Rough draft inspection notes 12/27/63 cg

R.F. Inspector 1-6-64

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Dept. of the Navy
U. S. Naval Radiological Defense Lab.
San Francisco, California
License Nos. 4-487-3, -8 & SNM-35

SECTION I
GENERAL INFORMATION AND ORGANIZATION

A. Introduction

1. An announced inspection of the Naval Radiological Defense Laboratory (NRDL), San Francisco, California was conducted on December 16, 17, 18, 19 and 20, 1963 by R. Fish, Region V Inspector, Division of Compliance. Mr. A. L. Smith, Head of the Health Physics Division, represented the licensee during the entire inspection. During this inspection the following NRDL personnel were interviewed:

Bill Neall, Health Physicist
Bill Friedman, Health Physicist
Frank Devlin, Health Physicist
Phil Fong, Health Physicist
Dick Marquiss, Health Physicist
Al Kielwasser, Health Physics Technician
George Wyatt, Scientific Staff Assistant

An introductory discussion was held with Captain D. C. Campbell, Commanding Officer. The summary of the inspection findings was presented to Captain P. F. Dickens, Head of the Medical Department, since Captain Campbell was unavailable at the time.

2. The inspection pertained to those activities authorized under Byproduct Material License Nos. 4-487-3, 4-487-6, 4-487-8 and Special Nuclear Material License No. SNM-35. Two items of noncompliance were noted in connection with license 4-487-3: unauthorized possession of americium-241 (10 CFR 30.3) and failure to leak test sealed sources

containing cobalt-60, strontium-90, and cesium-137 on a six month basis (Condition 14). The only item of noncompliance noted in connection with license No. SNM-35 was failure to leak test neutron sources containing plutonium on a six month basis as required by the licensee's procedures (incorporated by Condition 8). The only item of noncompliance noted in connection with license No. 4-487-8 was failure to note in the log a malfunction of the gamma range equipment. Such log notations are required by the procedures which are incorporated by Condition 15. No activities have taken place under License No. 4-487-6 since the last inspection.

B. Organization

3. NRDL is presently headed by Captain Campbell who assumed command in June 1963. NRDL is divided into four separate Departments: Technical Services, Scientific, Medical and Administration. The four Departments are headed respectively by Commander Connoley, Dr. Cooper, Captain Dickens and Commander Johnson. Each Department is subdivided into Divisions which are further divided into Branches. Three of the four Divisions in the Scientific Department are involved in AEC licensed activities (Chemical Technology Division, Biological and Medical Sciences Division and Nucleonics Division). The Heads of these three Divisions are Drs. Gevantman, Alpen and Krieger respectively. The Engineering Division of the Technical Services Department is responsible for radiological control, decontamination operations and operation of the laundry. The Health Physics Division serves as an advisior to the Engineering Division on matters involving radioactive materials and/or radiation. The Commanding Officer's representative at Camp Parks is Commander G. L. Bergey who is the chief administrative person at the site.

4. The Medical Department is divided into the Health Physics and Radiological Health Divisions. The latter Division is responsible for the medical functions, including

urinalysis, of the Department. The Health Physics Division is supervised by A. L. Smith and organized on a functional basis. Environmental monitoring at the San Francisco facilities is the responsibility of Marquiss and Kielwasser. Photo dosimetry (film badges) is the responsibility of Friedman. Routine monitoring is performed by Paul Rago, a lower grade Health Physicist. Licensing and accountability of all radioactive materials is the responsibility of Friedman and Kielwasser. In addition there is a liaison function where members of the Division act as advisors to the various other Divisions at NRDL. The following is the present assignment of liaison responsibilities: Fong, Chemical Technology and Biological and Medical Sciences Divisions; Devlin and Kielwasser, Nucleonics Division; Marquiss and Kielwasser, Technical Services Division; Neall and Jim Thomas (Health Physics Technician), Camp Parks Facilities.

5. Mr. Smith stated that the Health Physics Division has a staff of 12 persons. Seven of these people are classified as professional health physicists (including Smith), two are technicians, two are military personnel and one secretary. In Mr. Smith's absence Mr. Neall is in charge of the Division. Mr. Neall is also responsible for the industrial hygiene and other safety functions of the Division. According to Mr. Smith, Messers. Devlin, Friedman and Fong are the senior health physicists. The two military personnel are assigned to the film badge laboratory; however, they officially report to the military person in charge of the Radiological Health Division.

C. Isotope Committee and Authorized Users

6. The Isotope Committee is composed of the Associate Director of the Scientific Department, the Head of the Health Physics Division and the Heads of the Chemical

Technology, Biological and Medical Sciences and Nucleonics Divisions. The Associate Director, Dr. E. B. Tompkins, is the Chairman and Mr. Smith is the alternate Chairman. The following persons have been designated as alternate representatives to the committee: Chemical Technology, Mr. Zigman; Biological and Medical Sciences, Dr. Brauer and Mr. Cole; Nucleonics, Messers. Tachilin and Sinclair. This committee does not meet as a single unit.

7. Formal procedures have been established for the approval of new projects, revisions to projects and authorized uses-all involving radioactive materials. Initially these items are reviewed and discussed informally with the Health Physics Division through the liaison health physicist. The proposal is formally submitted on the licensee's internal Form 44 for new items or Form 44A for revisions. Information contained on the form includes a description of the experiment, a description of the facilities to be used, the persons permitted to use the material, the isotope(s) to be used and the quantity. Attached to the form is a health physics evaluation of the proposal, NRDL Form 76. Each proposal is reviewed by the Head of the Health Physics Division and the isotope committee representative for the Division making the proposal. The signature of these two reviewers represents the committee's approval.

8. The Health Physics Division maintains the file of committee approvals. These files consist of a single folder for each stub number, which is a number assigned by Health Physics simultaneously with the committee's approval. These files were reviewed during this inspection. It appeared from those files examined that the established procedures were being followed.

D. Purchase of Isotopes and Inventory Review

9. The Logistic Support Division of the Technical Services Department is responsible for ordering all radioactive materials. All such purchases must have the approval of the Health Physics Division before the order can be placed with the vendor. Health Physics Division approval provides the check to assure that only radioactive materials approved by the Isotope Committee are purchased. Health Physics is notified when shipments containing radioactive materials arrive. All shipments of radioactive material are opened by health physics personnel either in the isotope storage room or the laboratory in which the material will be used.

10. A card system is used to account for all radioactive material received at NRDL. This card is partially filled in at the time the order is approved and is completed when the shipment arrives. The following information is present on the card: the isotope, quantity, stub number, the experimenter's names, date of health physics approval, date of assay, date shipment was received at NRDL, location of material and when applicable the volume. The bottom of the card provides space for recording changes in the location of the material.

11. A random review of the card file was made during this inspection. With the exception of americium-241, the cards showed the licensee was within his possession limits. The cards did show that the licensee possessed two small americium-241 sources, containing 0.11 and 0.12 microcuries, and had received one shipment containing 100 microcuries of the isotope from the Lawrence Radiation Laboratory.* During the examination of the facilities a sealed can, containing approximately

* San Francisco Operations Office, USAEC, was informed of this transfer

10 microcuries of Am-241 according to the label, was observed in the hood of one of the laboratories. There was no record of the receipt of the 10 microcuries and Mr. Smith said he was not aware of this material. Later in the inspection Mr. Smith said that the material was received from the Lawrence Radiation Laboratory on an informal basis and had not been processed through the proper NRDL procedures. The following is the quantity of isotopes possessed as sealed sources:

cobalt-60	2168.2	curies
+ Gamma Range at Parks	~13,500	curies
strontium-90	242.38	millicuries
cesium-137	693.12	curies
plutonium		
PuBe	259	grams
PuF_4	760	grams

It was noted that NRDL possessed one 80 gram PuBe neutron source and an alpha calibration unit containing 781.5 micrograms plutonium under Section 91.b of the Act.

SECTION II
FACILITIES AT S. F. SHIPYARD, POSTING AND LABELLING

A. Building 815

12. The licensee's main facility is a seven story concrete building designated as Building 815. The seventh or top floor of the building is totally occupied by the cafeteria. The sixth floor is occupied by personnel of the Chemical Technology Division and is composed mostly of laboratories. The fifth floor contains

laboratories, animal quarters and some offices used by the Biological and Medical Sciences Division. The Nucleonics Division Laboratories and offices are located on the fourth floor. The entire third floor is occupied by administrative personnel. The Health Physics Division occupies a portion of the second floor. The instrument repair, maintenance and calibration facilities are also located on the second floor. Located on the first floor is the lobby, guard office, building equipment rooms, shop, storage rooms and some laboratories. Since entrance to the building is controlled at the lobby desk, the entire building has been classified as a restricted area.

13. The laboratories on the sixth floor have been furnished on the basis that Chemical Technology is the largest user of unsealed radioactive materials. These rooms contained benches, chemical hoods, sinks and the usual utilities. Each lab. where isotopes are used has additional equipment for proper handling and storing of the radioactive materials. Most of the isotopes are stored in caves fabricated from lead bricks. Some of the laboratories had glove boxes and a few had ion exchange columns. Most of the labs. where isotopes are used were furnished with a cardboard barrel (with a plastic bag liner) for dry radioactive waste and a 5 gallon plastic jug (in a metal can) for liquid radioactive waste. Because several of the labs. in one corner of the building had a limited amount of unused space, dry radioactive waste containers for these areas were centrally located in the hall outside the labs. The liquid waste containers were located in the labs. This corner of the building was used by the Nuclear Chemistry Branch which is experimenting with fission products (mainly rare earths) obtained from irradiating small samples of special nuclear materials.

14. The laboratories on the fifth floor varied in their furnishing depending upon the activities. Some were provided with laboratory hoods. All had benches and normal utilities. Some labs. were used for operating and sacraficing small animals and were appropriately furnished. The animal quarters consisted of large tiled rooms with drains in the floors. The animals, mostly mice and rats, were kept in wire cages which were stored in metal racks.

15. The fourth floor has one large permanent calibration range. The range is located on one end of the building with the radiation beams directed toward the outside wall. There are two entrances to the range, one designated room 4125 and the other designated 4177. The range contains two large sources, 120 curies of cesium-137 and 196 curies of cobalt-60. Each source was located in a separate shielded container which was on its own metal stand. Electric motors drive the mechanism for providing and shutting off each beam. White and flashing red lights, located on each container, indicate respectively the electric power is on and the beam is exposed. Both lights are not lit at the same time. The floor of the range has been marked to show the 50 mr/hr and 5 mr/hr areas for each unit. The range is locked when not occupied. The keys to the range are controlled at the Nucleonics Division office where only authorized persons can obtain them. The keys and pocket dosimeters are signed out.

16. The range, room 4125, is also used for storing other sources. At the time of the inspection only two additional sources were stored in the range area. One source was a 760 gram plutonium fluoride (PuF_4) neutron source and the other was a 79.16 gram plutonium beryllium (PuBe) neutron source. Each was stored in a

paraffin filled metal can.

17. Room 480 on the fourth floor has been used for radiation scattering measurements. This room is in one corner of the building. A 10 curie cesium-137 source and a 25.3 curie cobalt-60 source have been used in the scattering experiments. On December 18, 1963 the former source was observed in use. In all cases the source container is located near the middle of the room with the radiation beam directed toward one of the outer walls of the building. The sample toward which the beam is directed is located about six feet from the outside wall. On December 18th the sample was a concrete sample about 4 feet by 4 feet by 3 - 4 inches thick. A scintillation crystal connected to a multichannel analyzer is used for making the scattering measurements. The sources are located in shielded containers which are mounted on portable stands. Electric motors drive the mechanism which opens and closes the shutter. A flashing red light which operates when the beam is on is mounted on the top of each container. When measurements are made, a rope barrier is erected to prevent entrance into that portion of the room being used for the experiments.

18. Only sealed or plated radioactive sources are used in the laboratories on the fourth floor. Most of these sources are used as standards or calibration sources. One curie size cobalt-60 source was observed in a laboratory adjacent to room 480. This source and its shielded container were located on a bench with the radiation beam directed toward the outside wall of the building. This unit was similar in design and operation, including the flashing red light, to the two units in room 480.

19. A second permanent calibration range has been established in room 2125 on the second floor of the building. The wall of this room toward which the radiation beam is directed is also an outside wall of the building. The side walls of the room are lined with metal shelves which are used for storing surplus radiation monitoring equipment and accessories. At the time of the inspection an 80 gram PuBe neutron source in a paraffic filled metal drum was located in the back portion of the room.

20. The calibration source in room 2125 contains 120 curies of cesium-137. The source is in a shielded container on a metal stand. Electric motors operate the mechanism which raises the source to provide a beam and lowers the source to a shielded condition. The unit is provided with a timer which will automatically lower the source after a preset time. Three lights (blue, white and flashing red) are mounted on the top of the unit. When lit, the white lights shows there is power to the unit, the blue light shows the source is being raised and the red light shows the source is exposed. The door to the room is locked and the individual in charge of the NRDL instrument shop controls the key.

21. A 120 curie cesium-137 source in a shielded container was located in room 173 on the first floor of the building. The container was on a portable cart. The unit was similar in design and operation to the two located in room 480 (described in a previous paragraph). Sometimes the unit is used in the large climatic chamber which is located in this room.

22. A cobalt-60 irradiator is located in room 165. This is a permanent facility fabricated from steel and lead. The source is housed in a dome which moves on

a base. The base contains two wells which are used as irradiating chambers. The base has a shielding wall around its perimeter to stop the radiation leaking between the source dome and the base. The mechanisms for raising and lowering the source and moving the source dome from one well to the other are electrically driven. In case of an electrical failure these mechanisms can be operated by hand. Flashing red lights which operate when the source is in a down or in use position are located above the door to the room and above the source dome. At the time of the last inspection, November 1962, this unit was being operated with a leaking source. In June 1963 the leaking source was replaced and the unit was decontaminated. The replacement source presently contains about 1765 curies.

23. The licensee's laundry is located in room 195. Two commercial type washing machines are possessed. The drain pipe system for the two machine is such that the water can be pumped into either the building drain system or into 55 gallon drums. All wash water is pumped into drums and handled as radioactive waste.

24. Room 1109 is the isotope storage room. The isotopes are stored in either of two large concrete pits. One of the pits contains a rectangular array of steel pipes each of which is fitted with a shielding lid. The isotopes are located in shielded containers which are placed in the pipes. Shielded containers which are too large for the pipes are placed in the other pit. The shielded containers are handled with an overhead crane. A large combination safe in the room is used for storing special nuclear material. Benches are located against two of the walls and there is a chemical hood in the room. The hood has a CWS filter. A

large cave fabricated from lead bricks is on the bench near the hood. This cave is used for storing smaller quantities of isotopes. This room is kept locked and the keys are controlled by the guard office. Only authorized persons can obtain the keys.

25. The licensee has established a basic zone system with appropriate signs. There are four zones with the following meanings: zone 1, no radioactive materials present; zone 2, small amounts of radioactive materials creating no radiation problem; zone 3, radioactive materials present which can or do create radiation areas; zone 4, high radiation areas. Rooms considered as zones 2, 3 or 4 are marked with small signs displaying a conventional radiation symbol in magenta on a yellow background and appropriate wording for the existing radiation condition (zone 2, none; zone 3, Caution Radiation Area; zone 4, Danger High Radiation Area).

26. In addition to the zone posting, each room containing radioactive material is posted with a sign displaying a conventional radiation symbol in magenta on a yellow background and the words "Caution Radioactive Materials". This sign also provided space for noting the isotopes contained, the quantity of each isotope, the date of the information and the initials of the health physicist. Mr. Smith said that when the room does not contain any isotopes the sign is turned over so that only the plain grey back shows. According to Mr. Smith these signs are changed when material is added to that already in the room. Additionally these signs are checked on a periodic basis, usually monthly. For those rooms whose contents do not change very often, such as the rooms on the fourth floor and the permanent ranges and facilities, the signs may be checked only on a yearly basis.

27. The two entrances to the range on the fourth floor, rooms 4125 and 4177, were posted in the same manner. Both "Caution Radiation Area" and "Danger High Radiation' signs, each with a conventional radiation symbol in magenta on a yellow background were posted on the door. In addition the sign described in the immediately preceding paragraph was also posted. Two other signs on the door displayed the words respectively: "Flashing Red Light Indicates Source Exposed" and "Do Not Cross White Lines With Source Exposed." Copies of the operating procedures for the cobalt-60, cesium-~~317~~ 137, PuBe and PuF_4 sources were posted on the door. Also copies of the operating procedures for the cesium-137 source and the cobalt-60 source were attached to the appropriate unit.

28. The door to the isotope storage room was posted with four signs. Three of the signs displayed a conventional radiation symbol in magenta on a yellow background and the following words respectively: "Danger High Radiation Area," "Caution Radiation Area", "Caution Radioactive Materials". The fourth sign stated "Authorized Personnel Only." In addition there are holders on the wall next to the entrance permitting the display of signs showing what protective clothing is required before entering the room.

29. The examination of the facilities included a review of area posting and container labelling. It was noted that all rooms in which isotopes were located were posted with the appropriate zone sign and the "Caution Radioactive Material" sign previously described. With the exception of the containers in room 1109, all others which were examined had labels displaying, as a minimum, the following:

the words "Caution Radioactive Material", a conventional radiation symbol in magenta on a yellow background, the isotope contained, the quantity present, the date of measurement. The containers in the cave in room 1109 were labelled as just described. With respect to those containers in the steel pipes or the pit, the contents are listed on a chart which is hung on the wall in room 1109. In addition this area is posted with signs displaying conventional radiation symbols in magenta on a yellow background and the words "Caution High Radiation Area", "Caution Radiation Area" and "Caution Radioactive Material". Sealed sources which are used outside their shielded containers had tags which also displayed the words "Danger, Radioactive Material, Do Not Handle, Notify Military Authorities If Found" and a conventional radiation symbol in magenta on a yellow background. Form AEC-3's were observed to be posted on the main bulletin board near the lobby desk, on the bulletin board at the entrance to the cafeteria and other bulletin boards in the building.

B. Ship Shielding Facility

30. This facility is located about 1 mile from the main NRDL building. The area is flat land which has the San Francisco Bay on one side and a six foot high chain link fence (with 3 strands of barbed wire on the top) on the others. The gates are sealed with chains and padlocks. The keys to the locks are retained at the guard office in the main building and only issued to authorized persons. The entire area is considered a restricted area.

31. There are three separate areas in this facility. One area is used to simulate high level contamination over a large area. This is accomplished by circulating a 100 curie cobalt-60 source through a plastic tube which is placed in a wave like pattern on the ground. A 10 foot high semi circular earth barrier has been

erected between the chain link fence and the area where the source is circulated. This barrier is to reduce the radiation at the fence when the source is in use. A small wooden storage building is located inside but near the earth barrier. On the roof of this building is a pole with a red light. When the source is in operation the red light, which flashes, is turned on. At the time of the inspection the plastic tube had been stored and the source was in a padlocked shielded container at the edge of the experimental area.

