope, ^{137}Cs, as determined by a gamma spectrometer

count of a wipe test, and the efficiency of the PUG instrument for this isotope (approximately 50%), and the surface area of the probe (20 cm^2), an approximate value of 1350 pCi/cm^2 was derived. A total of eleven wipe tests were taken in this room. The highest, assuming a removal factor of 10%, and a detector efficiency of 30%, indicated approximately 135 pCi/cm^2 of removable beta activity. This is approximately 30 times the prescribed limit for removable beta contamination in an uncontrolled area.

Removable alpha activity was approximately 5 to 10 times the prescribed limit. Because of the activity levels found and the history of the room, it received the most attention during the survey.

2. CONDITIONED AIR DUCTING

The second problem concerns the heating and air conditioning ducting. In many rooms (both offices and laboratories), a fine powdery material appears to have fallen from the ceiling air conditioning and heating intakes onto the floor. A total of 16 samples were taken of this material in various rooms throughout the building. The material was counted for gross alpha and gross beta-gamma at the laboratory. Gross beta-gamma values as high as 300 pCi/g were measured. A gamma spectrometer count showed that the activity was due to ^{137}Cs.

Because of the nature of alpha radiation, only a qualitative estimate of alpha contamination was obtained using the wipe test method. Most of the samples gave low but positive alpha readings.

3. ROOM 2153 HOOD DUCTING

The interior of the ducting showed hot spots of approximately 90 pCi/cm^2 of beta-gamma activity. The ducting appears to be associated with filtration of the laboratory fume hoods. The fume hood ducting is still in place throughout the building, but was only easily accessible at this point.

4. OTHER CONTAMINATION

The following additional areas of contamination were observed:

a. The top surface of a desk stored in room 135 has approximately 90 pCi/cm^2 beta-gamma activity.

b. A sink in room 218 has approximately 45 pCi/cm^2 beta-gamma activity.

c. A bench in room 471 has approximately 90 pCi/cm^2 beta-gamma activity.

d. The floor in room 631 has a hot spot of approximately 2700 pCi/cm^2 beta-gamma activity of which approximately 70 pCi/cm^2 was removable.

e. The fume hood in room 670 has spots of activity ranging up to 45 pCi/cm^2.

CONCLUSIONS

The following conclusions are based on the results of this cursory survey:

1. More extensive decontamination is required in room 1109. The presence of removable contamination is not acceptable. At a minimum, all floor tiles should be replaced, contaminated areas of the bench removed and the cave floor covered.

2. The ducting discussed above under Item 2, appears to be seriously contaminated with ^{137}Cs activity. This activity appeared in several rooms and therefore appears a systematic source of existing and continuing contamination. Since this ducting is, in general, not open for thorough detailed examination, the extent of this problem cannot be delineated at this time. This ducting should be further examined and if necessary, cleaned and/or replaced.

3. The fume hood ducting is largely intact and thus was not open for a thorough radiologic evaluation. In a few rooms, the hoods had been removed and the open ducting was available for examination. The interior of the ducting was slightly above room background as were wipe tests taken from the ducting. The activity found inside the ducting in room 2153 indicates that some activity remains. Unless the fume hoods are to be used in the future, or a more thorough survey indicates that the system is clean, the ducting should be sealed off or removed.

4. Hot spots as described above under Item 4, should be corrected as follows:

a. The parts of the desk in room 135 that are contaminated should be removed to hot waste and the desk discarded.

b. The sink in room 218 should be decontaminated or removed.

c. Areas of the bench in room 471 should be decontaminated or discarded.

d. Contaminated tiles in room 631 should be removed to hot waste.

e. The fume hood in room 670 should be decontaminated or the activity fixed in place by painting and its location noted.

Because of time limitations, undoubtably some other minor areas of contamination were overlooked in this cursory survey. If available, records of the decontamination work performed in the building should be reviewed to assertain if the work included a detailed analysis and survey of both the air conditioning ducting and the fume hood systems.

1. 714-523-8560	San Diego home
2. 415-591-9981	Del Mar Mother in law

Data Display

Area Remov B/~~G~~ Rem α Fixed β γ
Fixed α. (2 times ESE &
RASO.

Recommendations.

Use of isotopes be restructured.
Random α survey / detailed in
rooms exceeding limits.

vents / fan blades of air
handler in all rooms where
isotopes were used.

NAVSEA / NNPU review /

Independent firm. / NNPU assist
on necessary equip

Removal Factor - included in limits for RASO Data.

Discussion

Description of Bld. J

1. Use of Bld / Who used it / Materials included R

2. Release - Survey / Decon / AEC R
Survey + Verification / Release

J 3. Current Building status + Custody (West Div)

J 4. Potential use of Bld by DOL and What use is. (Maritime Academy - approx 300 Students / Phone W/GSA.

R 5. Study by ~~ESE~~ LFE - Cursurey - Hot Spots.

6. As requested by CNO RASO rechecked to verify

R LFE ~~ESE~~ Data. Survey conducted during Period — — July 77

J 7. Points of Contact

J 8. Survey Techniques + Equip.

R 9. NAVY Response for survey + Decon.

Findings

1 Include known uses and isotopes per ~~our~~ avail Records.

2. ~~T~~ Impossible to determine thruout life of bldg all uses + isotopes.

R 3. ~~D~~ Limits for unrestricted - AEC
" " " - Navy
" " Draft Reg. Guide + Draft ANSI

Albert L. Smith, Alt Chairman RSC
Head, Health Physics Div - Feb 62 -
Disestablishment. HP Div, NRDL Jul 56 - Feb 62

temporarily
Rad waste stored overnight in room
or over weekend in room 195.

Rad waste Storage (Bld. 707) Area

Each floor has own air intake +
exaust system. Air is drawn in
at each floor level + then exausted
to the roof thru seperate ducts.
Exaust air is filtered in only those
spaces having hoods.

Head, Radiological Safety Br, HPD,
NRDL Jul 56 - Feb 62
HP, NRDL Oct 51 - July 56

Filbert T. Fong (SNAP-21)
Assoc. HP - NRDL 1959-63 30,000 ci Sr-90
HP, NRDL - 1963 - 1966
Sr. HP NRDL - 1966 - Disestablishment

Cdr M.M. Edwards, Jr
O i C
NRDL Disestablishment Gp.
(1-15-70)

Tochilin

1959 - Aug 69 — Head Radiological Physics Br, NRDL

1947 — 1959 Rad. Phy, Missions Div, NRDL

Certified — HP and Radiological Physicist - 52

Building 815 Monitoring Plan

I have noted that the "SCAD" method of monitoring for beta contamination is effective in locating "hot" spots and in assuring that the clearance guidelines for radionuclides (beta-gamma emitters) other than Sr-90 are met. Scanning a surface with the DT-304 probe held about ¼" from the surface, moving slowly and using the speaker, the trained monitor can detect levels in excess of 2000 d/m/100 cm². In practice I have scanned areas of 1 m² to determine hot spots and used the NOL scaler to determine the magnitude of the hot spots. To determine the average contamination level, the scaler is set for a 1-minute count and the 1 m² area is scanned at a rate to obtain complete coverage in 1 minute.