32. A second large cobalt-60 source (~ 375 curies) was in a shielded container in a locked building in another area of the facility. This unit could be removed from the building and was designed to provide a large beam of radiation. A flashing red light which operates in conjunction with the unit was mounted on the top of the unit. In operation the beam is normally directed toward the bay. Both the building and the unit were locked at the time of the inspection.

33. A third source, containing 1 millicurie of cobalt-60 was located in a third wooden building. This source has been used for calibration purposes. The source was in a shielded container and could be raised to a specified height by pulling on the rope attached to the source. The wooden building was locked with a padlock.

34. The gate to the entire facility was posted with two signs. One sign displayed the words "Caution Radioactive Material" and the other displayed the words "Caution Radiation Area". Both signs displayed conventional radiation symbols in magenta on a yellow background. Several warning signs have been posted at

facing building 529 houses the control unit to the neutron generator. This room also houses a multichannel anaylzer for analyzing samples exposed to the beam of the generator. The detector is a scintillation crystal. The second room serves the purpose of a small laboratory. A chemical hood is located in one corner. The tritium targets and gamma standards used for calibrating the analyzer are stored in the hood.

37. The gate to the fence around building 529 was posted with two signs. One sign displayed the words "Caution Radiation Area" and the other "Caution Radioactive Material". Both signs displayed a conventional radiation symbol in magenta on a yellow background. The other three sides of the fence were also posted with "Caution Radiation Area" signs. The door to building 529 was posted with a sign displaying the words "Caution Radiation Area" and a conventional radiation symbol in magenta on a yellow background. A second sign on the door displayed the following words: "Warning, Red Light Indicates Experiment In Progress, Do Not Enter." The door to the hood in building 506 was posted with a sign displaying the words "Caution Radioactive Material" and a conventional radiation symbol in magenta on a yellow background. The isotope containers in the hood was provided with labels which displayed the words "Caution Radioactive Material", a conventional radiation symbol in magenta on a yellow background and information on the isotope contained, quantity and date.

38. A portion of building 517 is occupied by NRDL. This area is used by personnel of the Biological and Medical Sciences Department for animal experiments. The

area is divided into several rooms, two of which were being used to irradiate small animals. A 2.5 curie cobalt-60 source was used in room 9. A nominal 43 curie polonium-beryllium neutron source was in use in room 3. The portion of the building occupied by NRDL has a single entrance which is locked except when an authorized user is present. The keys to this area are controlled by the guard office at the main NRDL building and are issued to authorized persons only. The entire area is considered a restricted area.

39. Room 9 is located in one corner of the building and has a single labyrinth entrance. The walls of the room are concrete. A mirror has been erected so that the source and animals can be viewed without being directly exposed to the radiation. A red light, which is lit when the source is exposed, is located at the end of the labyrinth. Two chain barriers, one located at the entrance to the labyrinth and the other just before the end of the labyrinth, have been erected. The source is raised from the shielded container (located on the floor) by pulling the rope near the room entrance.

40. Room 3 is a small room which has been provided with temporary neutron shielding in the form of boxes of paraffin. A rope barrier has been erected in the room to prevent persons from receiving excessive exposure due to the exposed source. This room is presently considered a temporary high radiation area.

41. The entrance to building 517 was posted with a sign displaying the words "Caution Radiation Area" and a conventional radiation symbol in magenta on a yellow background. The entrance to room 9 was posted with 3 signs. One sign displayed

the words "Caution Radiation Area", another displayed the words "Caution High Radiation Area" and the third displayed the words "Caution Radioactive Material". The latter sign also provided information on the isotope contained in the source, the quantity and date of measurement. All three signs displayed a conventional radiation symbol in magenta on a yellow background. The entrance to room 3 was posted with a sign which displayed the words "Caution Radioactive Material" and a conventional radiation symbol in magenta on a yellow background. Information on the isotope contained, quantity and date was also present on the sign. According to Mr. Smith the two source containers were properly labelled.

42. Two other areas within the shipyard are presently used in connection with waste disposal. One area was triangular in shape and completely enclosed with a chain link fence about 8 feet high. The two gates to the area were locked with padlocks. The keys to these locks are controlled by the guard office at the main NRDL building. This area is used for storing 55 gallon drums, most of which contained dry waste. The other area was within the fence at the end of building 364. Both building 364 and the enclosed yard are controlled by NRDL. The gates and building are locked and the keys are controlled at the guard office in the main NRDL facility. At present the building provides storage space only. Two liquid waste storage tanks are located below ground in the yard next to the building. Liquid waste is stored in the tanks until transferred to Nuclear Engineering Company, Cowell, California for disposal. The liquid waste is generated at the main NRDL building and is pumped into the tanks from either 55 gallon drums or the 5 gallon plastic bottles whichever is used. Both

fenced areas were considered restricted areas.

43. Caution Radiation Area signs with conventional radiation symbols in magenta on a yellow background were posted on the gates to the triangular storage area. A sign displaying the words "Caution Radioactive Material" and a conventional radiation symbol in magenta on a yellow background was posted on one of the gates. The drums in this area were marked with the words "Caution Radioactive Material" and displayed a conventional radiation symbol in magenta on a yellow background. The wooden top over the two liquid waste storage tanks was posted with the words "Caution Radioactive Material" and a conventional radiation symbol in magenta on a yellow background. The two tanks were posted in a similar manner.

SECTION III
PARKS ARMY BASE

A. Introduction

44. NRDL leases portions of the Parks Army Base for use as experimental and support areas. This base is located on U. S. Highway 50 about 3 or 4 miles from Pleasanton, California. The base is presently maintained on "a stand-by" basis by a compliment of about 50 men, most of whom are civil service employees working for the Department of the Army. An Army Major is in charge of the personnel. As part of the lease arrangements, NRDL is completely responsible for ~~those~~ the areas they occupy, including all maintenance.

45. The number of NRDL personnel at Parks is dependent upon the experimental work being performed. Some of the personnel are permanently assigned to Parks.

Personnel such as experimentors and project managers are present on a temporary or intermittent basis. A health physicist and a health physics technician are assigned to Parks; however, these persons may not be present at all times.

B. Facilities, Posting and Labelling

46. NRDL uses buildings 730 and 733 as the headquarters for operations carried on at Parks. Building 730, a large wooden structure, serves as project office space and a vehicle repair facility. Visitor control is through these offices. Film badges, both for employees and visitors, are issued and stored in this office area. Some of the records pertaining to the Parks operation are also maintained here. A Form AEC-3 was posted on the wall of the main office. Building 733 is occupied by the health physics organization. This health physics area contains counting facilities, survey meters for use throughout Parks, storage cabinets for records and counting standards and several desks and tables.

47. Building 131 houses the facilities for preparing fallout simulant, using Ba-La-140, and a laboratory for experimental work involving plutonium. This is a large wooden building with dock area on three sides. A chain link fence has been erected so as to enclose a 25 - 50 foot area around three sides of the building. The fence attaches to the west end of the building where there is no dock. The gates in the fence are locked when the area is not occupied and the fence defines the perimeter of the restricted area.

48. Building 131 can be divided into 3 separate areas. A row of rooms has been

built at the west end. One of these rooms is used as a laboratory for operations involving small quantities of plutonium. This room is furnished with glove boxes, hoods, benches and other normal laboratory equipment. The center section of the building is divided by 7 foot high walls into several rooms with a hallway down the center. The rooms in the center of the building have been used for storage. The eastern third of the building is a large room in which are located two high level cells. These cells are fabricated from concrete blocks and both have zinc bromide viewing windows in the front wall. Each cell is furnished with a set of master slave manipulators. The larger of the two cells, with a capacity of ~ 50 curies of Ba-La-140, is used for preparing the solution used in tagging sand for fallout studies. The smaller cell has a capacity of 1 - 5 curies of Ba-La-140. A large lead filled storage container is permanently located in the larger cell. Each cell has its own exhaust fan and CWS filter. A hallway provides access to the back of the cells. Cement mixers for preparing the tagged sand are located on the dock at the east end of the building. A conveyer belt and drying ovens are also located at this end of the building. The radioactive solution is transferred from the hot cell to the mixers by a system of metal tubing and rubber hoses. During operations a temporary restricted area is established outside the chain link fence near the east end of the building. Rope barriers are used to establish the temporary restricted area and prevent use of the railroad tracks which run next to building 131.

49. The chain link fence around building 131 is posted with signs displaying the

words "Caution Radiation Area" and a conventional radiation symbol in magenta on a yellow background. The main entrance to building 131 was posted with a "Caution Radiation Area" sign which displayed a conventional radiation symbol in magenta on a yellow background. The main entrance to building 131 was also posted with a sign displaying the words "Caution Radioactive Materials" and a conventional radiation symbol in magenta on a yellow background. This latter sign also displayed the isotopes within the building, the maximum quantities of each, a date and the initials of the health physicist. The door to the laboratory where plutonium was being used was posted with a sign displaying the words "Caution Radioactive Materials", a conventional radiation symbol in magenta on a yellow background and information on the radioactive material contained, maximum quantity, date and initials of the health physicist. Some radioactive material was stored in one of the rooms in the center part of the building. The entrance to this room was posted with a sign displaying the words "Caution Radioactive Material", a conventional radiation symbol in magenta on a yellow background, information on the isotopes, quantities, a date and the initials of the health physicist. A sign displaying the words "Hot Cell In Use" is located above the entrance to the room containing the two hot cells. This sign is lit when the cells are in use. "Caution Radiation Area" signs with conventional radiation symbols in magenta on a yellow background were posted at several locations in the room containing the hot cells. One sign displaying the words "Caution High Radiation Area" and a conventional radiation symbol in magenta on a yellow background was posted in the room containing the hot cells. According to Mr. Smith, more "Caution High Radiation Area" signs are posted in the room and on the dock when the tagged sand is being prepared.

Those containers with radioactive materials and located in building 131 were labelled with the words "Caution Radioactive Material", a conventional radiation symbol in magenta on a yellow background, and information on the isotope, quantity and date. The one cobalt-60 source which could be used outside its container had a tag, attached to the source, which displayed the words "Danger, Radioactive Material, Do Not Handle, Notify Military Authorities If Found" and a conventional radiation symbol in magenta on a yellow background. A Form AEC-3 was posted at two locations in the building.

50. A target complex consisting of about 15 wooden barracks type buildings is used for decontamination experiments involving the use of the Ba-La-140 tagged sand which simulates fallout. The entire area is enclosed with a fence about 4 feet high. The gate is locked with a chain and padlock. Experiments have been performed on decontaminating roofs, walls, streets and lawns. An earth sump is located in a low section of the complex, about 50 feet from the entrance. The licensee has also dug a large pit for storing contaminated lawn and dirt until the radioactivity has decayed to background. A portion of the street area has been built to simulate freeway surfaces. The edges of the roadway are walls of concrete about 18 inches high. Concrete lined ditches with metal grates on top are located on each end of the simulated freeway area. The ditches empty into two concrete lined sumps located on either side of the roadway. The entire target complex is considered a restricted area.

51. The entrance to the target complex was posted with two signs. One sign displayed

the words "Caution Radiation Area" and the other "Caution Radioactive Materials". Both signs displayed a conventional radiation symbol in magenta on a yellow background. "Caution Radiation Area" signs were also posted at the earth sump and the pit for storing the contaminated lawn and dirt. The licensee had posted "Caution Radiation Area" signs at various locations on the fence.

52. The northern portion of the gymnasium, building 880, has been used for experiments involving radioactive materials. This area of the gymnasium is separated from the rest by a wall from the floor to the ceiling. This northern portion is divided into three separate areas: one area containing offices and a counting room, the middle area containing several rooms with 7 foot high walls and the third area consisting mainly of one large room with a large enclosure fabricated from polyethylene sheets. Since the last inspection the licensee has built a small enclosure (~6 ft. x 6 ft. x 8 ft. high) from polyethylene sheet and placed it in one of the rooms in the middle area. This small enclosure has been used in connection with the contamination of small samples, representing various types of surfaces, with simulated contaminated sea water. One of the other rooms in the middle area was used for storing a small quantity of radioactive material. Since the last inspection use of the gymnasium for work involving radioactive materials has been limited to a few experiments conducted in the small enclosure. All doors to the north portion of the gymnasium are locked when the area is unoccupied.

53. The main entrance to the north portion of the gymnasium was posted with two signs. One sign displayed the words "Caution Radiation Area" and a conventional

radiation symbol in magenta on a yellow background. The other sign displayed the words "Caution Radioactive Materials", a conventional radiation symbol in magenta on a yellow background and information on the possible isotopes in the area, the maximum quantity that might be present and a date and initials of the health physicist. A Form AEC-3 had been posted on the wall of one of the offices. The containers with radioactive material were labelled with the words "Caution Radioactive Material", a conventional radiation symbol in magenta on a yellow background and information on the isotope contained, quantity and date.

54. A hemispherical pool is used for experiments involving the use of high explosives (TNT) and radioactive material (Au-198). A large area around the pool is enclosed with a wooden fence about 5 feet high. An ~~large~~ area around the pool has been surfaced with macadam. The pool water is constantly being circulated through a filter. A large metal frame which holds experimental equipment and sample collectors can be positioned over the pool. One pound charges of TNT and 10 - 30 millicuries of Au-198 are used in the experiments. The last experiment was conducted on July 18, 1963. The gate in the fence is locked with a padlock and chain when the area is unoccupied. The area within the fence is considered the restricted area.

55. The entrance to the pool restricted area was posted with two signs. One sign displayed the words "Caution Radiation Area" and a conventional radiation symbol in magenta on a yellow background. The other sign displayed the words "Caution Radioactive Material", a conventional radiation symbol in magenta on a yellow

background and information on the isotope used in the area, the maximum quantity that may be present and a date and initials of the health physicist.

56. The licensee has one area which is used for storing contaminated vehicles and equipment and radioactive waste. This area has 3 or 4 buildings and a large yard. The area is completely fenced and the gate is locked with a chain and padlock when the area is unoccupied. Almost all of the waste and contaminated equipment and vehicles are stored inside the buildings. The fenced area is considered a restricted area.

57. The entrance to this storage area was posted with two signs. One sign displayed the words "Caution Radioactive Materials" and a conventional radiation symbol in magenta on a yellow background. The other sign displayed the words "Caution Radiation Area" and a conventional radiation symbol in magenta on a yellow background. "Caution Radiation Area" signs were also posted at various locations around the fence. Containers with radioactive material and stored in the storage area had labels which displayed the words "Caution Radioactive Material" and a conventional radiation symbol in magenta on a yellow background. The labels also showed the isotope contained (in some cases mixed fission products), an estimate of the activity and a date.

C. Surveys and Records

58. As a general rule surveys are conducted on the basis of the experimental work being performed. The only exceptions to this rule are the continuous sampling of the air from the hot cell exhaust systems and the air monitors located so as to sample the air leaving the base. Building 131 is surveyed on a periodic basis but not routinely.

Samples of air near the perimeter of the base show concentrations of 10^{-12} - 10^{-13} μc/cc, beta-gamma. Air samples from the front of the hot cells and the dock where the cement mixers are located generally show concentrations of 1×10^{-8} μc/cc. The highest air sample from the area around the hot cells was 2.6×10^{-7} μc/cc; however, samples taken 1 hour before and 1 hour after the high sample showed 1.4×10^{-9} and 6.1×10^{-8} μc/cc respectively. The highest air sample from the hot cell exhaust systems showed 6.9×10^{-10} μc/cc. Air samples made in connection with the TNT and Au-198 experiments varied between 4.5×10^{-9} and 1.4×10^{-10} μc/cc. Concentrations of activity remaining in the pool after the explosions varied between 1.5×10^{-4} and 1.4×10^{-5} μc/cc. Water samples taken from the target complex sump during October and November 1963 showed a maximum concentration of 9×10^{-5} μc/cc. Records of direct radiation measurements did not disclose excess radiation in unrestricted areas.

D. Personnel Monitoring and Waste Disposal

62. All NRDL personnel are supplied film badges which are normally exchanged on a monthly basis. The badges are issued and developed at the main facility in San Francisco. Personnel working at the hot cell and target complex are also furnished dosimeters. Dosimeters of various ranges (0 - 200 mr, 0 - 500 mr, 0 - 5 r) are used. The dosimeters have been obtained from several manufacturers.

63. Dosimeter exposure records for those persons working at Parks are maintained by the health physicist at the base. A review of these records was made. The following represents the higher exposures for the months of October and November 1963:

name	October exposure
[redacted]	432 mr
[redacted]	575 mr
[redacted]	692 mr

name	November exposure
[redacted]	678 mr
[redacted]	240 + mr

Mr. Neall explained that on one occasion during November Mr. Nuckolls' dosimeter discharged beyond the end of the scale. This explains why the record shows 240 +. Film badge records are maintained at San Francisco and are discussed in Section IV of these notes.

64. Two methods of radioactive waste disposal are used at the Parks Army base. Waste generated at the target complex, including the contamination of vehicles and equipment, is allowed to decay to background. Other radioactive waste generated at Parks is transferred to the NRDL facilities in San Francisco for disposal with waste generated at those facilities (see Section IV of these notes) There are no records of the waste that is allowed to decay to background. Records are kept of waste transferred to the San Francisco facilities.

SECTION IV
SURVEYS, PERSONNEL MONITORING AND WASTE DISPOSAL

A. Surveys

65. All facilities at San Francisco are surveyed on a routine basis. The regularity of the surveys depends upon the nature of the operations in the varic areas with some monitored monthly, some quarterly, some semiannually and some yearly. The surveys consist of direct radiation measurements and wipes to

determine removable contamination. According to Marquiss a single large (~1 sq. ft.) wipe is taken as part of the routine survey. If the wipe shows there is more than slight removable contamination (evaluated with a survey meter) in the room a complete survey of the area is made with smaller wipe samples to determine the extent of the nonfixed contamination. The routine survey program includes continuous monitoring of the exhaust air and a continuous sampling of the air outside of the building.

66. In addition to the routine survey program, other surveys are conducted as the need arises. Most of the special surveys are of the direct radiation measurement type. Where as the routine surveys are usually conducted by Rago, all members of the health physics staff perform the special surveys. It should be noted that film badges are used to survey the radiation at various locations including the perimeter of some of the restricted areas.

67. Records of the routine and special surveys are kept in separate loose leaf binders. These records are usually kept on preprinted forms. A diagram of the area being surveyed is usually drawn on the back of the form by the health physicist. Records showing the activity present in the exhaust air and outside air samples are maintained in a third binder. In many cases the activity in the exhaust air samples were below that in the outside air samples. Records of the exhaust air samples show concentrations of beta-gamma activity in the range of 2 - 30 x 10^{-12} $\mu c/cc$. A review of the routine and special survey records was made. These records did show that there was removable activity in room 165 where the leaking cobalt-60 source was being used. The records

also show that subsequent to shipping the leaking source to Oak Ridge, the room was cleaned. The records did not disclose excessive radiation levels in unrestricted areas or radiation in areas that were improperly posted.

B. Personnel Monitoring

68. Film badges are used to monitor exposures received by NRDL personnel. The film used by NRDL is obtained from Radiation Detection Company, Mountain View, California. Presently NRDL uses a DuPont #558 package which consists of two films, a sensitive type (#508) and an insensitive type (#1290). In the past a DuPont #544 package, consisting of film Nos. 555 and 834, has been used. Normally a 6 - 9 months supply of films is received at one time. Radiation Detection Company supplies a calibration curve with each shipment. Normally the badges are exchanged on a monthly basis; however if there are indications of a significant exposure the badge will be processed immediately. Film badges with neutron film and finger ring badges are obtained from Radiation Detection Company under a contract for the service.

69. All beta-gamma film badges are processed at NRDL. Two Medical Corpsmen are permanently assigned to the film badge laboratory and are responsible for developing the badges and maintaining the records. The sensitive film (#508) from each pack is developed and read. Then the insitive film associated with all sensitive films showing a density reading of 1 or more are developed and read. All films are identified by number. Two or more control films are developed each day that film is processed. Control films are those films which have been exposed by NRDL personnel to a strontium-90 source so that they receive

an exposure to a known amount of radiation. The density of all films is determined with a Macbeth-Ansco Densitometer. Exposures are obtained from the calibration curve.

70. The film badge record system consists of work sheets, monthly reports, yearly reports and a card file. The work sheets are used for recording the film densities. Copies of the monthly report are supplied to all Branch Heads and other supervisory personnel who should be aware of the exposures received by persons under his direction. The monthly report consists of the following information: employee's name; badge number; individual gamma, beta, neutron and x-ray exposures for the month; individual gamma, beta, neutron and x-ray exposures for the calender year to the date of the report. The yearly report is similar to the monthly report except that exposures for all quarters plus the yearly total are listed for gamma, beta, neutron and x-ray. The card file contains the current year's film badge results for each NRDL employee and persons assigned to duty at NRDL. A copy of the cards used, Form 12ND NRDL-179 (Rev. 1/61), is in the Region V's file for NRDL. This form contains all the information present on Form AEC-5. The file system is set up according to employees' names. A Form AEC-4 has been completed for all personnel. Personnel monitoring records for those who have left NRDL are retained in an "inactive" file. The above information on personnel monitoring was furnished by W. J. Friedman.

71. The film badge records for the year 1963 were reviewed. The following exposure information was obtained from the records and includes the maximum exposures received by NRDL personnel:

Name	Month	Exposure	Name	Month	Exposure
A. J. Guay	Nov.	260 mr	M. J. Nuckolls	Oct.	320 mr
L. L. Wiltshire	Nov.	230 mr	L. L. Wiltshire	Oct.	460 mr
M. J. Nuckolls	Nov.	50 mr	W. J. Friedman	Oct.	510 mr
A. J. Guay	Oct.	430 mr	K. Miller	Oct.	850 mr
F. E. Moorhead	Oct.	10 mr	R. H. Sorenson	Aug.	1970 mr

Total Exposure for 1963 - 11-29-63

A. J. Guay	930 mr
L. L. Wiltshire	850 mr
M. J. Nuckolls	1245 mr
F. E. Moorhead	30 mr
K. Miller	850 mr
R. H. Sorenson	2070 mr

C. Waste Disposal

72. The principle means of radioactive waste disposal used by NRDL is transfer to a licensed waste disposal firm. Both dry and liquid waste is disposed in this manner. The dry waste is accumulated in the small cardboard barrels located in most of the laboratories. Health physics personnel collect this waste when the cardboard barrels become filled and transfer it to 55 gallon metal drums which have metal tops. The sealed drums are picked up by the waste disposal firm. Liquid waste generated in the laboratories is placed in 5 gallon plastic bottles.

These bottles when filled are collected by health physics personnel and transferred to the storage tanks near building 364. The liquid waste is pumped from these tanks into the waste disposal firm's tank truck. The concentration of activity in the liquid is checked by NRDL health physics and if greater than 1×10^{-2} μc/cc is diluted to this concentration before transfer. All wastewater from the laundry is disposed of by this means.

73. All liquid effluents from building 815, with the exception of those from toilets, are deposited into one of two large holdup tanks. When filled, the liquid in the tank is analyzed. If the concentration of activity is below the limits in Appendix B, Table II of 10 CFR Part 20 the contents of the tank is released to the sewer. According to Marquiss, two tanks of liquid are collected each working day and one tank is collected each day of the weekend or on a holiday. There is a period of about 4 hours between the time the tank is filled and the time the contents are released to the sewer. A period of 1 - 2 hours is all the time necessary to analyze the sample. Marquiss said that it was possible for a tank of liquids with concentrations in excess of the limits to be dumped (on Saturday or Sunday); however, when averaged with the other releases during the week, the concentration would be below the limit.

74. The licensee maintains records of all radioactive waste transferred to waste disposal firms and the results of radioanalysis of building 815 holdup tank samples. The transfer records are kept in a bound notebook, while the analysis records are in a loose leaf binder. The following information is

maintained with respect to the radioanalysis: sample number, sample date, liquid level in tank, vol. of liquid in tank (cc), vol. of liquid in tank (gal.), specific activity, total activity, total activity disposed to date for the year. The four highest concentrations were 1 - 2 x 10^{-6} μc/cc. The total activity released to the sewer in 1963, through 12/16/63, was 1792.2 μc. In 1963 the following radioactive waste transfers were made.

Nuclear Engineering Company (AEC licensee)

DATE		
1-28-63	mixed fission products	2 drums @ 4 mc each, 1 drum @ 2 mc 29 drums @<1 mc, 1 box @ 2 mc 3 boxes @~0.3 mc each, 4 boxes @<0.1 mc each
2-11-63 and 3-27-63	mixed fission products and Ba-La-140	6 boxes with a total of 52.8 mc
9-10-63	mixed fission products	1500 gallons liquid @ 1.7 x 10^{-3} μc/c

California Nuclear Company (California licensee)

11-18-63	mixed fission products	7 boxes (60 cu. ft. each) 5 mc total

AEC Land Burial, Idaho Falls, Idaho

2-28-63	1 concrete block	15.3 c Co-60, 3 c Sr-90, 10 c H-3, 200 mc mixed fission products

SECTION V
LEAK TESTING AND INSTRUMENTATION

A. Leak Testing of Sealed Source

75. Health physics personnel are responsible for leak testing all sealed sources. Since last January, this responsibility has belonged almost exclusively to Kielwasser. Kielwasser stated that leak tests are conducted according to the written procedures which were submitted with the February 6, 1963 application for license No. 4-487-8. A copy of these procedures is in the Region V file. Smith explained that because of the number of sealed sources, Kielwasser has found it necessary to leak test some of the sources each month. During the period of transition, an effort was supposedly made to leak test the sources before the six month period rather than extending the period beyond six months.

76. Leak test records consist of the counting work sheets and the inventory cards. The dates of the leak test are recorded on the card for each source. The work sheets are divided into columns which provide space for recording the date, counting data and results in terms of microcuries. A review of the leak test records was made and the following leak test data was specifically noted.

Source	Source Number	Curies	Leak Test Dates
cobalt-60	1	< 11 curies	June '62 and June 26, 1963
cobalt-60	4	6.3 curies (Mar.'51)	Jan. '63 and Sept. 17, 1963
cobalt-60	101	25.3 curies	Dec. '62 and Dec. 12, 1963
cobalt-60	106	7.2 curies	Dec. '62 and Sept. 18, 1963
cesium-137	1	10 curies	Dec. '62 and Dec. 12, 1963
cesium-137	8	130 curies	Jan. '63 and Sept. 19, 1963

cesium-137	10	500 millicuries	April 5, 1962 and May 15, 1963
strontium-90	36	5 millicuries	Feb. '62 and May 9, 1963
strontium-90	41	25 millicuries	June '62 and June 26, 1963
plutonium (PuF_4)	4	760 grams	June '62 and Sept. 3, 1963
plutonium (PuBe)	1	2 grams	June '62 and March '63
plutonium (PuBe)	2	79.93 grams	June '62, June 19, 1963 & Dec. 2,'6
plutonium (PuBe)	3	79.16 grams	June '62, July 23, 1963 & Dec. 10,'

It was also noted that several other cobalt-60 sources had not been leak tested on a six month basis as required by Condition 14 of license 4-487-3.

B. Instrumentation.

77. The licensee possesses numerous monitoring and counting equipment. This equipment is capable of measuring all types of radiation and all levels of radiation. Numerous monitoring instruments, capable of measuring all types of radiation, are located in the health physics office on the second floor of building 815. Standby monitoring equipment is stored in room 2125 of building 815. Counting and monitoring equipment was located in the laboratories and at various other sites in accordance with the needs dictated by the work being performed. A hand and foot counter was located outside the isotope storage room, room 1109. At Parks a supply of various survey instruments is maintained at the base health physics office. Other instruments are distributed throughout facilities according to the needs of the various areas. A list of the instrumentation available, as of February 1961, was included with the licensee's

February 24, 1961 application for license No. 4-487-3.

78. Mr. Smith described the changes in instrumentation which had occurred since the last inspection. Several of the older scalers have been replaced. In addition the following new equipment has been purchased.

1 single channel analyzer

2 gas flow counters (1 at Parks health physics office)

2 Baird Atomic scalers, Model 143 (both at Parks health physics office)

1 2 x 2 well crystal (at Parks health physics office)

1 Victoreen survey meter, Model 440

79. All navy type survey instruments are calibrated and serviced on a six month basis by the Radiac Facility at San Francisco Naval Shipyard. Other equipment is serviced and calibrated by the instrument shop of NRDL or the personnel using the equipment.

SECTION VI
LARGE GAMMA RADIATION FACILITY

A. Organization and Administration

80. The large cobalt-60 radiation facility, located at Camp Parks, is operated under the Administration of the Nucleonics Division. Mr. George Wyatt, Scientific Staff Assistant, is the Range Supervisor and responsible for the operation of the facility. The Range Health Physicist is Frank Devlin. Commander G. L. Bergey is the Resident Range Officer. Range Operators have been designated by

the NRDL Isotope Committee. Mr. Kenneth Miller is the Range Engineer. The duties and responsibilities of these designated persons have been described in Enclosure (1) to memorandum dated April 22, 1963 which is referenced in Condition 15 of license No. 4-487-8.

81. The facility is operated in the same manner as any research project. The original facility proposal was submitted on a NRDL Form 44 for approval by the Isotope Committee. Several modifications and procedure changes were submitted on NRDL Form 44A's. The health physics evaluation of the facility was presented on NRDL Form 76. Each new use of the facility is submitted to the Isotope Committee for approval. Mr. Wyatt stated that when he receives a request for use of the facility he assumes the program has already been approved by the Isotope Committee.

82. The training program, to be given to all persons who are nominated for the position of operator, was prepared by the Health Physics Division. According to Mr. Wayatt he reviewed the suggested program and approved its final form. The training program was described by Smith. A two hour discussion of the facilities, procedures and pertinent health physics items is held at building 815. Subsequent training takes place at the facility. Potential operators observe the operation of the facility and then operate the facility under the observation of an authorized operator. The examination consists of the individual completing one full cycle of the operation of the facility. To date the examination has been given by Frank Devlin or Kenneth Miller who was the Project Engineer on the design and setting up of the facility and

presently is considered the Range Engineer.

83. The licensee has established a list of personnel who act as Alternate Resident Range Officers when Commander Bergey is away from the base. According to Smith these persons have completed the training course but have not taken the examination. At least one of these individuals is present at all times when the facility is operated during nonnormal working hours. Their responsibilities are limited to turning the perimeter fence lights on and off at appropriate times, making radiation measurements in the control center (and recording the results) and returning the source or sources to a safe condition in case of an emergency. They are not permitted to raise the sources from their shielded storage containers. These are military personnel and these duties during the night are considered "watch" duty."

84. According to Smith, each operator is supplied with a folder. This folder contains a complete description of the facility and the procedures to be followed. This information is contained in Enclosure 2, and the 12 enclosures to it, to the April 22, 1963 memorandum from NRDL to the Division of Licensing and Regulation (subject: Byproduct Material License for Gamma Radiation Source). The licensee has modified Enclosure (11) to Enclosure (1). This enclosure formerly contained three instructions titled "Operating Instructions For Camp Parks Co-60 Facility", "Pre-Operational Check List For Camp Parks Co-60 Facility" and "Post Operational Check List For Camp Parks Co-60 Facility". The new enclosure is titled "Operators Instruction Sheet and Check Off List For The Camp Parks Co-60 Facility." The procedures are basically the same

with the exception that they reflect operational steps for the completed facility only and there has been some expansion of the detailed steps. In addition the licensee has generated an "Operators Daily Check List for Unattended Operation" and a "Standby Watch Operators Check List." The new check lists and procedures are retained in the Region V file. Smith noted that the folders supplied the alternate resident personnel did not contain the detailed drawings for the sources and containers.

85. Following Isotope Committee approval for the irradiation program, the researcher applies to the Range Supervisor for irradiation time. Mr. Wyatt said that he tries to set up the irradiation schedule for a period of six months at a time. Prior to the irradiation, the researcher obtains the set of keys to the facility, the log book and other forms from the Range Supervisor. The facility is operated with two persons present except for long irradiation periods when the facility is unattended but in a locked condition. Smith stated that in almost all cases the second person in addition to the range operator, has been Frank Devlin. Mr. Wyatt said that most of the experiments involve Divisions other than Nucleonics and an attempt has been made to have Nucleonics operators working with these other research personnel. After securing the facility at the conclusion of the irradiation, the set of keys, completed log book and completed forms are returned to the Range Supervisor. Smith noted that the Isotope Committee had approved leaving the gate to the high radiation area open during short, about 5 minutes or less, instrument calibration experiments by the Nucleonics Division. The approval was conditioned upon the gate being under continuous surveillance from the control center.

B. Facilities, Posting and Labelling

86. This facility is located in the back portion of Camp Parks. The site of the sources in a small valley surrounded by 3 hills. The restricted area is defined by a 5 foot high hog wire fence with two strands of barbed wire on the top. There are several gates in this fence, all of which are kept in a locked condition. One of these gates is located near the control center. An inner high radiation area has been defined with an 8 foot high chain link fence which is topped with 3 strands of barbed wire. The chain link fence has three gates, each in one of the valleys between the hills. These gates are kept locked except when someone is inside the high radiation area and then only one gate is open. An inner fence of hog wire, 4 foot high with two strands of barbed wire, encloses the source area, equipment shack and the machinery house. There are only two sets of keys to the facility. One set is controlled by the Range Supervisor and the other is controlled by the Resident Range Officer or an alternate in his absence.

87. The facility has four track sources and one tower source. The four track sources vary in size from 2790 to 3140 curies. The tower source is listed as 2000 curies; however, the radiation measurements indicate it is only about 1700 curies. The four track sources are located in lead filled steel containers which are mounted on small flat cars that travel on tracks. Air pressure against a working fluid raises the sources from the shielded containers. The tower source is also located in a lead filled steel container located at the bottom of the tower. The tower source is raised into position, at any point along the height of the 80 foot tower, by a steel cable which is attached to a winch in the machinery house. Enclosure (2) to Enclosure (1) which accompanied

the April 22, 1963 memorandum, NRDL to LR, adequately describes the arrangement. It is noted that an equipment shack is located near test station 1 and is not shown on the enclosure. The source containers and arrangement were found to be as described in Enclosures (3) to (8) inclusive. All source containers have covers which protect them from the elements when they are not in use. A concrete wall, about 7 feet high by 2 feet thick, has been erected just in front of the machinery house to serve as a radiation shield when the sources are exposed. Flashing red lights, which operate when the sources are exposed, are located on the top of the tower and on the top of a panel box near test station 1.

88. The control center is located on the top of one of the three surrounding hills, as shown in Enclosure (1) to Enclosure (1). The center is a small wooden building with windows in the corner facing the sources. There is a control panel for operating the sources and a telescope and long range binoculars for observing the radiation area. Both low and high range survey meters are located in the control center. A high range meter, designated IM-125(e)/PDR-43, which measures radiation from 0 - 500 r/minute (using three scales) is located in a panel box near test station 1. The meter readout is located on the control panel in the control center.

89. Signs have been posted at numerous locations on the restricted area fence. Some of the signs display the words "Danger Keep Out" and others display the words "Caution Radiation Area" and a conventional radiation symbol in magenta on a yellow background. Both types of signs were at a single location.

A sign displaying the words "Restricted Area" was posted on the side of the control center so as to be visible at the gate in the restricted area fence. The high radiation area fence was posted at numerous locations with signs displaying the words "Caution High Radiation Area" and a conventional radiation symbol in magenta on a yellow background. Lights were located above each such high radiation area sign. Each gate in the high radiation area fence was posted with a sign displaying the following words:

"Personnel Are Required To Wear Film Badges
Inside of Radiation Area
Film Badges Can Be
Obtained At Bldg. 730."

A Form AEC-3 was posted on the wall of the control center.

90. The side of the equipment shack was posted with a large sign displaying the following words:

"If You Are Reading This Sign
Danger
You May Not Be Exposed To Radioactive
Material--Leave This Area At Once!! And
Report Your Accidental Exposure To
The Camp Parks Military Command."

The words "Danger Radiation Area", in ~3 foot letters, had been spelled out on the ground near the pole as a warning to pilots and sky divers. A sign displaying the words "Caution Radiation Area" and a conventional radiation symbol in magenta on a yellow background was posted near the base of the tower. Each of the containers was posted with the words "Caution Radioactive Material", a radiation caution symbol in magenta on a yellow background and information on

the isotope contained, quantity and date.

C. Surveys and Records

91. Several surveys of the area have been conducted. The initial surveys were conducted when the first two sources were possessed under license No. 4-487-3. The high radiation area fence was established on the basis of the 20 mr/hr isodose lines from the tower source exposed (at full height) and then one of the cart sources exposed. The fence was set along the outer of the lines except where the fence followed a straight line outside either of the isodose lines. A survey of the high radiation fence, with all five sources exposed, showed the radiation levels varied from a maximum of 85 mr/hr to a minimum 30 mr/hr or less. The Nucleonics Division has also performed dosimetry measurements for various gamma source geometries. The dose data is needed by the Biological and Medical Sciences Division to determine the length and locations of their irradiation experiments. The licensee has recorded the fence survey results and dosimetry information.

92. A review of the log book and completed checklists, maintained by the Range Supervisor, was made during this inspection. These records show that the facility was first used on July 9, 1963. The log book shows that on two occasions dogs were removed from inside the high radiation area fence. The log also shows that F. Morehead first operated the facility as an operator on July 22, 1963. According to the log the facility was operated on 15 days in November '63 and 7 days in December '63, to the date of the inspection. At the time of the inspection the facility was shut down for maintenance. The checklists were completed according to instructions with two exceptions. On August 18,

1963 K. Miller did not complete the last page of the checklist (post operational checklist). On October 15, 1963 K. Miller did not complete item 10 which refers to the inspection of the machinery house prior to operation. Mr. Wyatt explained that these omissions on the checklist were pure oversight on the part of Miller. According to Wyatt there was no question that the steps had been performed. Because he had been the original project engineer, Miller just forgot to make the record.