The following plan is proposed:

A. High potential contamination areas (laboratories, isotope storage, hood exhaust plenum):

Floors, hoods, sinks, exhaust ducts:

Preliminary beta and alpha scan all surfaces — to locate hot spots and determine general contamination level in room — approx. 1 hour for one room.

One minute count (beta and alpha) at corners of one meter grid. One count in hood exhaust and in room exhaust duct. One minute counts on ½ meter grid in hood interiors. ~~Take~~ Wipe samples in room—

five on floor, two on bench tops, 1 in sink
two in hood, 1 ea in hood and room exhaust ducts
3 on walls and wall ledges.

Walls and ceilings —

Preliminary scan followed by 5 1-min counts each wall and ceiling, 1 count in center and remaining 4 to be ½ way between center and corners.

B. Low potential contamination areas (hallways, offices, shop areas, air supply rooms, cafeteria, auditorium, escalators, elevators, etc)

Cursory scan survey (15 minutes per room)

5 random 1-min beta-alpha counts, 1 wipe per 100 sq. ft. of floor area.

Beta absorber counts

Bldg 364 Hot Cell Wall Contamination

Absorber mg/cm²	c/10 min (gross)	c/m
BKG	292	29.2
0	1105	
6.45	975	
12.9	889	
25.8	720	
38.7	672	
63.8	490	
116.1	460	
337.5	251	
110.7	402	
221.4	255	

Bldg 364 Hot Cell Floor spot under grating

Absorber mg/cm²	c/m (all 1-min counts)
0	9803
6.45	8303
12.9	7328
25.8	5842
38.7	4662
51.6	3602
77.4	2341
110.7	1406
221.4	410
332.1	288
442.8	314

Bldg 815, Room 1109 NE Corner floor contamination

Absorber mg/cm²	c/m
0	4615 (1-min count)
6.45	3981 "
12.9	3800 "
25.8	2661 "
51.6	1503 "
77.4	892 "
110.7	586 "
162.3	268 "
221.4	114.5 (2 m count)
293	73.1 (10 m count)
332.1	67.6 "
442.8	69.8 "

3/20 Call Larry Brouch
767-2282
AV 297-2282
RON LUERSON / NRL

Materials Purchases in motion

Shipping dept thinks material may be shipped air cargo in two shipments

Polyethylene vials

NRL will numbers caps of vials
1-3000

Will use polyethylene vials for ~~convenience~~ since air shipment will present too much diffusion

Code 6070
Naval Research Laboratory
4555 Overlook Ave SW
Washington D.C. 20375

NRL – Can they handle 3,000 Smears?

^{3}H, ^{14}C, + Any & above ^{14}C

3,000 smears @ $2 ea = $6,000

Funds would be transferred from NAVSEA to NRL + Direct.

Sequential Gummed Labels

1 – 3000.

DEBRIEF CH JONES 4/2/79

41 ROOMS ON 5TH FLOOR
HAVE SOLAR PAPER
DON'T HAVE BOTTLES - ON THEIR WAY

ALL GRIDDED & SURVEYED.
EST. COMPLETION BY 13 APR.

COMPLETE SOLAR READINGS THIS WEEK OR
DURING NEXT WEEK.

MID-MAY RESULTS FROM NRL ON 41 ROOMS

20 APRIL - GOOD ESTIMATE ON DECON.

3 WKS FOR NAVSEA TO MOBILIZE
FOR DECON EFFORT. WILL HAVE
ADDITIVE ITEMS (PROBABLY) FROM NRL
RESULTS.

ROUGH ESTIMATE:
10 MEN (+2 HPs) 2-3 WEEKS

UNKNOWNS:
CERAMIC TILES ON WALLS & RED BRICK
ON FLOORS OF ANNAPOLIS ROOMS / LAUNDRY
HIGH COUNTS EVERYWHERE

Fume hoods	13
Sinks	15
Floor	31
Wall	5
Nozzle	1
Faucets	1
counter top	11
Exhaust Grill	1
filter housing	1
Exhaust duct	1

Areas above action level that may require decontamination

ROOM	LOCATION	dCPM
126	FH LRQ	377
126	FH URQ	112
126	FH base rt.	436
182	Sink	72
195	Floor grid #4 LRQ	11,022
195	Floor grid #10 LLQ	2,809
195	Floor grid #17 LLQ	948
195	Floor grid #28 URQ	948
195	Floor grid #9 general area	86
176/180	Floor grid #10	69,092
176/180	FH #2 back plate LRQ	1,029

218	Floor grid #19 URQ	692
218	Sink Counter, east	3,665
218	Floor grid #4, general area	1,521
218	FH #1 Nozzle on left wall	510
218	FH #1 Base, left	369
218	FH #1 Base, right	142
218	FH #1 window, inner left	2,090
218	FH #1 Base, right	140 ∝
218	FH #1 light fixture cover	40 ∝
218	FH #1 light fixture cover	25 ∝
2153	Floor outside door to hot side of filter housing	82 general area hot
2153	Filter housing before HEPA filter bank	
470	Floor grid #50	1,481
470	Floor grid #66	24,025
540	sink	80
540	Floor grid #3	370
540	Floor grid #5	258
540	Floor grid #13	238
540	Floor grid #14	172
540	Floor grid #29	122
540	Floor grid #10	72
540	FH URQ	334
540	FH LRQ	554
530	FH inside window left	382

549	FH Base, right	158
549	sink	95
		388
566	FH Base, right	532
566	FH Base, left	
		73
534	sink	
		127
681	sink	
		6,761
671	Floor grid # 8 LRQ	541
671	Floor grid # 12 ULQ	363
671	Exhaust grill, east	
		27,133
667	Partition, east side, grid # 1 URQ	548
667	Partition, west side, Vacum nozzle	338
667	Floor grid # 3 URQ	1,251
667	Floor grid # 9 LLQ	11,255
667	Floor grid # 29 center	
		~1041
665	Floor grid # 7 ULQ	723
665	Floor grid # 11 ULQ	18,967
665	Floor grid # 17 URQ	
		105 ∝
621	East wall, grid #1, ledge	50 ∝
621	East wall, grid #6 ledge	
		90
631	Sink	

658	FH #1 Base, LL	271
658	FH #2 Back, LLQ	2,075
658	FH #2 Base, RL	464
658	FH #2 Base, LL	162
658	Floor grid # 2	4,065
658	Floor grid # 10	9,177
658	Floor grid # 16	287
682	FH #2 Back LLQ	112 ∝
682	FH #2 Back URQ	27 ∝
682	FH #1	General ∝ all over
682	sink	78
682	sink faucets	30 ∝
666	sink	93
680	counter top	4 ∝
670	sink	95
670	sink, general area	87
670	FH #2 Back URQ	~854
670	FH #2 Back, URQ	15 ∝
672	sink	103
623	sink	89
622	sink	78

634	Sink	91
624	Sink	89
627	Floor grid # 4 URQ	533
627	Floor grid # 4 LRQ	480
627	Floor grid # 30 LLQ	1,389
627	Sink	88
627	Partition, east middle left	12,454
627	North wall, grid #5 LRQ	668
685	FH #1 exhaust duct above filter	416 ∝
679	Floor grid #19 LLQ	232

1109

1124-4041 cpm in ex duct. Not removable

613 cpm crane bridge

772 cpm floor general area

231 cpm cabinet door louver

83-414 cpm metal counter top

677 cpm SS sink

4092 cpm vault shelves

23,076 Vault concrete deck

6651 vault concret wall

130,697 Floor tile hot spot

wall O.K.

Areas above action level that may require decontamination

ROOM	LOCATION	GCPM
126	FH LRQ	377
126	FH URQ	112
126	FH base rt.	~136
182	Sink	72
195	Floor grid #1 LRQ	11,022
195	Floor grid #10 LLQ	2,809
195	Floor grid #17 LLQ	948
195	Floor grid #28 URQ	948
195	Floor grid #9 general area	86
176/180	Floor grid #10	69,092
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218	FH #1 Nozzle on left wall	510
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218	FH #1 Base, right	142
218	FH #1 window, inner left	2,090
218	FH #1 Base, right	410 ∝
218	FH #1 light fixture cover	410 ∝
218	FH #1 light fixture cover	25 ∝
2153	Floor outside door to hot side of filter housing	82
2153	Filter housing before HEPA filter bank	general area hot
470	Floor grid #50	1,481
470	Floor grid #66	24,025
5410	sink	80
5410	Floor grid #3	370
5410	Floor grid #5	258
5410	Floor grid #13	238
5410	Floor grid #14	172
5410	Floor grid #29	122
5410	Floor grid #10	72
5410	FH URQ	334
5410	FH LRQ	554
5430	FH inside window left	382

549	FH Base, right	158
549	Sink	95
566	FH Base, right	388
566	FH Base, left	532
534	Sink	73
681	Sink	127
671	Floor grid # 8 LRQ	6,761
671	Floor grid # 12 ULQ	541
671	Exhaust grill, east	363
667	Partition, east side, grid #1 URQ	27,133
667	Partition, west side, Vacum nozzle	545
667	Floor grid #3 URQ	338
667	Floor grid #9 LLQ	1,251
667	Floor grid #29 center	21,255
665	Floor grid #7 ULQ	~10-1
665	Floor grid #11 ULQ	723
665	Floor grid #17 URQ	18,967
621	East wall, grid #1 ledge	105 ∝
621	East wall, grid #6 ledge	50 ∝
631	Sink	90

658	FH #1 Base, LL	271
658	FH #2 Back, LLQ	2,075
658	FH #2 Base, RL	464
658	FH #2 Base, LL	162
658	Floor grid # 2	4,065
658	Floor grid # 10	9,177
658	Floor grid # 46	287
682	FH #2 Back LLQ	112 ∝
682	FH #2 Back URQ	27 ∝
682	FH #1	General ∝ all over
682	Sink	78
682	Sink faucets	30 ∝
666	Sink	93
680	counter top	4 ∝
670	Sink	95
670	Sink, general area	87
670	FH #2 Back URQ	854
670	FH #2 Back URQ	15 ∝
672	Sink	103
623	Sink	89
622	Sink	78

634	Sink	91	
624	Sink	89	
627	Floor grid # 41 URQ	533	
627	Floor grid # 4 LRQ	480	
627	Floor grid # 30 LLQ	1,389	
627	Sink	88	
627	Partition, east middle left	12,454	
627	North wall, grid #5 LRQ	668	
685	FH #1 exhaust duct above filter	416 ∝	
679	Floor grid #19 LLQ	232	

16. The licensee shall process and use byproduct material in accordance with the procedures represented in the application dated May 26, 1958, and as amended by:

A. Letter dated May 23, 1958 from the U.S. Naval Radiological Defense Laboratory, San Francisco 24, California to USAEC with attached abstracts entitled "Development of Reclamation Procedures for Land Targets" and "Radiological Safety Measures for Land Target Reclamation Study."

B. Letter dated July 1, 1958 from the Department of the Navy, Bureau of Ships, Washington 25, D.C. to USAEC.

C. Letter dated July 22, 1958 from the Department of the Navy, Bureau of Medicine and Surgery, Washington 25, D.C. to USAEC with attached BuMed ltr-Serial 5123 with 1st and 2nd endorsements.