93. The Isotope Committee's records of facility operator approvals was examined. These records show that on June 4, 1963 three operators were approved. On November 4, 1963 a second list of operators was approved, some for operating the cart sources only and some for operating both the cart and tower sources. The records also contain an application, dated July 25, 1963, for F. Morehead and Frank Devlin to be approved as facility operators. According to Smith, both of these persons had passed the examination in the first part of July and the records are not correct or complete.

94. During the discussions with Smith, it was learned that in October 1963 the facility did not operate normally on one occasion. Neither Smith nor Wyatt nor Devlin who was present at the time, could provide the date of the occurence. Apparently the hose from the air supply to the working fluid of one of the cart sources was not securely fastened. After the source was raised the hose became detached from the air supply. The hose was provided with a "quick disconnect" fitting which sealed the hose upon separation from

the air supply fitting. The air trapped in the hose prevented the source from returning to a shielded condition. It was necessary to operate the emergency air system to return the source to the container. The emergency system applys a greater pressure on the opposite side of the fluid. When the source was returned to shielded condition the hose for the normal air supply was removed from the cart. To prevent the problem from reoccuring, a small hole has been drilled in the fitting on the end of the hose which connects to the normal air supply.

95. Neither the log book nor any other record maintained by the licensee records this malfunction. Smith, Wyatt and Devlin were fully aware of the particulars. Smith's and Wyatt's only explanation was that the problem and its solution was fully discussed verbally and that such emergencies were anticipated which resulted in the emergency air system being provided. Condition 15 of license No. 4-487-8 requires the licensee to follow the submitted procedures. The instructions and checklists require the recording of malfunctions of the facility in the log book.

SECTION VII
INSPECTION CONCLUSION

96. During the inspection an inquiry was made into the particulars associated with the large exposure (1.97 rem) received by R. H. Sorenson in August 1963. Smith stated that Sorenson was using one of the larger sources and had walked through the beam several times. Sorenson subsequently realized what had happened and

that he had not observed the usual safety procedures. Smith noted that this was not an overexposure since Form AEC-4 had been completed; however, he thought that the facts associated with the exposure had been recorded. No such record could be found by Smith.

97. A verbal summary of the inspection findings was presented to Smith and Captain Dickens at the conclusion of the inspection. Captain Campbell was not able to be present for the summary. The only items of noncompliance were failure to leak test sealed sources on a six month basis, unauthorized possession of americium-241 and failure to record a malfunction of the large gamma facility on the log book. Smith explained that they were in the process of changing the dates when various sources should be leak tested so that some could be checked each month rather than all at once. In the future there should be no problems in leak testing all sources on a six month basis. Prior to the inspection the licensee had applied to LR for an amendment to their license permitting the possession of 10 millicuries of americium-241. According to Smith, future malfunctions of the gamma facility will be recorded in the log book. The absence of a written summary of the facts concerning the large exposure to Sorenson was also discussed. Note was made that some time in the future there may be a need for this information.

592 Notes
JRM:ia
4/29/68

s/ R McKeon Inspector Concur 30 1968
W. E. Ward Reviewer 4/30/68

Department of the Navy
U.S. Naval Radiological Defense Laboratory
San Francisco Bay Naval Shipyard
San Francisco, California

License Nos. 4-487-3 and SNM-35

General

1. An announced reinspection was conducted on April 17, 18, 19 and 22, 1968 of byproduct material license 4-487-3 and special nuclear material license SNM-35, both research licenses, at the above address and at Camp Parks, California. There were no representatives from the State of California present during the inspection. Personnel contacted at NRDL and present during various parts of the inspection are listed below.

A. Smith	Head, Health Physics Division, and RSO Duties include responsibility for the overall operation and supervision of the laboratory's radiological safety program.
W. Neall	Health Physicist (reporting to A. Smith) Supervisor, Camp Parks radiological safety program
J. Thomas	Physical Sciences Technician Reports to W. Neall and provides health physics services at the Camp Parks facility.
F. Fong	Health Physicist reporting to A. Smith Provides the bulk of the health physics services for the laboratories located in the main building (815) at Hunter's Point.
R. Marquis	Health Physicist (reporting to A. Smith) Duties include film badge dosimetry, waste disposal, and instrumentation.
A. Keilwasser	Physical Science Technician Responsible for accountability of all controlled materials, SNM and byproduct, maintains records of receipt and transfer of radioactive materials,

performs and maintains records of leak tests of sealed sources.

W. Cobbin — Health Physicist reporting to A. Smith Provides H.P. services for the TNC neutron generator and VanDeGraff accelerator and shares responsibilities for health physics services in Building 815.

Dr. T. Birdwell LCDR, MC, USN — Head, Medical Department, NRDL, as of July, 1967 to date. He, along with A. Smith, is Alternate Chairman of the NRDL Isotopes Committee called the Radiological Safety Committee.

J. McCracken — In charge of the radiobioassay program and reports to the Head, Radiological Health Division, CDR Block.

2. The last inspection of both the byproduct and SNM licenses was conducted on May 2, 3, 5 and 8, 1967, at which time no items of noncompliance were found.

3. According to Mr. Fong, Health Physicist, reporting to A. Smith, the use of radionuclides at the laboratory has decreased, in his opinion. He said that the use of these materials, in his estimation, was down about 50% from a year ago. He stated that more emphasis is being placed on non-nuclear work in biological and chemical warfare studies, probably as the result of the Viet Nam war effort. He did state, however, that some of the slack in the work has been taken up with increased emphasis on ~~SANP~~ SNAP capsule corrosion studies. It was observed by the inspector that many of the laboratories, which had previously been used for radioactive material studies, had been renovated for other work. It was also discovered that many of the isotopes in the various laboratories had remained in storage since the last inspection and, in some cases, over a period of several years.

would not appear that adequate evaluation of internal plutonium deposition could be made since the counting statistics would appear to be poor. J. McCracken pointed out that 1 cpm was equivalent to 5 dpm on their counter which appears to be a factor of 100 times higher than the usual limits generally used by other licensees. Earlier Mr. Fong, who evaluates urinalysis results, stated that they had no real limit outside of the licensee's judgement on urine sample counts but that, in his opinion, 1 cpm would not be significant. Those present stated that they really hadn't looked into refined techniques for evaluating plutonium urinalysis, but stated they would look into the matter and establish more refined criteria for sample analysis and evaluation including limits.

Organization and Isotopes Committee

6. The organization has changed very little since the inspection of May, 1967. An organizational diagram may be found in Appendix A of the last inspection. The changes are as follows: Dr. T.Birdwell, LCDR, replaces CDR M. I. Varon, M.D., as Medical Director. CDR M. M. Edwards replaces CDR B. Sanson as Technical and Administrative Services Director. The position of Radiological Health Division Chief, which was vacant at the time of the last inspection, is now held by CDR Block.

7. The primary function of the Radiological Safety Committee is as described in paragraph 10 of the previous inspection. There has been one change in membership; Dr. T. Bridwell replaces Dr. Varon.

8. The committee is supposed to meet yearly, but the minutes reviewed showed that the last general assembly of the committee was on November 30, 1965. According to A. Smith, isotope approvals are given by the members individually rather than having a general meeting for this purpose. Smith also said that they were going to have a meeting within the next months. A review of the minutes of November, 1965 showed that the general meetings were being changed from quarterly to annually. The minutes also showed that a spill involving americium-241 had occurred when a temporary student employee was working with the material, resulting in minor contamination spread. According to A. Smith, informal meetings sometimes are held between a few of the Branch Heads and himself or the Health Physics Branch on particular items of interest involving Health Physics rather than calling a meeting of the Radiological Safety Committee, since Mr. Smith is a member of the committee.

Instruction and Procedures

9. Written procedures are required by the license. The title of these procedures is NRDL INST. P5100.11, December, 1966. These procedures are available to radioisotope users from their Branch Heads. An interview of some of the users revealed that they were familiar with the procedures and had read them. According to A. Smith, the procedures are going to be revised but only with minor pen and ink changes with no changes in the procedures.

10. There have been some informal procedures established for use of the VanDeGraff particle accelerator. Personnel are now bioassayed on a weekly basis because of the discovery of tritium contamination on the floors and walls of the target room area. The records revealed that the contaminationwas in the neighborhood of 10^6 dpm/100 cm^2. Other informal procedures for the accelerator are in the

form of a written proposal to the VanDeGraff management people (Physical Sciences Division). This proposal included venting all vacuum pumps to the building exhaust system, better ventilation of the target area, requesting that more air sampling equipment (tritium monitors) be procured, continue efforts to decontaminate the target room below 10^4 dpm/100 cm^2 as required in the formal NRDL instructions for noncontrolled areas, and maintain worksheets of survey wipes on personnel shoes.

Procurement, Records of Receipt and Transfer

11. Receipts of transfer and procurement were reviewed with Mr. A. Keilwasser, who has charge of these records. According to Mr. Keilwasser, the method of procurement of radioactive materials has not changed since the previous inspection (a complete description of procurement methods is described in Paragraph 13 of the previous inspection notes). According to Mr. Keilwasser, there have been no exports of radioactive materials since the last inspection. A review of the records of receipt and transfer indicated that NRDL is receiving about 150 orders per year for both byproduct and SNM. These records are maintained in a logbook, which has titles "Ordered" and "Received". The "Ordered" page shows the date the material was ordered, the isotope ordered, the amount in microcuries, millicuries, or curies, the stub number (which is actually a number indicating the month, day and year and which originates from the potential user), the requestor's name, and the supplier of the material. The "Received" column shows the date received, the isotope, the amount in microcuries, millicuries or curies, a new stub number which has been assigned by the Health Physics Branch and entered on a stub card (stub cards are kept as additional records of receipt and transfer to maintain control of quantities within licensed amounts), the requestor's name, and the supplier. SNM is

entered in terms of micrograms, milligrams, or grams.

12. A logbook entitled "Transfers" shows the point of origin of a particular material, the isotope, the amount in uCi, mCi, or Ci, and a description which includes who transferred the material and any other pertinent information. The records indicated that there have been approximately 50-60 transfers of radioactive material per year.

Inventory of Licensed Material

13. Attached as Appendix A is an invnetory of byproduct material with atomic numbers 1 - 84 which, according to the license, can be in any chemical or physical form. Appendix B shows an inventory of the materials in special form. The alphabetical letters in the left-hand margins correspond to the alphabetical letters in the license. Attached as Appendices C, D and E are inventories of plutonium, U-235 and U-233, respectively. The amounts and forms possessed by the licensee were found to be according to the license.

14. Physical inventories of the licensed material are not taken on any particular routine basis, according to Mr. Keilwasser. He stated that since all procurements go through him, he has an up-to-date inventory at all times in his card file. The inventory cards are separated according to sealed and unsealed sources. The cards show the date of receipt, the experimenter using the material, the license amendment under which the material falls, the date of the license amendment, and the inventory amount. The card also shows the laboratory number in which the material is being used. According to Mr. Keilwasser, once a year he sends an inventory sheet to each user to fill out showing the amount of material he has on hand, the correction for decay, and whether he may have transferred the material to another laboratory.

15. In addition to the material in inventory, the licensee possesses four 80-gram plutonium-beryllium neutron sources, which they received under the provisions of 91(b) of the Atomic Energy Act. The records revealed that these four sources were received under the provisions of 91(b).

FACILITIES AND EQUIPMENT AND USES

Use of Material

16. The license authorizes use of byproduct material anywhere in the United States by NRDL when such use is in accordance with the procedures established by the Radiological Safety Committee. SNM possessed under SNM-35 may be used at military facilities provided such use is under the direct supervision and control of NRDL personnel and used in accordance with the procedures established by the Radiological Safety Committee. No SNM is used at Camp Parks.

17. Condition 11 of SNM-35 prohibits the licensee from inserting any SNM into a nuclear reactor. An amendment, issued and granted on December 15, 1965, authorizes the licensee to chemically separate, on a laboratory scale, the byproduct material resulting from the irradiation of small quantities of SNM. This amendment authorizes the irradiation of SNM at the Vallecitos Nuclear Test Reactor facility, Pleasanton, California. The licensee also transfers SNM to the TRIGA facility, Berkeley, California, and to the Stanford Research Institute for irradiation in those reactors. The licensee transfers the material for irradiation and return to NRDL utilizing a transfer form, No. 12ND NRDL-703, revised March, 1968 and attached as Annex F. These two reactors insert the material for irradiation under their own licenses and then transfer the products back to NRDL. Condition 14 of the SNM license exempts NRDL from the requirdments of Section 70.53 and 70.54 of 10 CFR 70 with respect to

transfers made by NRDL of less than 10-gram quantities of SNM for purposes of irradiation and return. An examination of the records of SNM transferred for irradiation and return were reviewed with Mr. Keilwasser. The records showed that, at most, the amount received by NRDL of U-235 plus fission products was five grams.

18. According to A. Smith, no research and development work with SNM material was being conducted at the time of this inspection.

19. Small amounts of byproduct material are still being used for seaweed uptake studies, animal injection, and animal irradiations. A large part of the program involves instrumentation studies and calibrations under the radiological Physics Radiation Instrument Branch. Tritium targets are utilized in the VanDeGraff accelerator, which is currently in operation.

20. Based on the inspector's observations of facilities and records and on statements of the various users and Health Physics personnel, it appeared that the radioactive material being used is as authorized by the two licenses.

Facility Tour at Hunters Point

21. The main laboratories inside of Building 815 and those laboratories located outside of Building 815 were toured.

22. Most of the first floor of Building 815 is taken up with the Radiation Physics Radiation Instrument Branch personnel. The main work on the first floor of this building involves the testing of instrumentation, developing new types of instruments, cobalt-60 irradiation, neutron calibration (utilizing plutonium-beryllium sources), and one laboratory devoted to the bio-medical program (seaweed uptake studies).

23. The second floor of the building contains the health physics offices and certain laboratories that involve health physics programs, such as water chemistry, counting room, film badge processing, etc.

24. The third floor of Building 815 is strictly administration and contains no radioactive material.

25. The fourth floor of Building 815 involves work under the Radiation Physics Branch (which also has laboratories on the first floor) and includes instrumentation development and repair involving small amounts of byproduct material for calibrations purposes. The main NRDL calibration range is also located on the fourth floor and contains the same sources for calibration as indicated on the previous inspection notes.

26. The Bio-Medical Division is mainly located on the fifth floor and is involved with animal studies which includes radioactive material injection into dogs and rats using tritium and carbon-14. Most of the users on this floor admitted that they have been performing very little work utilizing radioactive material in recent months and, in some cases, hadn't conducted any work in over a year.

27. The Chemical and Technical Division is located on the sixth floor and includes work on capsule corrosion studies, physical and chemical properties of radioactive material, studies using some SNM, and separation of byproduct material from SNM that the licensee has had irradiated. The Pu-238 laboratory is also located on the sixth floor. According to F. Fong, the Health Physics Branch has keys to the Pu-238 laboratory, and he said that Health Physics personnel must always be in attendance whenever work is performed in that laboratory.

28. On the first floor of Building 815 is located the Pu-238 and Pu-239 waste preparation laboratory, Room 1109, and is used exclusively by the Health Physics Branch, who have the only keys to the lab.

29. All the laboratories utilizing radioactive materials were noted to be posted in accordance with 10 CFR 20 requirements. In addition, radioactive materials posting signs located at the doors of the laboratories also included the quantities and types of isotopes in storage or use in that particular lab at the time. In all cases, it was noted that these inventories had been brought up to date in April, 1968. In addition, it was noted that the various containers for storage of the radioactive material in the labs were labelled according to regulations.

Other Buildings at Hunters Point

30. The VanDeGraff accelerator building, No. 816, was toured. Access to the target room of the VanDeGraff accelerator was limited due to the tritium contamination which existed on the floors and walls of the room. Shoe covering was required to make a tour through the target room area. Mr. Cobbin, Health Physicist, who was on this particular part of the tour, pointed out two tritium monitors located in the target room area and stated that he was going to move them outside the building and shield them due to excessive amounts of background radiation within the building which affected the instruments. It was also noted that the licensee had stored two Pu-239 sealed sources in the laboratory. According to Cobbin, the only targets used at the VanDeGraff accelerator are Titanium tritide hydrogen-3 targets, four or five curies each. He stated that there were several contained within a locked, steel container attached to the side of the wall in the target room but he wasn't certain how many were inside. The building was noted to be posted in accordance with the regulations.

31. Building 529 is the control building for the neutron generator located in Building 506. In 529, it was noted that there was a plutonium-beryllium source, 2.96 grams, stored there. According to the neutron generator operator, the primary work going on in Building 529 is the measurement of gamma energies from irradiations of various materials. A Na I gamma scanner was located in the room.

32. Building 506 houses the neutron generator which, according to the operator, had not been used in almost a year. It was noted that a steel can attached to the outside of the wall of the building was used to store titanium tritide (hydrogen-3) foils.

33. Mice irradiations, utilizing a 10-curie cobalt-60 sealed source, were being performed in Building 364 during this inspection. It was noted that the irradiation room was adequately posted and contained a red alarm light indicating a high radiation area.

34. Outside of Building 364 are located the two underground liquid waste tanks and the liquid waste sampling and processing room. It was noted that several bottles of liquid waste were setting on the floor inside of the room. The compound was posted as required by the regulations.

35. The solid waste storage area is designated Area 707. It was noted that there were eight crates of byproduct material waste ready for shipment and one crate containing accountable SNM amounting to about 100 milligrams Pu-239. The dose rate indication on the waste stored in the area showed 4 mrem/hr at two inches on one waste drum. The waste storage area was also noted to be adequately posted as required by 10 CFR 20.

Camp Parks Facilities Tour

36. The outside area designated 312 contained several crates of dirt containing byproduct material which had been used in root uptake studies of plants performed by the Stanford Research Institute during the Spring of 1967. According to W. Neall, who was present during this part of the tour, no plant uptake studies were continuing for this season but routine radiation surveys were still performed within the area that housed the crates of dirt. It was also noted that a continuous air sampler was in operation in the area. Mr. V. Lane, SRI Research Engineer, was contacted at the SRI laboratory at Camp Parks to discuss the extent of his plant isotope uptake program. He stated there were no immediate plans to grow any more plants for these studies, but they had thousands of samples left over from the spring of 1967, which they were still counting in the laboratory. He also said they were producing simulated plant fallout samples under a contract with Oak Ridge National Laboratory.

37. SNAP capsule corrosion studies in seawater are being performed at the hydropond area at the camp. The work is being performed in a trailer set up inside an exclusion area fence. At the time of this inspection, the user was performing experiments in the seawater corrosion studies and stated that the only isotopes the capsules contained were tantallum-182 and cobalt-60. It was noted that the trailer was posted "Caution - High Radiation Area" with the standard colors. According to J. Thomas, Health Physics Technician who was also present during this part of the tour, the average dose rate at the fence had been 0.03 mr/hr on routine surveys. He also said that the only keys to the fence gate were in his possession and that each user on the experiment had to contact him for the keys.

38. The surface roughness area (fenced compound) was toured. Amendment 23 authorized the licensee to use a total of 173 millicuries of strontium-85 in this particular compound for the study of the uptake of strontium from soil by plant crops growing under field conditions. The plants were grown in the spring of 1967 and harvested. It was noted that the area which had been used for the plant growth was marked off with four red poles indicating the radioactive material area. According to Mr. Thomas, there was no radioactive material detectable at this time since the strontium-85 had decayed down to nondetectable levels.

39. Amendment 23 also authorized burial of zirconium-95 and krypton-85 near Building 560, which is under the exclusive use of the Health Physics Branch. The area was noted to be overgrown, and the signs had been taken down since, according to J. Thomas, the isotopes had decayed sufficiently.

40. The hot cell building, designated 131, was toured. The building contains a variety of different rooms used for different purposes, including not only research work but waste storage for Camp Parks. According to Mr. Thomas, one side of the hot cell area was being used for the Stanford Research Institute work on simulated cesium-137 fallout samples for an Oak Ridge contract; the other side for separating Y-90 from Sr-90 for the University of California fallout studies. It was noted that there were three room air samplers located in the room, as well as one hot cell stack air sampler. One room contained six lead casks of strontium-90 solution (a mixture of seawater and Sr-90 pellets), totalling about 102 curies of strontium-90. According to Mr. Neall, users periodically sample the seawater, which is in contact with the strontium-90 pellets, to determine the solubility coefficient for Sr-90 pellets in seawater.

41. The waste storage area was noted to contain eight drums of solid waste, and it was pointed out at this time that the licensee solidifies all liquid wastes and also stores them in this room. The isotope storage room (located across from the waste room) contained a variety of liquid waste bottles and several casks of stored byproduct material. The containers were labeldd according to the regulations.

42. In June, 1967, the University of California began work on fallout studies on plants using ytterium-90. The work at Camp Parks is currently being performed in Building 305. A tour of the facility was taken in the presence of Mr. N. Balder, who is a researcher for the univeristy. Yttrium-90 is milked from the strontium-90 - yttrium-90 solution in the hot cell (Building 131) and then brought over to the 305 building, where it is stored inside a glove box. The solutions are made up in the glove box and the plants inverted and dunked into the solution. These plants are then set in large crates and transferred to a special growing chamber, which is sealed, with adequate ventilation and absolute filtration on the chamber exhaust. The air circulating from the chamber is sampled. The laboratory also includes a resin cleanup system for the drain water from the plants, as well as a vegetable grinding room where the grindings are prepared, ashed down and counted. The resins and solutions are stored in two underground tanks located in the cellar of the building. It was noted that all the fume hoods, exhaust hoods, and plant growing chamber exhausts went through absolute filters which were located on the second floor of the building. The exhaust air is also monitored.

43. All the outside areas at Camp Parks were noted to be posted as required by 10 CFR 20. The various containers, crates, casks, etc., were noted to be labeled in accordance with the regulations.

Instrumentation

44. According to Mr. Smith, the only new instruments they are anticipating for purchase are more tritium monitors (gamma compensated), for use in the VanDeGraff particle accelerator room. Since the last inspection, they have purchased an RCL 256-channel analyzer used in the health physics counting room and are in the process of purchasing a 1,028-channel analyzer to be used for the whole body counter.

45. In making the various tours, it was noted that nearly all of the instruments had been calibrated on a quarterly basis, as determined by the tags affixed to the instrument cases. However, in one or two cases, the instruments at Camp Parks were slightly overdue, but the users maintained that, even though overdue, they did change the batteries on a periodic basis and source check the instruments prior to any use.

Survey Program

46. The licensee maintains an extensive survey program involving routine and special surveys of various areas. According to Mr. Smith, all of the routine surveys of the various laboratories in Building 815, the outlying buildings at Hunters Point and the areas at Camp Parks are performed by health physics personnel. The records of the routine surveys show the date, location, description of the survey, the object monitored, distance, instrument used, dose rates for beta-gamma, and signature of the technician. Smear survey records show results in dpm/100 cm^2, the area or object surveyed, and remarks. At

Building 815 in the health physics office is located a frequency logbook showing the frequency at which certain laboratories are supposed to be surveyed and also whether they are to be surveyed for beta-gamma and/or alpha contamination. The special survey forms show all the data required on the routine survey forms, except that these surveys are done on a demand basis, and indicate additional information or remarks. Another logbook shows results of water samples, air samples, and wipe surveys, including those required for sealed sources which are transferred onto sealed source tickler cards.

47. Special work permit records are used for maintenance personnel to perform work in radioactive materials areas. These special permits must be filled out by the health physics people prior to the start of any job involving maintenance. Completed SWP records show the date, the type of job, the safety instructions to be followed, the clothing requirements, the dose rates for the job, and other general instructions for the maintenance personnel. It was noted that about 50 SWP records are generated per year.

48. In reviewing the records, it was noted that the dose rates for the different activities in Building 815 were very low, in the neighborhood of 10 mr/hr maximum, and the results of wipe test surveys were well within the limits of the NRDL standard instruction manual. The routine and special survey records at Camp Parks were similar to those used at Hunters Point.

49. Air sampling inside of the laboratories at Building 815 has not been too extensive over the last year based on the low amounts of radioactive material used in the laboratories. Air sample records for labs 677 and 685, which handle SNM, indicated a maximum concentration of 10^{-13} uc/cc alpha. For

byproduct material, the maximum concentration for air was noted to be 6×10^{-10} uc/cc beta-gamma for Rooms 658 and 622. In addition, air samples are made for fallout studies and analyzed for beta-gamma only. The records for air samples at both Hunters Point and Camp Parks show the number of the sample, the time the sample was counted, the counts per minute on the sample, the conversion to dpm, and the concentration. According to Mr. Fong, the need for air sampling is based on the amount of activity, whether wet or dry operation, and the type of procedures used in a particular laboratory.

Stack and Environmental Monitoring

46. The stack monitoring system for Building 815 consists of a strip chart recorder and strip filter paper, which is monitored with a side window glass GM tube and contains an alarm system which sounds in the health physics office when a certain predetermined level is reached. It was noted that the sample is only counted for beta-gamma activity, not for alpha. According to Mr. Fong, they felt that there wasn't much need for taking alpha samples of the building exhausts since the two laboratories that contain most of the SNM had absolute filters and other laboratories handled only small microcurie amounts ~~on~~ OR sealed sources of SNM. It was also pointed out by Messrs. Fong and Smith that there is no absolute filtration system in Building 815 except for the two laboratories that handle SNM. It was noted at Camp Parks, however, that most jobs involving byproduct material (there is no SNM at Camp Parks) utilized absolute filtration systems and stack monitoring devices in all cases. According to R. Marquis, there has been no indication of excess activity being relased from Building 815. He also stated that wenever they change the dust stop filters located in the fume hoods in the various laboratories, he personally monitors each dust-stop filter and stated that he has found absolutely no contamination for alpha-beta-gamma on any of these filters. When asked if he made a record of the surveys

of these filters, he said he forgot to. Later, at the exit interview, it was pointed out that the licensee may want to consider monitoring for alpha activity, as well as beta-gamma, in their building 815 exhausts.

50. The environmental monitoring program at Hunters Point is limited to film badges located at various places and on fences around outside enclosures. A review of the records revealed that the highest noncontrolled area dose for any three-month period was 80 mrem on a badge located on the wall outside of the VanDeGraff accelerator building. Badges for noncontrolled areas at Camp Parks revealed a maximum of 170 mrem for a one-month period on a badge located at the Stanford Research Institute's plant growth studies compound fenced area, which amounts to about 0.23 mr/hr. Condition 15 of the license exempts the licensee from 20.105(a) of 10 CFR 20 regarding dose rates in unrestricted areas. The condition allows dose rates according to the conditions of a memo from NRDL to the AEC dated September 1, 1961, which states that the licensee will not exceed 10 mr/hr in unrestricted areas for a period of not greather than 10% of the year and for an occupancy of not greater than 1% of the year. In reviewing the environmental film badge records, it appeared that the licensee has not exceeded this requirement.

51. The only records of stack monitoring at Building 815 are the strip chart recorder records. Seven environmental air sample monitoring stations are located at Camp Parks as well as air samplers on the various exhaust stacks on several of the laboratories. A review of the records showed that the average concentration for the environmental air samplers was between 10^{-13} and 10^{-14} uc/cc beta-gamma. The exhaust air sampler for the hot cell area revealed between

$3x10^{-15}$ to 10^{-14} uc/cc beta-gamma. One sample for the hot cell exhaust revealed 10^{-11} uc/cc after it was established that a leak developed in the absolute filter. The highest stack sample for the University of California project at Camp Parks was $4.8x10^{-13}$ uc/cc beta-gamma. No environmental water, soil or vegetation samples are taken at Hunters Point; however, a few are taken at Camp Parks due to the nature of the work involving outside, uncovered areas. The highest water sample, which was taken from water accumulated in the Stanford Research plant growth compound, revealed $6x10^{-6}$ uc/ml beta-gamma. Most water samples were observed to have an activity of about 10^{-7} uc/ml. According to Messrs. Neall and Thomas, some soil samples had been taken in past years but none since the last inspection.

Bioassay Program

52. The bioassay program was reviewed with Mr. J. McCracken, LTJG, who is in charge of the radiobioassay program. He stated that personnel who come to work at NRDL are always bioassayed prior to employment and when they terminate. He stated that tritium bioassay was performed on a weekly basis and plutonium on a six-month basis. He said that byproduct urinalysis sampling was done as requested and dependent on the level of a given program. In each case of byproduct bioassay,he analyzes for the isotope which may be suspect rather than trying to establish a gross beta analysis. He also said that strontium-90 users are bioassayed on a monthly basis.

53. Mr. McCracken stated that whole body counting wasn't being performed on a routine basis yet but that they were making plans to do this as soon as they received the new 1,028-channel analyzer. According to Mr. McCracken, significant urine samples are those which show two standard deviations above

normal for all radioisotopes including SNM. He stated that anything less than two standard deviations was considered statistically insignificant and not reportable to the Health Physics Branch. He said that each employee is categorized for bioassay according to the type of work he is doing and the radioactive material he is using. He stated that the results of the urinalysis are put on a special urinalysis form and then sent to the Health Physics Branch, who then review the results. A review of the records revealed that there had been no significant internal tritium deposition on the VanDeGraff accelerator operator, Mr. F. Watson, and that the very highest result was 0.5 microcuries of tritium per liter of urine. Other records for other materials revealed no significant internal deposition.

54. The plutonium bioassay records were reviewed. According to Mr. McCracken, the one-minute background counts are taken on an alpha scintillation counter and then the chemically-treated and filtered sample submitted by the employees are counted three times for one minute each. Of the records reviewed, all the counts for urine samples were less than the counts for background. When asked if there was any attempt to convert the cpm to dpm and what the alarm level was, Mr. McCracken replied that 1 cpm was equivalent to 5 dpm and that an evaluation of any results was left to the Health Physics Branch. Later, Mr. Fong was asked if he considered 1 cpm above background for plutonium in an urine sample significant; he replied "No, I don't believe it is." It was brought out at the exit interview that it appeared that one-minute counts for plutonium samples may not give adequate statistics. It was suggested that if 1 cpm were statistically significant, it could mean a significant deposition of plutonium in the human body, especially in the cases of insoluble plutonium compounds. Dr. Birdwell agreed that the laboratory has not really taken a good look at

evaluation of plutonium urine samples and that he felt it would be a good idea to make a further investigation of the adequacy of their evaluations. It was also pointed out by the inspector that values greater than 0.05 dpm per liter for the Pu were considered significant by many researchers according to the literature.

Personnel Monitoring

55. Personnel monitoring records were examined with Mr. R. Marquis. According to Marquis, everyone at the laboratory is badged. He stated that the frequency of film badge changing was monthly or quarterly according to the level of activity the employees were working with. He also said that they perform their own analysis for beta-gamma on the film badges but send neutron film bo the Radiation Detection Company, Mountain View, California, for analysis. Since the last inspection, the licensee has used data processing to report dose data. An IBM card is assigned to each employee which includes the film number, the charge code, whether monthly or quarterly badge frequency, whether neutron badges are required, whether current Form AEC-4 is in effect, the employee name, social security number, date of birth, age, the date that current monitoring for the employee started, and the lifetime total. It is important to note that these cards are used for data processing only, and there are no immediate plans to use them for computers. According to Marquis, computerization of the film badge program is a long-range program.

56. The data actually processed on printout sheets does not include all of the information on the card (such as birthdate) since some of the material is not needed by those groups receiving the data processing forms. According to Marquis, however, printing out all the data on data sheets is possible but not practical.

57. A review of the records show that the maximum exposure received by any one employee at Hunters Point or at Camp Parks was 975 mrem for the entire year of 1967. The highest beta exposure for this same year was 495 mrem, and for neutrons was 0 mrem. The highest exposure for the first quarter, 1968, was 440 mrem gamma, 0 beta and 30 mrem neutrons. For 1967, of the 650 people badged at NRDL, only 46 received positive film badge results during the entire year. The information on the data processing sheets was compared with the DD-1141 forms which the licensee maintains. Two arithmetical errors were noted on the DD-1141 forms, one in which the dose entered was 150 mrem (compared to 430 mrem on the data processing sheet) and the omission of the badge report for May, 1967, on one employee, which reduced the total on the Form DD-1141 by 95 mrem. It was pointed out to Mr. Marquis that, although it was important that the corpsmen make proper entries on the DD-1141 forms, all of the information required by the regulations was contained on the data processing and/or IBM cards.

58. The licensee uses a few pocket dosimeters, both Bendix and Landsverk types, with ranges of 0-200 mrem but, according to Marquis, these are not used except in areas where large exposures are a potential.

Waste Disposal

59. The waste disposal records were reviewed with Mr. R. Marquis. According to Mr. Marquis, there has been no incineration of radioactive wastes and no burial, except as amended by the license for special activities at Camp Parks, since the last inspection. According to Marquis, the licensee is considering burial at Camp Parks within the limits of 10 CFR 20.304.

60. The licensee has two liquid waste disposal system, one sanitary sewage and one process waste. The process waste goes to two 15,000-gallon tanks and one-gallon samples taken twice a day. These are then dumped twice a day to the sewage system if the sample shows concentration below 10 CFR 20 limits. A review of the records revealed that the highest activity in the water in these process waste tanks was 8×10^{-7} uc/cc for beta-gamma and nondetectable for alpha. The licensee's limit for these waste tanks is 3×10^{-6} uc/cc before the liquid is solidified and sent to a licensed waste disposal company.

61. The records revealed that one shipment of liquid waste went to the Nuclear Engineering Company waste disposal firm, consisting of 1,400 gallons with a concentration of 2.2×10^{-2} uc/cc.

62. One solid waste shipment had taken place since the last inspection. It involved 23 55-gallon drums and 9 large boxes of 64-cubic feet each. The records show that the shipment took place on June 23, 1967 to the Nuclear Engineering Company, and the receipt showed that about 50 curies of tritium and five millicuries of mixed fission products were shipped.

63. At Camp Parks, all radioactive liquid wastes are solidified before shipment and, since the last inspection, there has been no shipment of radioactive waste from Camp Parks of any kind.

Leak Tests of Sealed Sources

64. Leak tests on all active sealed sources are required on a six-month frequency for both SNM-35 and byproduct material license 4-487-3. The licensee has certain exemptions for leak testing for both licenses which are as follows.

Condition A of the SNM license states that the source shall be tested for leakage immediately prior to storage and upon removal of the source from storage prior to use or every two years thereafter, whichever is sooner. Condition 12A(a) of the byproduct material license states that any licensed sealed sources containing byproduct material is exempted from periodic leak tests provided the quantity of byproduct material contained in the source does not exceed 10 times the quantity specified for the byproduct material in Column 2, Schedule A, Section 31.100, 10 CFR 31, and Condition 12A(3) states that the periodic leak test required by this condition does not apply to sealed sources that are stored and not being used.

65. The leak test cards were reviewed with Mr. Keilwasser. The leak test cards showed the dates on which the sources were leak tested and are kept in separate files, one for sources in use and one for sources in storage. An additional card catalogue is labeled according to the months of the year as a tickler system for sources to be surveyed in any one particular month. In all cases the cards reviewed showed that the leak test frequencies had been six months and in all cases the contamination levels found were less than 0.005 microcuries.

66. One card for a 2 millicurie cadmium 109 source, which was fabricated by the health physics branch on October 19, 1967, had leaked after it was delivered to the user at the laboratory. The source leaked on November 6, 1967. The source was leak tested on October 19, with an activity of 4.7×10^{-5} microcuries, and again on November 7 after the source was repaired with an activity level of 1.9×10^{-5} microcuries, and again on November 22, with an activity level of

1.1×10^{-4} microcuries.

67. The user reported to the health physics branch that his hands were contaminated after handling the sealed cadmium source. A survey of the user revealed 0.2 millirads/hour on his hands. The user was decontaminated to background radiation levels. No attempt was made by the health physics branch personnel to survey the source at this time but rather take it out of service and repair it. According to Al Smith, no attempt was made to evaluate the leak rate of this source since he felt that it must have been less than 0.005 microcuries judging from the contamination on the man's hands.

68. On April 22, 1968 Mr. Smith re-evaluated the probable leak rate from the source and determined that the contamination on the user's hands was 0.04 microcuries and therefore assumed that the source leak rate was much higher. The health physics branch did not report the leaking source to the AEC as required by Condition 12C of the license since the original assumption was that the leak rate was less than the level stipulated in Condition 12C. Later at the exit interview those present were told that since re-evaluation of the leaking source revealed at least 0.04 microcuries cadmium 109 removable contamination, that the licensee had been in noncompliance for not reporting the leaking source to the Commission. On April 26 a belated report of the leaking source was received by Region V.

Miscellaneous

69. During the inspection of May 2, 1967 the licensee stated that they were considering computerizing the radioactive material inventory and the film badge results. According to Mr. Smith plans for computerizing the two types of records were far reaching and there was no immediate plan to begin this in the near future.

70. During the inspection of May 2, 1967 it was questioned whether the fume hoods had velocities of greater than 100 linear feet per minute, particularly in Lab 1109 where plutonium wastes are prepared. During this inspection a representative from the Engineering group at NRDL stated that there was a routine for checking the velocities in the various fume hoods and was conducted every 18 months using an Alnor Velometer. Furthermore, according to Mr. Marquis, differential pressures are measured across the duststop filters of the various fume hoods and he said are normally one inch of water. He stated that whenever the delta pressure reached three inches of water the filters were changed.