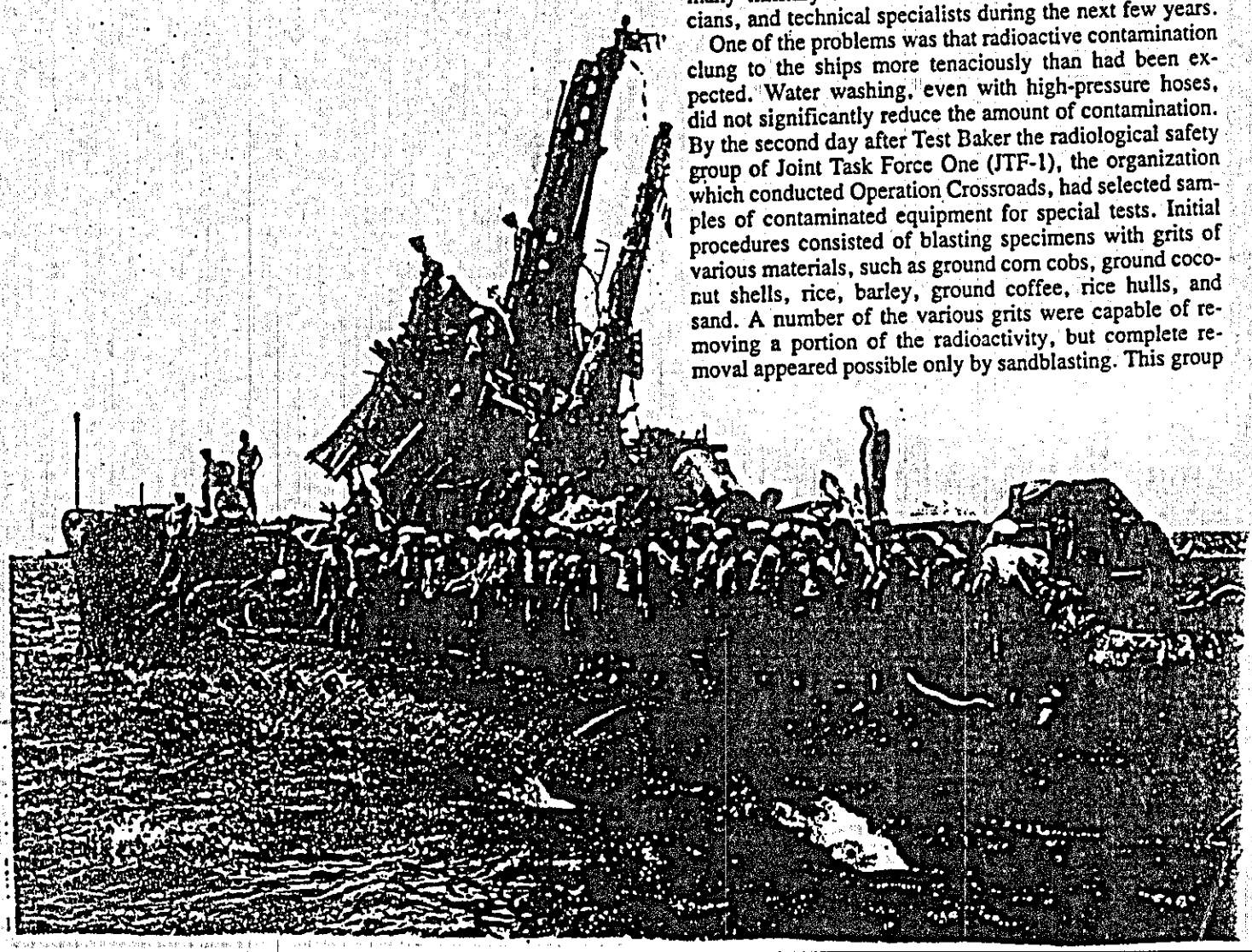
The Legacy of Crossroads

By C. Sharp Cook

If we'd known then what we know now, these sailors wouldn't have ridden the *Skate* (SS-305) after the atomic tests in mid-1946. This is just part of what was learned in the aftermath of Bikini.

The two nuclear detonations of Operation Crossroads, especially the underwater detonation on 25 July 1946 known as Test Baker, provided a spectacular display but left the Navy with a multitude of problems.[1] The participants in this test were not adequately prepared for many of the results they observed. The whole operation had been a step into the unknown and the only way of handling many of these difficulties was through trial and error. Solving the resulting problems occupied many military and civilian scientists, engineers, physicians, and technical specialists during the next few years.

One of the problems was that radioactive contamination clung to the ships more tenaciously than had been expected. Water washing, even with high-pressure hoses, did not significantly reduce the amount of contamination. By the second day after Test Baker the radiological safety group of Joint Task Force One (JTF-1), the organization which conducted Operation Crossroads, had selected samples of contaminated equipment for special tests. Initial procedures consisted of blasting specimens with grits of various materials, such as ground corn cobs, ground coconut shells, rice, barley, ground coffee, rice hulls, and sand. A number of the various grits were capable of removing a portion of the radioactivity, but complete removal appeared possible only by sandblasting. This group

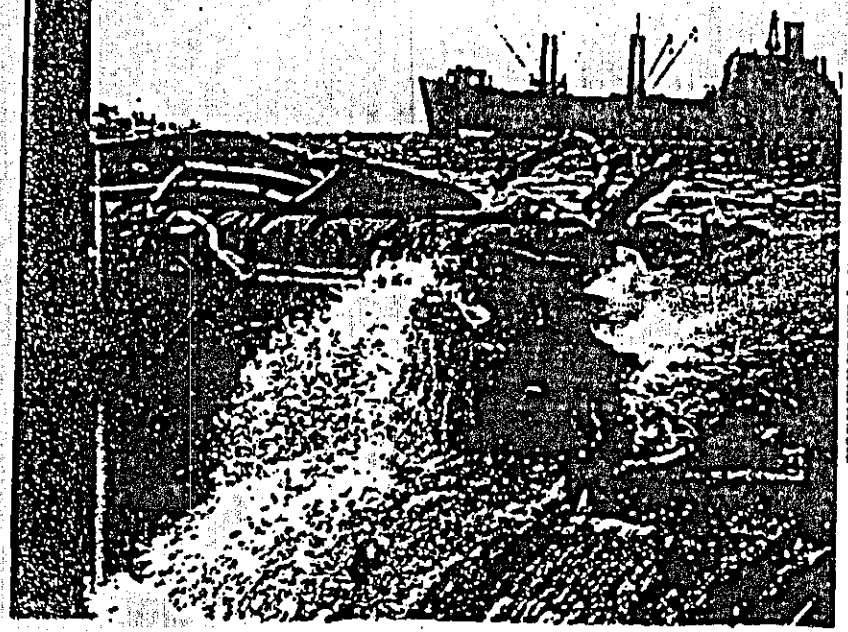


found that painting over the contaminated surface did not reduce the amount of radiation. (We now know this was because of gamma radiation.) Further studies of possible methods for removing radioactive materials included testing the detergent action of soap powders, lye, and volatile naphtha; the dissolving action of acetic, hydrochloric, and sulphuric acids; and absorption by flour, cornstarch, and activated charcoal. Brass surfaces could be decontaminated with nitric acid. These initial investigations also revealed that most reagents reduced the amount of radioactivity only if they actually removed paint or surface corrosion.

The reason for the somewhat frenzied activity so short a time after Test Baker was that officials of Joint Task Force One were anxious for the rapid removal of radioactive materials from target ships so that crews could once again man them. Planners had anticipated a longer delay after Test Baker than after Test Able, but reoccupation was fully expected.

Within a few days after Test Baker, officials began to realize more thoroughly the potential dangers of radioactive contamination to personnel. The crew of the submarine *Skate* (SS-305), for example, was initially allowed to reboard with a minimum of precautions and even allowed to bring food on board. But, as her executive officer explained, "The age of innocence ended several days later."[2] On 31 July the director of ship material of JTF-1 issued very strict safety guidelines for those people who boarded any of the target ships.

By early August another problem had become evident from laboratory examination of contaminating materials: part of the contamination was being produced by plutonium which, if ingested, could be a serious health hazard. This finding exacerbated the problem, because plutonium emits alpha particles that the monitoring devices in use at that time were not capable of detecting. Further investigations showed apparent widespread existence of alpha-particle emitting radioactive substances, even in regions which had earlier appeared not to have significant amounts of contamination. Problems were mounting so rapidly that the effort to decontaminate target ships while still in the lagoon at Bikini was terminated on 10 August. The base of operations was moved from Bikini to Kwajalein Atoll and, beginning 19 August, target ships were towed to Kwajalein.