71. During the inspection of May, 1967, it was brought out that there appeared to be a lack of proper monitoring equipment for personnel working in the various laboratories, in particular survey instruments to be used by employees prior to leaving the laboratory. During this inspection Mr. Smith stated that they felt they were in good shape in this regard and that several instruments had been placed in laboratories where the potential for contamination was greatest. Later, during a tour of the laboratories, it was observed that there were several monitoring instruments available to the employees in those areas where potential contamination to personnel existed.

72. According to Smith there has only been one incident involving the leaking cadmium 109 source which was not reported to the AEC. He also stated that there were no unusual occurrences other than the leaking source.

Attachments:
Appendices A, B, C, D, E and F

17 APR 1968

(A.) Any byproduct material with Atomic Nos. 1-84, inclusive, in any chemical or physical form. (Max. 5 Curies)

Ac^{227}	5.4 mc
Ag^{110}	1.0 mc
As^{73}	0.1 mc
Ba^{133}	0.4 mc
C^{14}	46.4 mc
Cd^{109}	14.5 mc
Ce^{144}	258.1 mc
Cl^{36}	0.09 mc
Co^{57}	6.2 mc
Co^{60}	25.7 mc
Cs^{134}	34.7 mc

(A) Continued

Eu^{152}	1.5 mc
Fe^{55}	2 mc
Ge^{68}	1 mc
H^{3}	412.2 mc
Kr^{85}	205 mc
Mn^{54}	1 mc
Na^{22}	5.1 mc
Ni^{63}	5.8 mc
Pb^{210}	2.3 mc
Po^{210}	0.1 mc
Ru^{106}	8 mc
S^{35}	1 mc

(A) Continued

Sr^{85}	100 mc
Tc^{97}	30 mc
Tc^{99}	1 mc
Te^{127}	5 mc
Ti^{44}	7.1 μc
Tl^{204}	38 mc
Tm^{170}	2.5 mc
Y^{88}	1 mc
Zn^{65}	5 mc
Zr^{95}	1 mc

17 APR 1968

(B.) Am^{241} 22.9 mc

(N) Pa^{240} Be 33 mc

(C) Am^{241} O sealed since 29 2 Curies

(P) Buried Fission Products

(D) Am^{243} 0.965 μc

(O) Pm^{147} 50 mc

(E) Ba^{140} —

(R) Tm^{170} —

(F) Cf^{252} —

(S) Tm^{171} —

(G) Cm^{244} 0.05 mc

(T) Cs^{51} —

(H) Co^{60} 1769.45 Curies

(U) Ta^{182} 4 mc

(I) Cs^{137} 925.22 Curies

(V) Cs^{137} 16.3 Curies

(J) Au^{198} —

(W) Y^{90} —

(K) H^{3} targets 124.28 Curies

(X) Pm^{147} —

(L) La^{140} —

(M) Np^{237} 0.2 mc

APPENDIX B

Form AEC-578
(Revised 1-59)

UNITED STATES ATOMIC ENERGY COMMISSION

MATERIAL STATUS REPORT 380051

FOR SPECIAL NUCLEAR MATERIALS HELD UNDER LICENSE
PREPARE A SEPARATE REPORT FOR EACH LICENSE

Form Approv
Budget Bureau
No. 38-R11

RIS:YBN

1. REPORTING LICENSEE:
   a. Name: U.S. Naval Radiological Defense Laboratory — c. License No.: SNM-35
   b. Address (INCLUDE ZIP CODE): San Francisco, California 94135. — d. Period Ending: 31 Dec 1967

2. MATERIAL: (Prepare separate report for each material)	3. WEIGHT UNIT	4. TOTAL QUANTITY AND ISOTOPE DATA	
Plutonium	Gram	a. ELEMENT	b. ISOTOPE
5. BEGINNING INVENTORY:		1040.91	968.28
6. RECEIPTS:			
From ____ Shipper's License No. ____		0.00	
7. TOTAL RECEIPTS		0.00	
8. PRODUCTION		0.00	
9. MATERIAL TO BE ACCOUNTED FOR (Total of lines 5, 7, and 8).		1040.91	968.28
10. SHIPMENTS:			
To ____ Consignee's License No. ____		0.00	
11. TOTAL SHIPMENTS		0.00	
12. PROCESSING LOSSES, DISCARDS, ETC.:			
a. MATERIAL FOR WHICH THE REPORTING LICENSEE IS FINANCIALLY RESPONSIBLE		0.00	
b. MATERIAL FOR WHICH THE REPORTING LICENSEE IS NOT FINANCIALLY RESPONSIBLE		0.00	
13. BURN-UP		0.00	
14. ENDING INVENTORY		1040.91	968.28
15. MATERIAL ACCOUNTED FOR (Total of lines 11, 12a, 12b, 13 and 14).		1040.91	968.28
16. DETAIL OF ENDING INVENTORY:			
a. MATERIAL ON HAND FOR WHICH REPORTING LICENSEE IS FINANCIALLY RESPONSIBLE TO THE AEC UNDER ABOVE LICENSE.		1040.91	968.28
b. MATERIAL ON HAND FOR WHICH SOMEONE OTHER THAN REPORTING LICENSEE IS FINANCIALLY RESPONSIBLE TO THE AEC (Detail below)		0.00	
Name ____ License No. ____			
c. Total of a. and b.		1040.91	968.28
17. MATERIAL IN POSSESSION OF OTHERS FOR WHICH REPORTING LICENSEE IS FINANCIALLY RESPONSIBLE TO THE AEC UNDER ABOVE LICENSE (Detail below)		0.00	
Name ____ Possessor's License No. ____			
TOTAL		0.00	

APPENDIX C (1)

COMPOSITION OF ENDING INVENTORY

FORM OF MATERIAL	ELEMENT	% OF ISOTOPE CONTAINED	ISOTOPE	REMARKS
18. COMPOSITION OF ITEM 16a.				
PuF_4 Neutron Source	760.00		706.98	
PuBe Neutron Sources (5)	258.05		240.04	
Pu-Al Wire	22.47		20.90	
Pu-Al Wire	0.30		0.28	
PuO_2	0.09		0.08	
Pu Plated Sources	< 0.01			
TOTAL	1040.91		968.28	
19. COMPOSITION OF ITEM 16b.				
	0.00			
TOTAL	0.00			
20. TOTAL INVENTORY ON HAND *(Total of Items 18 and 19).*				
21. COMPOSITION OF ITEM 17.				
	0.00			
TOTAL	0.00			

22. TO THE BEST OF MY KNOWLEDGE AND BELIEF THE INFORMATION GIVEN ABOVE AND IN THE ATTACHED SCHEDULES, IF ANY, IS TRUE, COMPLETE, AND CORRECT. Alfred Kielwasser

30 Jan 1963 ALFRED KIELWASSER, Accountability Representative

(Date) *(Signature and Title)*

18 U.S.C., SECTION 1001, ACT OF JUNE 2[illegible] 1948, 62 STAT. 749, MAKES IT A CRIMINAL OFFENSE TO MAKE A WILLFULLY FALSE STATEMENT OR REPRESENTATION TO ANY DEPARTMENT OF[illegible] ENCY OF THE UNITED STATES AS TO ANY MATTER WI[illegible] ITS JURISDICTION.

GPO 903-236

APPENDIX C (2)

Form AEC-57a
(Revised 1-59)

UNITED STATES ATOMIC ENERGY COMMISSION

MATERIAL STATUS REPORT

FOR SPECIAL NUCLEAR MATERIALS HELD UNDER LICENSE
PREPARE A SEPARATE REPORT FOR EACH LICENSE

680051

Form Approv
Budget Bure
No. 38-R11

RIS:YBN

1. REPORTING LICENSEE:
a. Name: U.S. Naval Radiological Defense Laboratory
b. Address (INCLUDE ZIP CODE): San Francisco, California 94135
c. License No.: SNM-35
d. Period Ending: 31 Dec 1967

2. MATERIAL: *(Prepare separate report for each material)*: Uranium Enriched in the Isotope 235
3. WEIGHT UNIT: Gram

	4. TOTAL QUANTITY AND ISOTOPE DATA	
	a. ELEMENT	b. ISOTOPE
5. BEGINNING INVENTORY:	97.53	90.92
6. RECEIPTS:		
From: Union Carbide Corp. Y-12 Plant — Shipper's License No.: FZB	107.00	99.75
7. TOTAL RECEIPTS	107.00	99.75
8. PRODUCTION	0.00	0.00
9. MATERIAL TO BE ACCOUNTED FOR *(Total of lines 5, 7, and 8).*	204.53	190.67
10. SHIPMENTS:		
To — Consignee's License No.	0.00	
11. TOTAL SHIPMENTS	0.00	
12. PROCESSING LOSSES, DISCARDS, ETC.:		
a. MATERIAL FOR WHICH THE REPORTING LICENSEE IS FINANCIALLY RESPONSIBLE	6.58	6.14
b. MATERIAL FOR WHICH THE REPORTING LICENSEE IS NOT FINANCIALLY RESPONSIBLE	0.00	
13. BURN-UP	0.00	
14. ENDING INVENTORY	197.95	184.53
15. MATERIAL ACCOUNTED FOR *(Total of lines 11, 12a, 12b, 13 and 14).*	204.53	190.67
16. DETAIL OF ENDING INVENTORY:		
a. MATERIAL ON HAND FOR WHICH REPORTING LICENSEE IS FINANCIALLY RESPONSIBLE TO THE AEC UNDER ABOVE LICENSE.	197.95	184.53
b. MATERIAL ON HAND FOR WHICH SOMEONE OTHER THAN REPORTING LICENSEE IS FINANCIALLY RESPONSIBLE TO THE AEC *(Detail below)*	0.00	
Name — License No.		
c. Total of a. and b.	197.95	184.53
17. MATERIAL IN POSSESSION OF OTHERS FOR WHICH REPORTING LICENSEE IS FINANCIALLY RESPONSIBLE TO THE AEC UNDER ABOVE LICENSE *(Detail below)*	0.00	
Name — Possessor's License No.		
TOTAL	0.00	

APPENDIX D

COMPOSITION OF ENDING INVENTORY

FORM OF MATERIAL	ELEMENT	% OF ISOTOPE CONTAINED	ISOTOPE	REMARKS
18. COMPOSITION OF ITEM 16a.				
Metal Foil	139.35	93.22	129.90	
Solution (HNO_3)	46.06	93.22	42.94	
Metal Wire	9.99	93.18	9.31	
Metal Foil (1 mil)	1.52	93.17	1.42	
Metal Particles	0.99	93.14	0.92	
U-235 (UO_2)	0.04	93.14	0.04	
Plated Sources (3)	< 0.01			
TOTAL	197.95		184.53	
19. COMPOSITION OF ITEM 16b.				
	0.00			
TOTAL	0.00			
20. TOTAL INVENTORY ON HAND *(Total of Items 18 and 19).*	197.95		184.53	
21. COMPOSITION OF ITEM 17.				
	0.00			
TOTAL	0.00			

22. TO THE BEST OF MY KNOWLEDGE AND BELIEF THE INFORMATION GIVEN ABOVE AND IN THE ATTACHED SCHEDULES, IF ANY, IS TRUE, COMPLETE, AND CORRECT.

Alfred Kielwasser

30 Jan 1968 (Date) — ALFRED KIELWASSER Accountability Representative (Signature and Title)

18 U.S.C., SECTION 1001, ACT OF JUNE 25, 1948, 62 STAT. 749, MAKES IT A CRIMINAL OFFENSE TO MAKE A WILLFULLY FALSE STATEMENT OR REPRESENTATION TO ANY DEPARTMENT OR AGENCY OF THE UNITED STATES AS TO ANY MATTER WITHIN ITS JURISDICTION. GPO 903-236

APPENDIX D (2)

Form AEC-578
(Revised 1-59)

UNITED STATES ATOMIC ENERGY COMMISSION

MATERIAL STATUS REPORT

FOR SPECIAL NUCLEAR MATERIALS HELD UNDER LICENSE
PREPARE A SEPARATE REPORT FOR EACH LICENSE

Form Approv
Budget Bureau
No. 38-R11.

R:S:YBN

1. REPORTING LICENSEE:
a. Name U.S. Naval Radiological Defense Laboratory
b. Address San Francisco, California 94135 (INCLUDE ZIP CODE)
c. License No. SNM-35
d. Period Ending 31 Dec 1967

2. MATERIAL: *(Prepare separate report for each material)*	3. WEIGHT UNIT	4. TOTAL QUANTITY AND ISOTOPE DATA	
		a. ELEMENT	b. ISOTOPE
Uranium-233	Gram		
5. BEGINNING INVENTORY:		12.06	11.73
6. RECEIPTS:			
From / Shipper's License No.		0.00	
7. TOTAL RECEIPTS		0.00	
8. PRODUCTION		0.00	
9. MATERIAL TO BE ACCOUNTED FOR *(Total of lines 5, 7, and 8).*		12.06	11.73
10. SHIPMENTS:			
To / Consignee's License No.		0.00	
11. TOTAL SHIPMENTS		0.00	
12. PROCESSING LOSSES, DISCARDS, ETC.:			
a. MATERIAL FOR WHICH THE REPORTING LICENSEE IS FINANCIALLY RESPONSIBLE		0.00	
b. MATERIAL FOR WHICH THE REPORTING LICENSEE IS NOT FINANCIALLY RESPONSIBLE		0.00	
13. BURN-UP		0.00	
14. ENDING INVENTORY		12.06	11.73
15. MATERIAL ACCOUNTED FOR *(Total of lines 11, 12a, 12b, 13 and 14).*		12.06	11.73
16. DETAIL OF ENDING INVENTORY:			
a. MATERIAL ON HAND FOR WHICH REPORTING LICENSEE IS FINANCIALLY RESPONSIBLE TO THE AEC UNDER ABOVE LICENSE.		12.06	11.73
b. MATERIAL ON HAND FOR WHICH SOMEONE OTHER THAN REPORTING LICENSEE IS FINANCIALLY RESPONSIBLE TO THE AEC *(Detail below)*			
Name / License No.		0.00	
c. Total of a. and b.		12.06	11.73
17. MATERIAL IN POSSESSION OF OTHERS FOR WHICH REPORTING LICENSEE IS FINANCIALLY RESPONSIBLE TO THE AEC UNDER ABOVE LICENSE *(Detail below)*			
Name / Possessor's License No.		0.00	
TOTAL		0.00	

APPENDIX E (1)

COMPOSITION OF ENDING INVENTORY

FORM OF MATERIAL	ELEMENT	% OF ISOTOPE CONTAINED	ISOTOPE	REMARKS
18. COMPOSITION OF ITEM 16a.				
U-233 $O_2(NO_3)_2$	0.10	98.7	0.10	
U-233 Foil (20 mil)	1.41	97.7	1.38	
U-233 Oxide	10.55	97.11	10.25	
TOTAL	12.06		11.73	
19. COMPOSITION OF ITEM 16b.				
	0.00		0.00	
TOTAL	0.00		0.00	
20. TOTAL INVENTORY ON HAND *(Total of Items 18 and 19).*	12.06		11.73	
21. COMPOSITION OF ITEM 17.				
	0.00			
TOTAL	0.00			

22. TO THE BEST OF MY KNOWLEDGE AND BELIEF THE INFORMATION GIVEN ABOVE AND IN THE ATTACHED SCHEDULES, IF ANY, IS TRUE, COMPLETE, AND CORRECT.

Alfred Kielwasser

30 Jan 1968 ALFRED KIELWASSER, Accountability Representative

(Date) *(Signature and Title)*

18 U.S.C., SECTION 1001, ACT OF JUNE 25, 1948; 62 STAT. 749, MAKES IT A CRIMINAL OFFENSE TO MAKE A WILLFULLY FALSE STATEMENT OR REPRESENTATION TO ANY DEPARTMENT OR AGENCY OF THE UNITED STATES AS TO ANY MATTER WITHIN ITS JURISDICTION. GPO 903-236

APPENDIX E (2)

U. S. NAVAL RADIOLOGICAL DEFENSE LABORATORY
SAN FRANCISCO, CALIFORNIA 94135

SPECIAL NUCLEAR MATERIAL TRANSFER FOR IRRADIATION AND RETURN TO NRDL
(No change in lease responsibility for this transfer.)
12ND NRDL-703 (Rev 3/68)

Pursuant to an exemption granted by the Atomic Energy Commission on May 27, 1965, the transfer of Special Nuclear Material recorded herewith need not be reported on Forms AEC-578 or AEC-388 under the provisions of Section 70.53 (Material Status Reports) and Section 70.54 (Material Transfer Reports) of the Commission's Rules and Regulations, Title 10, Chapter 1, Code of Federal Regulations, Part 70.

1. Transfer Series (From)	To	Number

2. Transferred To

3. NRDL Investigator

4. Description of Material

5. QUANTITY

WEIGHT UNIT	ELEMENT WEIGHT	WEIGHT % ISOTOPE	ISOTOPE WEIGHT

6. Date Transferred	Signature
7. Date Received	Signature
8. Date Returned to NRDL	Signature
9. Date Received	Signature

ANNEX F

UNITED STATES
ATOMIC ENERGY COMMISSION
DIVISION OF COMPLIANCE
REGION V
2111 BANCROFT WAY
BERKELEY, CALIFORNIA 94704

TELEPHONE: 841-5121
EXT. 651

April 29, 1969

H. E. Book, Senior Radiation Specialist
Region V, Division of Compliance

INSPECTOR'S EVALUATION AS PER MM 900-15
DEPARTMENT OF THE NAVY, U.S. NAVAL RADIOLOGICAL DEFENSE LABORATORY
SAN FRANCISCO BAY NAVAL SHIPYARD, SAN FRANCISCO, CALIFORNIA
LICENSE NOS. 4-487-3 AND SNM-35

There appeared to be no health and safety problems associated with activities under both of the licenses.

During the inspection, NRDL announced that it would be shut down and phased out by the end of 1969. The shutdown would include the main laboratory (Building 815) as well as the particle accelerators (Van de Graff, Cockroft Walton and Cyclotron). NRDL activities at Camp Parks would be stopped and some of the programs transferred to new licensees such as the Stanford Research Institute, who has already received an AEC license, and the University of California, who may apply for an AEC license.

Activities under both licenses have not changed essentially since the previous inspection. The only new activity was the preliminary "tune up" operation of the cyclotron.

The licensee has been developing techniques in bioassay and evaluations during the past year, but it is the inspector's opinion that much more refinement is needed. Plutonium urinalysis has been done on a trial basis utilizing chemical separations methods and counting techniques using a wide beta counter which yields results in the neighborhood of <1 dpm per 24-hour sample. A routine program for tritium and SNM material bioassays has been established.

Also, the licensee has been trying to develop techniques for bioassay evaluations utilizing the whole body counter at NRDL. The licensee has procured a 1024-channel analyzer but has not had the funds to perform much research or calibrations for many isotopes or provide the necessary manpower to carry out a routine whole body counting program. The lack of further refinement in the area of bioassay does not appear to be a significant problem since the quantities and chemical states of radioactive material, both byproduct and SNM, should not result in significant personnel exposures.

The only item of noncompliance noted was the failure of the licensee to perform leak tests on certain strontium-90 sealed sources as required by the byproduct license. Details may be found in the accompanying notes. No items of noncompliance were found for the SNM licensed activities.

J. R. Metzger

J. R. Metzger
Radiation Specialist

591 & 592 Notes
Metzger/msb
4/29/69

F R Metzger Inspector 4-29-69
C H E Book Reviewer 4-29-69

Department of the Navy
U.S. Naval Radiological Defense Laboratory
San Francisco Bay Naval Shipyard
San Francisco, California 94135

License Nos. 4-487-3 and SNM-35

General

1. An announced reinspection was conducted on April 21-24, 1969, of the byproduct material and SNM research licenses at the above address and at Camp Parks, California. There were no representatives from the State of California present during the inspection. Both licenses were last inspected on April 17-19 and 22, 1968, at which time one item of noncompliance on the byproduct license was found, involving the failure of NRDL to report a leaking sealed source. An inspection conducted in May 1967 of both licenses revealed no items of noncompliance.

2. One item of noncompliance was found associated with the byproduct license, involving the failure of the licensee to leak test certain strontium-90 sealed sources as required by Condition 12A(1) of the license.

3. Much of the following information regarding NRDL plans was gathered prior to the announcement of phasing out NRDL; many of the licensee's plans will, therefore, probably be terminated.

Organization, Persons Contacted

4. There has been no change in the organizational structure and group functions since the previous inspection. An organizational diagram

is attached as Exhibit A. As the exhibit shows, there has been a change in the Commanding Officer and Medical Director, as well as a few other minor personnel changes.

5. Personnel contacted at NRDL, who were present at various parts of the inspection, are listed below.

A. Smith, Head, Health Physics Division, and Radiation Safety Officer. Duties include responsibility for the overall operation and supervision of the laboratory's radiological safety program.

W. Neall, Health Physicist reporting to A. Smith, Supervisor, Camp Parks radiological safety program.

J. Thomas, Physical Sciences Technician reporting to W. Neall. Provides health physics services at the Camp Parks facility.

F. Fong, Health Physicist reporting to A. Smith. Provides health physics services for the main laboratory at Hunters Point.

R. Marquis, Health Physicist reporting to A. Smith, whose duties include film badge dosimetry, waste disposal and providing monitoring for the cyclotron.

A. Keilwasser, Physical Sciences Technician, responsible for accountability of all controlled materials, SNM and byproduct. Maintains records of receipt and transfer of radioactive materials, performs and maintains records of leak tests of sealed sources.

Lt. Cdr. A. L. Wiley, Head, Medical Department, NRDL, and Alternate Chairman of the NRDL Radioisotopes Committee known as the Radiological Safety Committee.

HM-1-E6 W. E. Howard Handles photodosimetry records for the Health Physics Branch.

HM2 H. Griffith Handles bioassay records and performs analysis on initial and termination byproduct material bioassays.

Isotopes Committee

6. The Radiation Safety Committee has met once formally (September 11, 1968) since the previous inspection. An examination of the minutes of that meeting showed that proposals had been made which would require NRDL investigators to provide their own radiation monitoring coverage whenever the Health Physics Branch could not provide adequate coverage. Also included in the minutes were summaries of small spills and incidents which had occurred at NRDL together with their causes and corrective actions.

7. According to Mr. Smith, members of the Radiation Safety Committee may meet informally, as required, to take action on proposed uses of radioactive material. He said this usually involves a meeting with the Branch Heads of the groups that are going to use the radioactive material.

Instruction of Personnel

8. Written procedures are required by the license. These procedures are entitled NRDLINSTP 5100.11. According to Mr. Smith, these particular procedures are used at the laboratory and have not changed since the previous inspection. Mr. Smith did say, however, that the general procedure (NAVMED 5055), on which the license referenced procedures

are based, have changed in part. An example of some of the changes in the general NAVMED instructions includes that all new personnel must report all therapeutic and diagnostic doses received prior to employment at NRDL, to include blood analysis results, radiation treatment of cancer, as well as any other previous large-scale medical treatments involving radiation. Mr. Smith said that the Bio-Med Division at Bethesda, Maryland, then determines (after looking at the complete history of the individual) whether that individual should work with ionizing radiation on an occupational basis. Smith stated that in the past there have been cases where plaintiffs have been awarded damages due to health impediments supposedly caused by small amounts of ionizing radiation. He said that there may be certain borderline cases where Bio-Med may decide not to hire an individual because it would be difficult for them to prove whether any additional occupational exposure above their therapeutic doses would not cause any biological damage. He said this was the first time, that he knew of, where anyone had developed this type of procedure.

9. According to Smith, the NAVMED instructions will be changed in the future to require another type of film used in film badge dosimetry (Eastman film) rather than the type they have been using. Smith said, however, that none of these changes in the general instructions have affected the P 5100.11 instructions. He also said that they had developed no informal procedures.

Procurement, Records of Receipt, Transfer, Export

10. A complete description of the procurement procedure is described in the inspection notes of May 1967 and April 1968. According to A. Keilwasser, the procedures have not changed.

11. An observation of the receipt and transfer logbook showed that NRDL had been receiving routine orders at the rate of about 150 per year. The logbook also showed that nonroutine or special orders amounted to about 35 during the past year.

12. Two types of transfers were indicated in the logbook. The book showed that normal transfers amounted to about 30 per year, and transfers of SNM to a reactor for irradiation and return amounted to 32 for the year prior to the inspection. The book showed that irradiations of SNM had been performed at the TRIGA reactor, University of California; Vallecitos Nuclear Reactor (NTR); and the AGN reactor in San Ramon, California. The records showed that the maximum amount of U-235 transferred and returned was 5 grams, and the maximum amount of byproduct material irradiated and returned was 16 grams. License condition 14 of SNM-35 exempts the licensee from the requirements of Section 70.53 and 70.54 of 10 CFR 70 for making transfers of less than 10 gram quantities of SNM for purposes of irradiation and return.

Inventory of Licensed Material

13. An inventory of byproduct material is attached to this report as Exhibit B and of SNM material as Exhibit C. A comparison of the quantities possessed by the licensee with the respective licenses

showed that the inventory is less than those quantities authorized by either license.

14. The licensee has no method of immediately calculating inventories of licensed material in their possession. For the past two or three years, according to Mr. Keilwasser, they had been attempting to develop a computer data processing system so they could obtain an immediate inventory at any time, but so far have not had the time to develop the system. He said that, at present, an inventory requires that he receive an estimate from each user at the laboratory of the amount of material in his possession and refer to the inventory cards for sealed sources to determine the total inventory. He said that he has a mental note of the materials on hand, since the orders for material have been small and the totals amounting to much less than authorized by the license. He stated that if a user requested 2 or 3 curies of byproduct material, he would then take an inventory, since this would be close to the amounts authorized by the license. He said that in all cases of SNM, he performs an inventory since the amounts authorized by the SNM license are generally small.

Use of Licensed Material

15. The uses of the radioactive material with respect to both licenses were found to be essentially the same as described in previous inspection notes. Some of the programs at Camp Parks have been terminated and the areas released by NRDL personnel. With regard to the Van de Graff accelerator, tritium targets have not been used in the past six months, being replaced with beryllium targets.

16. Small amounts of byproduct material are still being used for various instrument calibration studies, animal injections, animal irradiations, and sea water solubility studies.

17. As noted earlier, the cyclotron has been used involving animal irradiations and generally operated at low level for "tune up" runs. According to those present during the inspection, there have been no problems with the cyclotron.

18. According to Mr. Smith, they have procured no new tritium monitors for use at the Van de Graff accelerator because tests performed on certain commercial types were unsatisfactory. He said they would still continue to use the Navy type tritium air monitors, as required. According to Messrs. Fong and Smith, much of the work at NRDL has been reduced, but some of the slack has been taken up by the testing of SNAP devices. In this regard, some work has been going on in the plutonium laboratory at NRDL. Smith also said they are negotiating for SNAP device experiments utilizing strontium-90.

19. Based on the inspector's observations of facilities and records and on statements of the various users and health physics personnel, it appeared that radioactive material was being used as authorized by the two licenses.

Facilities, Equipment

20. A tour was made of all of the facilities at Hunters Point and Camp Parks, California. During the tour, it was observed that the facilities were the same as described in the previous inspection notes,

with little or no change in the activities performed by the various users.

21. The only new activity observed was the cyclotron, Building 820, which was shut down at the time of this inspection. According to Marquis, they have performed only minor irradiations on animals and operated the cyclotron on a "tune up" program. Marquis said he had experienced no problems during cyclotron operation. Results of dosimetry studies during cyclotron operation may be found elsewhere in this report under "Survey Program".

22. At Camp Parks, the Stanford Research Institute plant growing area had been cleared out and the area released at the time of this inspection. A confirmatory survey was also performed by Region V on April 14, 1969, which showed the area to be less than AEC de minimus levels for contamination, both fixed and removable. The hydropond area at Camp Parks had also been cleaned out, surveyed, and released by NRDL personnel. The area had been used for sea water solubility studies involving cobalt-60. The cobalt-60 had been moved to the Camp Parks hot cell complex.

23. During the inspection at Camp Parks, it was observed that all of the equipment used by the Stanford Research Institute in Building 312 had been transferred to the hot cell complex where SRI's new offices are located. SRI has recently received an AEC license for conducting their experiments with plants which had been performed under NRDL's byproduct license. According to J. Thomas, the transfer of radioactive materials in the hot cell area to SRI would be completed by the end of June 1969.

24. One other change in activities at Camp Parks involved fallout studies on plants by the University of California in Building 305. Whereas the experiment had involved inverting plants into a liquid strontium-90 solution, the present study included dropping fine sand impregnated with strontium-90 onto the plants to simulate fallout. Thomas also stated that the University of California was considering applying for a license to continue their experiments on plant fallout studies in Building 305, which was being done under the NRDL byproduct license.

25. All areas and facilities visited at both Hunters Point and Camp Parks were found to be posted as required by the regulations. All containers of byproduct and SNM material were also found to be labelled as required.

Instrumentation

26. The types of instrumentation used and the frequency of calibration was as described in previous inspection notes. An examination of the instruments showed that they had been calibrated at three-month intervals. Calibrations were performed at the main laboratory at NRDL.

27. One new type of instrument had been procured since the previous inspection, a Hewlett-Packard Model 5421A 1024-channel analyzer used in conjection with the 4" x 4" sodium iodide crystal in the whole body counter at the main laboratory.

Survey Program

28. The licensee maintains an extensive program for environmental monitoring, air sampling and area surveys. The types of surveys are described fully in the inspection notes of April 1968.

29. An observation of the records revealed that the dose rates in unrestricted areas at both Hunters Point and Camp Parks were well within the license exemption from the conditions of 10 CFR 20.105(a) regarding dose rates in unrestricted areas. The condition states that the licensee will not exceed 10 mr/hr in unrestricted areas for a period of not greater than 10% of the year and for an occupancy of not greater than 1% of the year.

30. According to Mr. Marquis, they had experienced difficulty at Hunters Point in maintaining film badges for purposes of environmental monitoring on the various fences around the naval shipyard. He said that the badges were frequently stolen.

31. Records showed that the maximum result from environmental film placed at the fence near Building 364 (animal irradiator) showed 540 mrem/year gamma radiation. The maximum result for the film badge placed on the fence outside the Van de Graff building (No. 816) showed 560 gamma and 670 mrem neutrons, making a total of 1230 mrem/year. According to Marquis, there was virtually no occupancy in that area since the area had been planted in shrubs, restricting access. Marquis assured the inspector that the occupancy was much less than 1% of the time. An examination of the records for film badges placed outside of the cyclotron building (No. 820) showed 0 mrem. The licensee has established 14 film badge locations in the unrestricted areas around Building 820.

32. The maximum dose in unrestricted areas for Camp Parks occurred at the cobalt-60 range area, for which the records showed 4.08 rem/year outside the fence. Once again, assurance was given that occupancy in those areas was much less than 1% per year and the dose rate, based on 4 rem/year, amounted to about 0.3 mrem/hour. Records of exposure for film placed on the fence outside the hot cell at Camp Parks revealed 2.06 rem/year and the film badge placed near the fire house at Camp Parks revealed 0.020 rem/year. The licensee also utilizes film badges inside the various laboratories and restricted areas for purposes of area monitoring in addition to the environmental film badge program.

33. Since the previous inspection, the licensee has instituted a program for alpha counting stack air samples in addition to the regular beta-gamma counting. There are three points of release for exhaust air to unrestricted areas at the main laboratory. Stack sampling is provided for the plutonium solubility studies laboratory, Room 685; SNM waste packing area, Room 1109; and the main building exhaust for all other laboratories. It should be noted her that the plutonium laboratory incorporates triple filtration prior to release to unrestricted areas and Room 1109 incorporates single filtration.

34. Stack sample records for the plutonium laboratory were examined and showed a maximum of 3×10^{-15} uCi/cc alpha. According to Mr. Marquis, samples were counted four days after removal to allow the radon-thoron daughter products to decay sufficiently. Stack air samples from Room 1109 were examined, and the maximum was found to be 4.8×10^{-15} uCi/cc

alpha. The samples from these two laboratories were also counted for beta activity, the average of which was observed to be 1×10^{-13} uCi/cc.

35. The main building exhaust air is also sampled for beta and alpha activity. The records showed that all alpha concentrations were less than 1×10^{-14} uCi/cc. Beta activity concentrations for the main building are recorded on a strip chart. Records of individual laboratory room samples were examined and found to be less than 10^{-12} uCi/cc beta and less than 10^{-14} uCi/cc alpha.

36. There is no SNM material in any research process at Camp Parks. The licensee maintains records of air samples for release to unrestricted areas (stack samples) as well as air sampling in the process areas. Records for stack samples for the University of California, Building 305 experiment were examined, with the maximum beta activity recorded as 3.7×10^{-12} uCi/cc, with most samples showing 10^{-14} uCi/cc. Some air samples in the occupied laboratories of Building 305 showed 5×10^{-11} uCi/cc beta.

37. Records for the hot cell (Building 131) air exhaust showed the maximum to be 5×10^{-13} uCi/cc beta. Air samples taken in the occupied areas around the cell showed an average of 1×10^{-11} uCi/cc.

38. The licensee maintains 13 environmental air sample locations around Camp Parks. Records showed that the average air sample taken in unrestricted areas was about 5×10^{-13} uCi/cc beta.

39. Dose rate surveys of the various laboratories and unrestricted areas, both at Hunters Point and Camp Parks, were performed by the licensee. A program for routine wipe surveys of the various laboratories was also performed. Surveys were also made on a demand basis during each job in which employees performing the work were monitored and the areas surveyed after the completion of the job. Records for these types of surveys were examined and found to show that dose rates in the laboratory areas had been low and contamination spreads kept to a minimum within the laboratories. Occasionally, some contamination had been found to be spreading in the University of California complex at Camp Parks but was immediately detected due to the constant monitoring provided by health physics personnel. According to J. Thomas, in these cases the contamination was immediately cleaned up and not carried beyond the restricted areas.

Bioassay

40. Routine bioassay records were maintained by the Medical Department at NRDL. According to Mr. Griffith, who was interviewed during this part of the inspection, monthly routine urine samples were provided by employees whenever work involving tritium was performed. He also stated that in all cases, initial and termination bioassays are required of all individuals. He said this had often included a whole body count, which had not been done on a routine basis until recently when they were providing this service for employees terminating.

41. According to Al Smith, even though the Medical Department maintains records and performs analyses for routine samples, the Health Physics group has been given the responsibility of evaluating all bioassay results. Health Physics also has performed the chemistry and counting of the specialized types of samples, including plutonium. Smith stated that he personnally had performed the chemistry on monthly samples for people working in the plutonium laboratory. He stated that instead of using film to analyze for plutonium, he was performing a chemical separation on the urine, electroplating the samples and counting them on planchettes inside a wide beta counter set on the alpha voltage plateau. He said that they were able to see as low as 0.2 dpm.

42. An examination of some of the records revealed that some entries were in the neighborhood of 0.6 dpm alpha per 24-hour sample, and in one case, a sample for one employee showed 3.29 dpm with a resample showing 2 dpm alpha. Mr. Smith was asked what the procedure required as far as evaluating the high count. He stated that he was having trouble with the proper chemical treatment of the samples and that he had no faith in the high counts because of improper electro-deposition of the sample onto the planchette. He said that another sample would be provided and the employee would be counted on the whole body counter to detect the americium-241 in the plutonium. He stated that he really didn't believe that the employee had any internal deposition of plutonium since records of surveys and air samples had indicated that there had been no problems in the plutonium laboratory.

43. Also, Smith stated that the nature of the work in the plutonium laboratory involved the use of microspheres in sea water for solubility studies, which should not present a major contamination problem even inside the glove box. Mr. Fong stated that an instrument had been placed inside the glove box which showed a maximum indication of 50,000 dpm alpha on the surface of the exhaust filter attached to the glove box. Mr. Smith replied that if all else failed, they may attempt to have the employee counted at Hanford in Richland, Washington, to make a comparison between their counts and the NRDL analysis of the urine and whole body counting data.

44. The review of the records for bioassay for tritium showed the maximum had been 5.8 uCi/liter of urine submitted. An examination of the IBM cards for terminating employees, both for urinalysis and whole body counting, showed no detectable activity. According to Mr. Griffith, he had seen no positive results as yet for termination counts.

45. Griffith said that they had been using a well counter for gross beta counts on urinalysis samples but they were going to begin using a liquid scintillation device. He said they were also going to use the whole body counter in conjunction with the liquid scintillation device to establish a gross count for both beta and gamma emitters.

46. Records of whole body counts were maintained on typewriter printout sheets from the whole body counter analyzer. Mr. Smith said they

were still experimenting with emergency cases from other firms in trying to calibrate their own counter. He stated that they had a long way to go in developing the use of the whole body counter but had been held up due to a lack of funds and manpower. Mr. Smith also stated that they had been considering all plutonium as soluble and had not considered insoluble plutonium problems. He said that since it had been brought up, they would consider calibrating the whole body counter for americium-241 in order to make plutonium lung deposition measurements.

Personnel Monitoring

47. Film badges were provided to personnel on either a monthly or quarterly basis depending upon the types of activities they were involved with. NRDL analyzes the film badges. A complete description of the film badge and personnel monitoring procedure may be found in the inspection notes of April 1968.

48. According to Marquis, they had attempted data processing of film badge results but had been unsuccessful since they could not make the machine properly print out quarterly exposures. He stated that the current system remained the same as before; all results of film badge analyses were handwritten onto Forms DD-1141.

49. Various discussions with Smith and Marquis indicated that NRDL was seriously considering sending their film to Bethesda, Maryland, for the Navy to analyze. Smith stated that, as a result, they may have

to redefine their restricted areas to cut down on the number of film badges issued, since now all employees must use a film badge to work inside any NRDL laboratory. At the time of this inspection, about 650 employees were being badged. According to Marquis, of this number only 82 people for the year 1968 had shown positive exposure on their film badges.