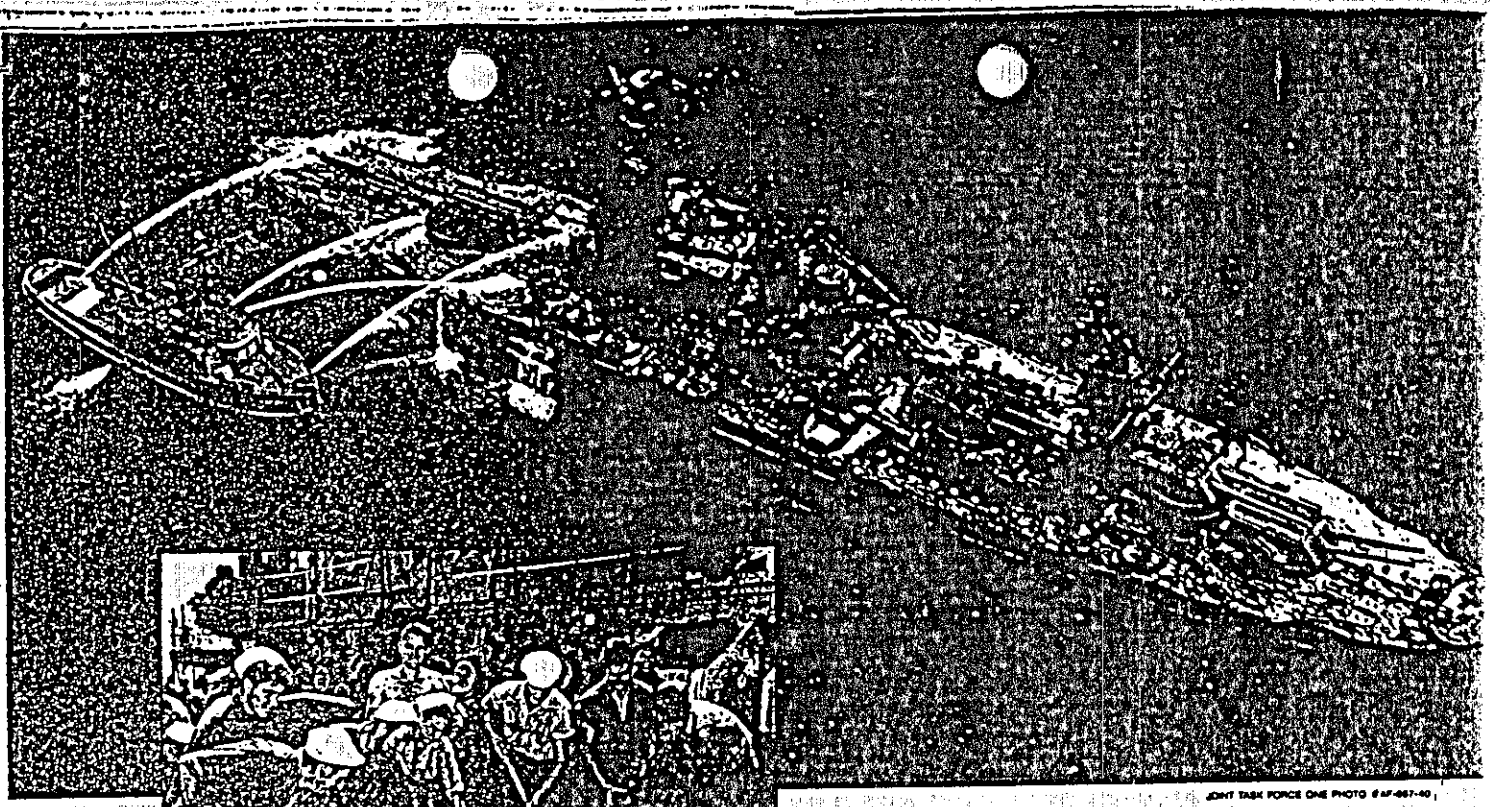


The long-term nature of the overall problem was becoming apparent and resulted in a number of directives. One of the more important was a letter, dated 27 August, from the Chief of Naval Operations (CNO), which established a radiological safety program for the Navy. Among the assignments in this letter were those to his own office, OpNav, to establish policies and coordinate bureau activities. The Bureau of Medicine and Surgery (BuMed) was directed to establish safety tolerances and regulations, to determine physiological effects and develop treatment methods, and to approve specifications for instruments which provide medically useful information. The Bureau of Ships (BuShips) was to develop and procure instruments for detection of radioactivity and equipment for individual and collective protection of personnel on shipboard, and to develop methods and equipment for decontamination of ships. On 30 August the CNO also directed that all ships found radiologically unsafe were to be sunk at sea in deep water.

The operation at Kwajalein, which continued until July 1948, two years, was of a caretaker nature. As BuShips developed methods and equipment for decontamination of ships, decisions were made regarding the disposition of the contaminated target ships—which to tow to sea and sink and which to tow to designated shipyards for further investigation. With the exception of a small number of ships which were on the periphery of the array at Test Baker, such as the *Genieva* (APA-86) and the *Conyngham* (DD-371), contamination of target ships was so great and decontamination procedures so elusive that plans for remanning these ships had to be abandoned.

Since all target ships at Bikini had ammunition on board to serve as test material, a special disposal unit was formed to remove this ammunition. This operation was completed during November 1946, after which the task of ship disposal became the primary objective. A few were selected to be towed to Pearl Harbor Naval Shipyard, to Puget Sound Naval Shipyard, and to San Francisco Naval Shipyard for additional inspection. On 1 December, the *Crittenden* (APA-77) was towed out of Kwajalein and arrived on New Year's Day at San Francisco. Soon the *New York* (BB-34) and the *Nevada* (BB-36) were sent to Pearl Harbor; the *Hughes* (DD-410), the *Pensacola* (CA-24), and the *Salt Lake City* (CA-25) to Puget Sound; and the *Gasconde* (APA-85) and the *Independence* (CVL-22) to San Francisco.

Support (non-target) ships were not immune from radiation problems. Several days after Test Baker, radioactivity was found to be accumulating in the evaporators and salt-water piping of these ships and in the marine growth and rust of their hulls, a result of the contaminated waters of Bikini lagoon. On 19 August, Commander Joint Task Force One issued a memorandum in which he pointed out that support ships which had been in Bikini lagoon between 25 July and 10 August most probably would have become radiologically contaminated, at least to some degree, and that further monitoring would be required before



JOINT TASK FORCE ONE PHOTO #AF-667-40

JOINT TASK FORCE ONE PHOTO #AACR-668-27777-9

Following Test Baker target ships were hosed off and scrubbed, with minimal effect. A Navy fireboat sprays the *New York* (BB-34), which was eventually towed to Pearl Harbor, studied, and sunk.

these ships could be considered completely clear of radioactivity. This was particularly important to ensure the safety of personnel engaged in future work on sides and evaporators, since these two areas had been found to be the principal collecting regions for radioactive matter.

The radiological safety advisor, after further study and analysis, concluded that the precautions outlined in the instructions of 19 August were inadequate for protection of personnel against possible injurious effects resulting from inhalation or ingestion of alpha-particle emitters. Instructions were directed to all ships which spent an accumulated time of ten or more days in Bikini lagoon after 25 July. They were to avoid drydocking until receipt of detailed instructions, to avoid exposing any internal or external saltwater surfaces, and to avoid exposing personnel to fumes resulting from welding or cutting, or to dust originating from surfaces contaminated by salt water.

A flurry of recommendations and instructions followed, representing to some degree the uncertainty and the urgency most people felt regarding the problems they had encountered. Commander Service Force Pacific recommended that all non-target ships assemble in one area, preferably San Francisco, for detailed determination of their radiological status. The impetus for making San Francisco the primary center for the investigation of contamination was that it was near the facilities at the University of California Crocker Radiation Laboratory (UCRL). Because BuShips also had two shipyards in the area, Hunters Point and Mare Island, San Francisco was a logical choice.

Commander Joint Task Force One cited the impractical nature of returning ships from the Marianas or from Philippine or Asiatic waters to San Francisco and suggested that monitors and equipment be flown to Guam or some other selected location for clearance of these ships. On 3 September, OpNav informed the Commander in Chief Pacific and Commander Western Sea Frontier that diversion of some Crossroads ships to other principal West Coast shipyards was authorized if congestion in the San Francisco area would otherwise result. OpNav also directed that diversions be held to an essential minimum because of the superior radiological safety facilities in the San Francisco area. That same day, OpNav directed the Bureau of Ships to comply with recommendations from Commander Joint Task Force One that drydocking and shipyard work be avoided until complete radiological monitoring and clearance had been obtained.

On 26 August, Captain William E. Walsh, Joint Task Force One medical officer, set up headquarters in the offices of the 12th Naval District medical officer and officially established the ship clearance organization in its initial form. On 30 August, Commander Western Sea Frontier directed the Commandant 12th Naval District to drydock one or more ships of Destroyer Division 71, then present at San Francisco Naval Shipyard, in a floating dry dock for radiological monitoring. These actions led to the first such inspection, of the *Laffey* (DD-724), which began on 5 September in floating repair dock ARD 32. The inspection party consisted of Captain Walsh, Dr. Robert A.

Newell, a radiologist at Stanford University Medical School, Dr. F. H. Rodenbaugh, a San Francisco radiologist, and Lieutenant Wayne A. Chadbourn, one of the Navy medical officers who had received special training for the work associated with Operation Crossroads.

Because this inspection was the first of its kind, some apprehension existed among the work force regarding the dangers involved. Shipyard personnel received a series of lectures explaining what was to be done, safety precautions they needed to take to protect themselves from radioactive particles, and to assure them that no great danger faced them.

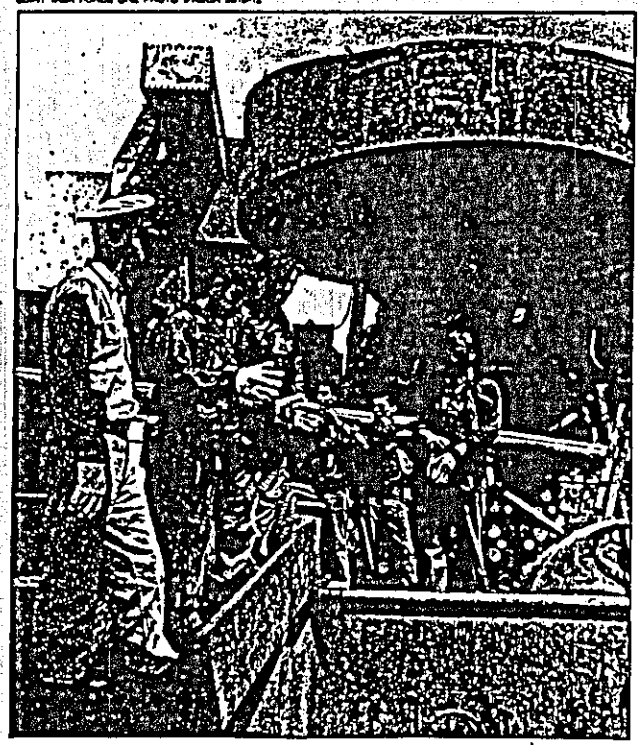
At 1130 on 5 September, the inspection party descended into the dry dock and started a survey of the hull using Geiger counters. To the relief of everyone, the readings indicated that the amount of radioactivity on the hull was considerably below the dangerous level. One interesting note in the report of the inspection was that "despite the warning by the inspection party to the Yard workers not to handle scrapings without gloves, the members of the inspection party did not observe this precaution themselves." As so often is the case, the old adage, "Do as I say and not as I do," seemed to prevail.

Following the outside hull inspection, the evaporator in the forward engine room was opened and a section of saltwater piping was removed for analysis at UCRL. Results indicated that the saltwater systems were considerably more radioactive than the hull plating but still not to the degree that would be unsafe for shipyard personnel during overhaul. Because of these results, on 6 September Captain Walsh authorized the planning office of the San Francisco Naval Shipyard to proceed with all repair and alteration work on the *Walker* (DD-517), *Barton* (DD-722), *Lowry* (DD-770), and *Laffey*, with the exception of the work on the underwater body and any machinery in which salt water had been circulated. As an additional precaution, however, Captain Walsh ordered that while the *Laffey* was in floating dry dock, no one be allowed to enter the dock except those actually working on the ship.

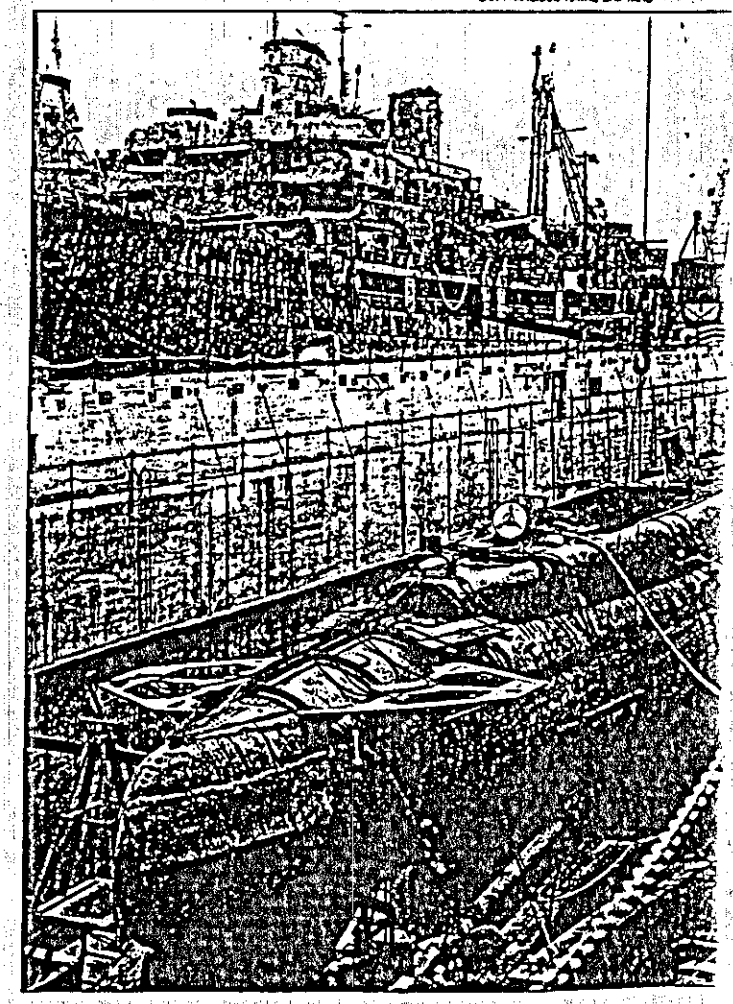
During early October there was considerable discussion regarding final clearance standards for these ships. Some controversy arose as to whether a different standard should exist for ships returning to sea duty and those being mothballed. BuShips favored more relaxed standards for those ships being returned to sea duty while BuMed favored similar or identical standards in both situations.

Experimentation on non-target ships continued through the middle of October at San Francisco, based on laboratory work at Crocker. By the middle of October, instructions were issued on acid cleaning of evaporators and other saltwater piping which had been contaminated. By that time 55 non-target ships had arrived on the West Coast, and even though everyone was in a new field with many unknowns, work proceeded in a reasonably orderly

JOINT TASK FORCE ONE PHOTO #ABCR 2019-12



SAN FRANCISCO NAVAL SHIPYARD



An ammunition disposal unit, equipped with rescue breathing gear, prepares to remove munitions from the *Nevada* (BB-36) at Kwajalein. Above, the *Crittenden* (APA-77) and a submarine undergo decontamination analysis in drydock at the San Francisco Naval Shipyard.

manner. By the beginning of 1947, 80 of the 159 non-target ships had been granted final radiological clearance.

The decontamination work was classified top secret. Today, such a high classification for these discussions seems much too restrictive. We now know that many of the questions people had regarding the nature of contamination, and what information could be gleaned from knowledge about that contamination, was not as critical from a security point of view as had at one time been suspected. At that time the authorities still considered that this radioactive contamination might be a source of plutonium for future explosive devices. Another security concern was the possibility of determining bomb efficiency by analyzing radioactive debris from ex-Crossroads ships. One of these questions was answered during a late November conference at BuShips when it was concluded that a small cyclotron would be an easier and simpler source of plutonium.

At a Washington conference concerning radiological decontamination on 4 October 1946, Dr. J.G. Hamilton, who represented the University of California's radiation laboratory, raised a question concerning the fundamental relationship and function of UCRL to the Army and Navy in their decontamination work. He inquired about the permanency of the temporary laboratory which had been established at San Francisco Naval Shipyard, and he recommended that the yard undertake practical experimental work on a more permanent basis, with assistance as necessary from the lab. He also urged that both military and civil service personnel be trained for such work. The problem, as seen by Dr. Hamilton, was that the Crocker laboratory was making satisfactory progress on the emergency problems faced by the Navy only by deferring some longer range research problems, which were the primary responsibility of the lab.

On 18 November, the Chief of the Bureau of Ships directed San Francisco to expand and make permanent the temporary laboratory facilities which had been established as a part of the shipyard's industrial laboratory. This would provide BuShips with a facility in which to carry out its mission as assigned by the CNO. The Bureau of Medicine and Surgery would share the facilities at the shipyard, and both BuShips and BuMed would provide appropriate military personnel, equipment, and supplies to carry out their work. On 2 February 1947, Lieutenant Roger G. Preston, a BuShips petroleum researcher with a doctorate in chemistry, became officer in charge of the Navy's radiation laboratory.

The SFNS radiation laboratory grew rapidly. Hiring of civilian scientists, engineers, and support personnel began during March 1947. The title officer in charge was upgraded to director and, on 2 May 1947, Commander John J. Fee assumed this position, which he held until 18 July 1950, when Captain Joseph L. Bird relieved him.

After a short time the name "radiation laboratory" for the facilities at San Francisco Naval Shipyard began to be confused with the University of California's Crocker lab. As a result, on 21 April 1948, after considerable discussion, the laboratory at the shipyard became the Naval Radiological Defense Laboratory (NRDL), the name it retained until it was closed in 1969. During this period it served as the Navy's primary source of information regarding nuclear weapons effects.

Work on the decontamination of ships from Operation Crossroads proved to be formidable. Though all of the non-target ships received final clearance, the target ships eventually had to be sunk in accordance with the CNO's directive of 30 August 1946. The *Independence* remained at San Francisco until January 1951, providing a considerable fund of knowledge regarding ship contamination, before she was eventually sunk.

During the next two decades NRDL grew, became a separate BuShips command and, in 1955, moved into a new seven-story building designed especially for the work it was doing. The scientists and engineers at NRDL solved many of the nation's problems related to ionizing radiations, both within the laboratory and at nuclear weapons tests. However, many events anticipated during the late 1940s did not come to pass. For example, NRDL did not become a tri-service laboratory, as many in the Navy had hoped, because the Army and Air Force wanted their own laboratories. Even within the Navy, nuclear power was developed under Admiral Hyman G. Rickover in a separate division, and BuMed did some of its ionizing radiation research in other departments.

A buildup of radioactivity in the earth's biosphere led to the 1958 moratorium on nuclear testing and the 1963 limited test ban treaty. The conflict in Vietnam began sapping the resources of the Department of Defense and an urgent search for ways to economize ensued. Reorganization of the Navy Department led to the abolishment of BuShips and the transfer of all laboratories to the newly-created Naval Material Command. Smaller technically specialized laboratories were consolidated into larger "centers of excellence," each of which concentrates on a specific environment in which the Navy operates. As a result, NRDL was closed and its functions dispersed among several organizations, since nuclear and radiation problems can occur in all known environments.

In 1985 the main NRDL laboratory building and the cyclotron building were sold to private owners. The cyclotron facility is now being used for the manufacture of wood moldings and the main laboratory houses records.

The consensus of many years of research on the best way to cure the problem of exterior contamination of a ship was to use a washdown system which essentially covered surfaces with a thin layer of moving water at the time they were coming into contact with fallout. But ultimately, an ounce of prevention is worth a pound of cure.

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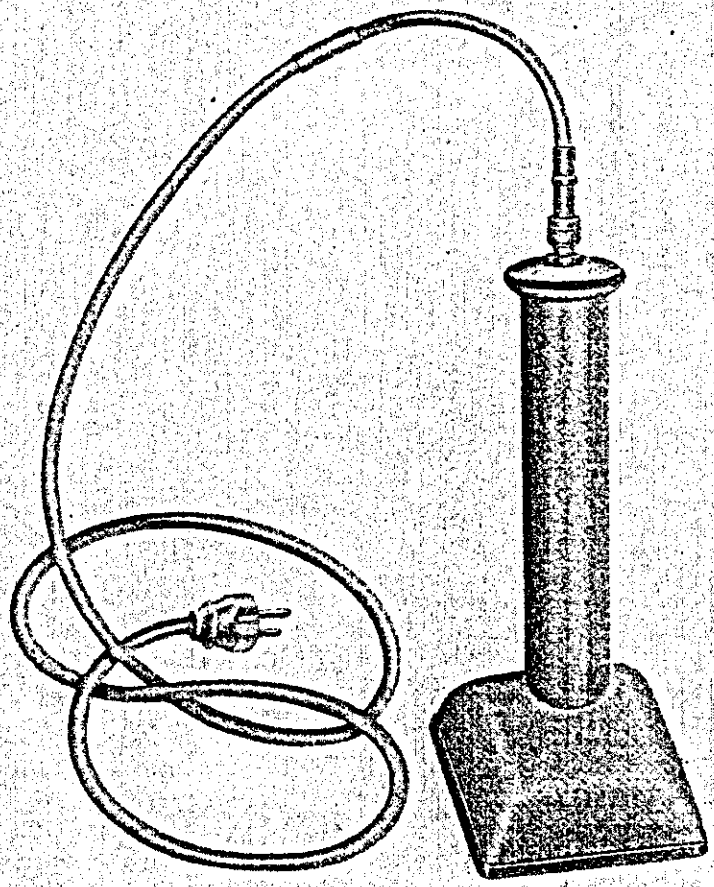
[1] *See* Captain Thomas M. Daly, USN, "Crossroads at Bikini," *U. S. Naval Institute Proceedings*, July 1988, pages 64–73.

[2] *See* Captain R. D. McWethy, USN(Ret.), "Comment and Discussion," *Proceedings*, August 1986, pages 84–85, 89.

Dr. Cook, a former Fulbright scholar, received his doctorate in physics from Indiana University in 1948. He worked for many years at the Naval Radiological Defense Laboratory, serving as head of the radiation physics division from 1965 to 1969. Since 1985 he has been professor-emeritus of physics at the University of Texas at El Paso.



TECHNICAL REPORTS SERIES No. 120

Monitoring of Radioactive Contamination on Surfaces

INTERNATIONAL ATOMIC ENERGY AGENCY, VIENNA, 1970

4.3. Beta contamination monitoring – low-energy emitters

Because of the short range of low-energy beta radiations special problems similar to those encountered in alpha monitoring are raised.

Geiger tubes or scintillators with thin windows (about 2 mg/cm^2) or gas-flow or air-filled proportional counters are most suitable. Indirect methods are usually employed to monitor for tritium [28] and plutonium-241.

5. INDIRECT METHODS OF SURFACE MONITORING

5.1. General

Indirect methods of surface contamination monitoring are used when unsuitable geometry or interference from other radiations prevent direct monitoring and as a complementary method when direct monitoring has shown the presence of radioactive contamination. A wide range of techniques is available, but all depend upon the removal of radioactive material from the surface being examined. It may be necessary to take samples from the area being monitored to another area for counting.

The fraction of material removed during routine indirect monitoring is not known accurately. A smear test may remove anything from 0 to 100% of the contamination present, but generally a removal factor of about 10 to 20% is assumed. The variations in the removal factor make quantitative estimation of the amount of contamination present on the surface uncertain. The removal factor is affected by varying the pressure applied during smearing, by the type of surface or smear, and by the form of the contamination. Devices to ensure uniformity in pressures applied and area sampled have been described [29] and usually include some form of spring loading of a pad to which the smear paper is attached.

When a smear paper is used manually, most of the contamination picked up on the paper is concentrated in an area of about 5 cm^2 coincident with the area of the finger tips [29]. Because this area may be small compared to the area of the detector used to measure the smear activity, erroneous results may be obtained unless the probe is specially calibrated.

Most surfaces in radioactive laboratories and process areas can be smear-tested satisfactorily. Outside these areas where rough brickwork, tarmacadam roadways, concrete paths and hardstandings, areas of gravel, soil or grassland may be encountered, the ability to obtain a satisfactory smear sample varies from the difficult to the almost impossible.

If successive smears show decreasing amounts of activity, but it is suspected that some radioactive contamination is left on the surface being examined, further tests should be made after 24 h. Experience has shown that where direct and indirect monitoring has indicated that fixed contamination only is left after some decontamination procedure, after such a period loose contamination again may be detected. In certain cases the amount of removable activity detected on smears has reached a level approaching that originally found [29].

The validity of indirect methods in which the amount of activity transferred to rinse solutions or wash-down liquors is estimated depends upon the solubility of the contaminant in the liquid in question, or on the homogeneity of particles dispersed in the liquor.

CLASSIFICATION *(Of attached material)*

OFFICE OF THE ASSISTANT SECRETARY OF THE NAVY (I&L)

NAVSO 2700/65 (4-74)

FROM		TO	DCN
OASD-I&L	LYNCH	GSA	9-91894

SUBJECT

Navfac in San Bruno, Ca desire to utiliza the Radiology Lab Bldg 815 for co-location of all Fed Lab in the San Franciso, area

C/R		C/R	
DOCUMENT DATE	RECEIVED	CAT / TYPE / TC	FILE
13FEB76	25FEB76	D / A	
DUE TO: ASN (I & L)	DATE	DUE TO: / DATE	DUE TO: / DATE

REMARKS

EXTERNAL ROUTING

PC	ACTIVITY	
E	CNO	
E	CNM	
E	NAVFAC	
E	FACS	

ASN (I & L) INTERNAL ROUTING

SEQ		PC	INITIAL
	CIVILIAN SPEC ASST		
	EXECUTIVE ASST		
	MARINE CORPS AIDE		
	AIDE & SPECIAL ASST	E	
	DIRECTOR SUPPLY SUPPORT		
	DIRECTOR SHIP PROGRAMS		
	DIRECTOR ORD PROGRAMS		
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	SPECIAL ASST TELECOMM		
	DIRECTOR INSTAL & FACS	E	
	DIRECTOR PROCUREMENT		
	SPECIAL ASST TRANSPORTATION		
	SPECIAL ASST SMALL BUSINESS		
	MAIL ROOM SUPERVISOR	E	

STAFF COMMENTS

03 —

PURPOSE CODES (PC)

A. Preparation of reply for secretarial signature.
B. Necessary action. *(Action addressee is expected to take necessary action, as considered appropriate)*
C. Please reply direct for the secretary.
D. Please furnish data on which to base a reply.
E. Information and retention.
F. Lead Office for any required coordination, rewrites, etc.
G. Signature.
H. Information and return for SECNAV official files.
I. Comment or recommendation.
J. Coordinate with action addressees, as necessary.
K. Coordinate with Lead Office, initial and return.
L. Reply to be cleared by this addressee.
S. Reply to be signed by this addressee.
X. ASN (I&L) cognizance office.

PLEASE RETURN TO ASN (I & L)

CLASSIFICATION *(Of attached material)*