50. The records for film badge results for the year 1968 showed the maximum to be 795 mrem gamma, 6300 mrem beta, and 30 mrem neutron. The highest gamma exposure had been received by Mr. J. Thomas, and the highest beta exposure was received by an SRI employee (W. Lane) also at Camp Parks. The maximum film badge exposure for 1969 through March was 255 mrem gamma, with no beta or neutron radiation.

51. The licensee utilizes pocket dosimeters for certain types of operations.

Waste Disposal

52. The main laboratory at Hunters Point utilizes two water disposal systems, one process and one sewage. The process system consists of two 15,000-gallon holdup tanks which are monitored for alpha, beta and gamma radiation prior to release to the sewer. Records revealed that NRDL was releasing water at the rate of about 12,000 gallons/week. The licensee's own limit for waste water is 3×10^{-6} uCi/cc beta and 1×10^{-7} uCi/cc alpha. According to Marquis, anything above 1×10^{-6} uCi/cc beta requires that an isotopic analysis be performed. Examination of the records revealed that the highest concentration

for beta was 4.0×10^{-6} uCi/cc. An analysis was performed on the sample for strontium-90 and other byproduct material. It was discovered that iron-59, which had been accidentally released from one of the laboratories, made up the major portion of the sample and the water was released. The records also showed that a maximum of about 2 millicuries had been released during the year prior to this inspection.

53. High level liquid waste is stored in 5-gallon jugs and solidified for shipment. Plutonium wastes are solidified and put in 2R containers prior to shipment. The records showed that approximately 1000 gallons of fixed fission products and hydrogen-3 liquid wastes had been solidified and shipped by Nuclear Engineering Company for disposal. The records also showed that two shipments took place for solid wastes from Hunters Point, one to California Nuclear on June 13, 1968 and a second to Nuclear Engineering on February 26, 1969. The former contained approximately 1.2 curies of cobalt-60 and about 10 uCi of mixed fission products; the latter contained about 10 curies of hydrogen-3 and 3 grams of plutonium-239.

54. Solid waste had been shipped by Nuclear Engineering on March 6, 1968 from Camp Parks. The records showed that 12 drums containing 6.5 mCi of cesium-137 and four boxes containing 16 mCi of cesium-137 were picked up by Nuclear Engineering Company.

Leak Tests

55. The methods and procedures for leak testing sealed sources are described in paragraph 66 of the April 1968 inspection.

56. An examination of the records for leak tests indicated that all sealed sources had been checked at six-month frequencies, as required, with the exception of all strontium-90 sealed sources. According to Mr. Keilwasser, failure to leak test the strontium-90 sources was an oversight on his part. Of the nine strontium-90 sources in the licensee's possession, six were determined by the licensee, with agreement by the inspector, to require leak tests. Two of the nine sources were determined not to be sealed sources since they were made with a combination of dental plaster and strontium-90 and were not sealed. These two sources were controlled from a contamination standpoint. One other source was a Radiac strontium-90 source possessed under another license. The status of the six sealed sources was found to be as follows.

Serial No. of Source	Quantity	Leak Test Date	Months Since Last Leak Check
50	19.7 mCi	4/9/68	11
52	100.0 mCi	3/11/68	12
41	25.0 mCi	4/9/68	11
46	50.0 mCi	4/9/68	11
42	26.0 mCi	3/21/68	12
73	40.0 uCi	6/13/68	9

57. Each source was physically observed by the inspector. In most cases, the sources were found to be in storage by the various users but were considered by the Health Physics Branch as sources in use. The byproduct license exempts the licensee from leak testing sources

which are in storage and not being used; the SNM license exempts the licensee from leak testing SNM sources in storage and not being used for a period not to exceed two years. Mr. Smith was later told that if two of the nine sources were not considered to be sealed sources, they should not be classified in the sealed source file. He agreed and said they would be disposed of.

Miscellaneous

58. According to Mr. Smith, there had been no incidents occurring since the previous inspection. Mr. Smith said they had a number of AEC contracts for SNAP work, including fuel solubility studies involving promethium-147, strontium-90 and plutonium-238.

Exit Interview

59. Present during the exit interview were Messrs. F. Fong and A. Smith. Lieutenant Commander Wiley could not appear at the exit interview because he was on leave.

60. Those present were told that there appeared to be one item of noncompliance, failure of the licensee to leak check six strontium-90 sealed sources as required by byproduct license condition 12A(1). Mr. Smith said he agreed and said that the sources would be leak checked immediately and two other sources (which were considered as not sealed) would be disposed as waste.

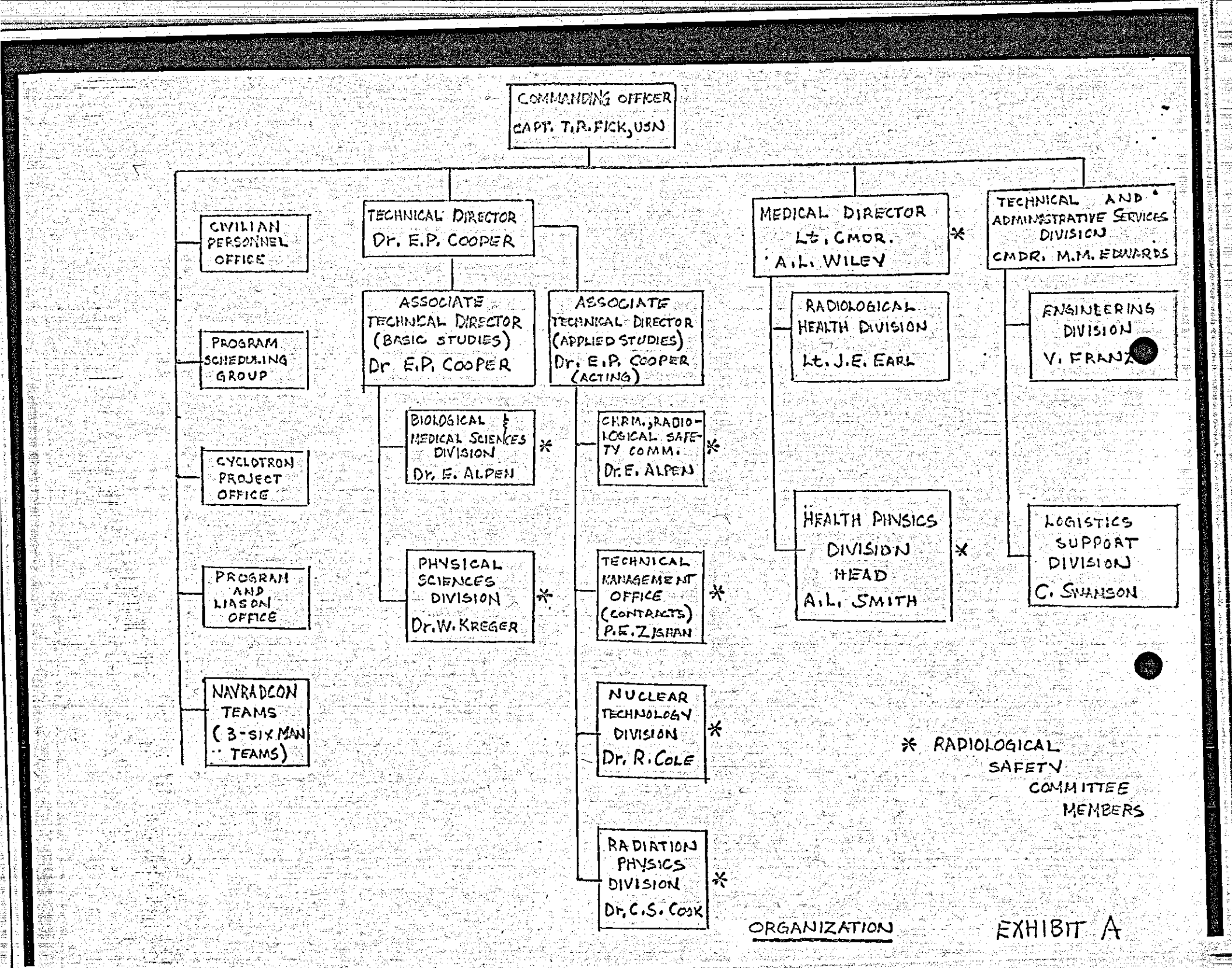
61. Some comments were offered about the plutonium laboratory with regard to the handling of microspheres of plutonium-238 and sea water in glass flasks which were said to be transported from the glove box

to the storage cabinet within the lab. Those present were told that this would appear to be poor practice. Those present agreed and indicated that, in this instance, there should be no problem since contamination surveys within the glove box indicated low amounts of activity and it was not likely that much contamination could be removed from the microspheres.

62. They were also told that the installation of surgical tubing into the glove box for pulling an air sample out of the box appeared to be poor practice since the integrity of the glove box would be broken whenever the sample was removed. Those present agreed and stated that they had never opened the air sampler and would take steps to remove it in the near future. Once again, it was determined that the activity within the glove box was low enought that there should be no hazard involved.

63. Some comments on evaluations of bioassays were also presented and discussed in detail with those present. Those present were told that it appeared that they were attempting to make evaluations of bioassay data but that much work needed to be done in refining the techniques in the area of plutonium monitoring. Those present agreed and said that they were going to attempt to calibrate the whole body counter to detect americium-241 in plutonium. They also said that they were going to incorporate a corpsman from the Medical Group into the Health Physics Branch so that they could have better control over the bioassay procedures and other associated problems.

64. Those present were also told that there appeared to be no items of noncompliance associated with the SNM-35 license and were given a Form AEC-591 so indicating. They were also told that they would be receiving a letter from the Director, Region V, Division of Compliance, pointing out the item of noncompliance on the byproduct license and would be asked to reply in writing of any corrective actions taken.



ORGANIZATION

EXHIBIT A

Naval Radiological Defense Laboratory Radioisotope Inventory as of 23 APR 1969

(A) Any byproduct material with Atomic Nos. 1-84, inclusive, in any chemical or physical form.

Ac-227	5 mc
Ag-110	5 mc
As-73	1 mc
Ba-133	1 mc
Bi-207	1 mc
Bi-210	1 mc
C-14	47 mc
Ca-45	1 mc
Cd-109	4 mc
Ce-144	45 mc
Cl-36	1 mc
Co-57	1 mc
Co-58	1 mc
Co-60	20 mc
~~Cs-137~~	
Cs-134	25 mc
Eu-152	1 mc
Fe-59	1 mc
Ge-68	1 mc
H-3	578 mc
Hg-203	80 mc
I-125	50 mc
Kr-85	100 mc
Mn-54	1 mc
Na-22	4 mc
Ni-63	5 mc
Pb-210	1 mc
Ru-103	1 mc
Ru-106	2 mc
S-35	1 mc
Sb-125	2 mc
Sn-113	5 mc
Sr-85	10 mc
Tc-97	30 mc
Tc-99	1 mc
Te-127	1 mc
Ti-44	1 mc
Tl-204	10 mc
Zn-65	1 mc
Zr-95	1 mc

EXHIBIT B-1

(B)	Am-241	53 mc
(C)	Am-241	2 C
(D)	Am-243	1 mc
(E)	Ba-140	--
(F)	Cf-252	4 uc
(G)	Cm-244	50 uc
(H)	Co-60	1250 C
(I)	Cs-137	1098 C
(J)	Au-98	--
(K)	H-3	140 C
(L)	La-140	--
(M)	Np-237	200 uc
(N)	Po-210	1 mc
(O)	Sr-90	225 C
(P)	MFP	1 C
(Q)	Pm-147	25 mc
(R)	Tm-170	200 C
(S)	Tm-171	--
(T)	Cr-51	--
(U)	Ta-182	1 C
(V)	Cs-137	15 C
(W)	Y-90	--
(X)	Pm-147	2800 C

EXHIBIT B-2

Form AEC-571
(Revised 1-59)

UNITED STATES ATOMIC ENERGY COMMISSION

MATERIAL STATUS REPORT

FOR SPECIAL NUCLEAR MATERIALS HELD UNDER LICENSE
PREPARE A SEPARATE REPORT FOR EACH LICENSE

Form Appr
Budget Bu
No. 38-R

RIS: YBN

1. REPORTING LICENSEE:
a. Name: Naval Radiological Defense Laboratory
b. Address: San Francisco, California. 94135
c. License No.: SNM-35
d. Period Ending: 31 MAR 1969

2. MATERIAL: *(Prepare separate report for each material)*	3. WEIGHT UNIT	4. TOTAL QUANTITY AND ISOTOPE DATA	
Uranium-233	Gram	a. ELEMENT	b. ISOTOPE
5. BEGINNING INVENTORY:		12.06	11.73
6. RECEIPTS:			
From / Shipper's License No.		0.00	
7. TOTAL RECEIPTS		0.00	
8. PRODUCTION		0.00	
9. MATERIAL TO BE ACCOUNTED FOR *(Total of lines 5, 7, and 8).*		12.06	11.73
10. SHIPMENTS:			
To / Consignee's License No.		0.00	
11. TOTAL SHIPMENTS		0.00	
12. PROCESSING LOSSES, DISCARDS, ETC.:			
a. MATERIAL FOR WHICH THE REPORTING LICENSEE IS FINANCIALLY RESPONSIBLE		0.00	
b. MATERIAL FOR WHICH THE REPORTING LICENSEE IS NOT FINANCIALLY RESPONSIBLE		0.00	
13. BURN-UP		0.00	
14. ENDING INVENTORY		12.06	11.73
15. MATERIAL ACCOUNTED FOR *(Total of lines 11, 12a, 12b, 13 and 14).*		12.06	11.73
16. DETAIL OF ENDING INVENTORY:			
a. MATERIAL ON HAND FOR WHICH REPORTING LICENSEE IS FINANCIALLY RESPONSIBLE TO THE AEC UNDER ABOVE LICENSE.		12.06	11.73
b. MATERIAL ON HAND FOR WHICH SOMEONE OTHER THAN REPORTING LICENSEE IS FINANCIALLY RESPONSIBLE TO THE AEC *(Detail below)*		0.00	
Name / License No.			
c. Total of a. and b.		12.06	11.73
17. MATERIAL IN POSSESSION OF OTHERS FOR WHICH REPORTING LICENSEE IS FINANCIALLY RESPONSIBLE TO THE AEC UNDER ABOVE LICENSE *(Detail below)*			
Name / Possessor's License No.		0.00	
TOTAL		0.00	

EXHIBIT C-1

FORM OF MATERIAL	ELEMENT	% OF ISOTOPE CONTAINED	ISOTOPE	REMARKS
18. COMPOSITION OF ITEM 16a.				
$U-233\ O_2(NO_3)_2$	0.10	98.7	0.10	
U-233 Foil (10 mil)	1.41	97.7	1.38	
U-233 Oxide	10.55	97.11	10.25	
TOTAL	12.06		11.73	
19. COMPOSITION OF ITEM 16b.				
	0.00			
TOTAL	0.00			
20. TOTAL INVENTORY ON HAND *(Total of Items 18 and 19).*	12.06	11.73		
21. COMPOSITION OF ITEM 17.				
	0.00			
TOTAL	0.00			

22. TO THE BEST OF MY KNOWLEDGE AND BELIEF THE INFORMATION GIVEN ABOVE AND IN THE ATTACHED SCHEDULES, IF ANY, IS TRUE, COMPLETE, AND CORRECT.

19 APR 1969 *(Date)*

Alfred Kielwasser Accountability Representative *(Signature and Title)*

18 U.S.C., SECTION 1001; ACT OF JUNE 25, 1948; 62 STAT. 749; MAKES IT A CRIMINAL OFFENSE TO MAKE A WILLFULLY FALSE STATEMENT OR REPRESENTATION TO ANY DEPARTMENT OR AGENCY OF THE UNITED STATES AS TO ANY MATTER WITHIN ITS JURISDICTION.

GPO 958-255

U.S. GOVERNMENT PRINTING OFFICE : 1961 OF—604648

EXHIBIT C-2

(Revised 1-59)

Budget Bureau No. 38-R114

MATERIAL STATUS REPORT

FOR SPECIAL NUCLEAR MATERIALS HELD UNDER LICENSE
PREPARE A SEPARATE REPORT FOR EACH LICENSE

RIS: YBN

1. REPORTING LICENSEE:
   a. Name: Naval Radiological Defense Laboratory
   b. Address: San Francisco, California 94135
   c. License No.: SNM-35
   d. Period Ending: 31 MAR 1969

2. MATERIAL: *(Prepare separate report for each material)*	3. WEIGHT UNIT	4. TOTAL QUANTITY AND ISOTOPE DATA	
Plutonium	Gram	a. ELEMENT	b. ISOTOPE
5. BEGINNING INVENTORY:		1040.91	968.28
6. RECEIPTS:			
From / Shipper's License No.			
* Naval Civil Engineering Lab. / SNM-678		160.00	148.84
* Nuclear Materials & Equip. Corp. / SNM-414		16.00	14.00
7. TOTAL RECEIPTS		176.00	162.48
8. PRODUCTION		0.00	
9. MATERIAL TO BE ACCOUNTED FOR *(Total of lines 5, 7, and 8).*		1216.91	1131.12
10. SHIPMENTS:			
To / Consignee's License No.		0.00	
11. TOTAL SHIPMENTS		0.00	
12. PROCESSING LOSSES, DISCARDS, ETC.:			
a. MATERIAL FOR WHICH THE REPORTING LICENSEE IS FINANCIALLY RESPONSIBLE		0.00	
b. MATERIAL FOR WHICH THE REPORTING LICENSEE IS NOT FINANCIALLY RESPONSIBLE		0.00	
13. BURN-UP		0.00	
14. ENDING INVENTORY		1216.91	1131.12
15. MATERIAL ACCOUNTED FOR *(Total of lines 11, 12a, 12b, 13 and 14).*		1216.91	1131.12
16. DETAIL OF ENDING INVENTORY:			
a. MATERIAL ON HAND FOR WHICH REPORTING LICENSEE IS FINANCIALLY RESPONSIBLE TO THE AEC UNDER ABOVE LICENSE.		1216.91	1131.12
b. MATERIAL ON HAND FOR WHICH SOMEONE OTHER THAN REPORTING LICENSEE IS FINANCIALLY RESPONSIBLE TO THE AEC *(Detail below)*		0.00	
Name / License No.			
c. Total of a. and b.		1216.91	1131.12
17. MATERIAL IN POSSESSION OF OTHERS FOR WHICH REPORTING LICENSEE IS FINANCIALLY RESPONSIBLE TO THE AEC UNDER ABOVE LICENSE *(Detail below)*		0.00	
Name / Possessor's License No.			
TOTAL		0.00	

NOTE: SS STATION Pu-238 ; 13.2 GRAMS - NOT SHOWN ABOVE.

EXHIBIT C-3

FORM OF MATERIAL	ELEMENT	% OF ISOTOPE CONTAINED	ISOTOPE	REMARKS
18. COMPOSITION OF ITEM 16a.				
PuF_4 Neutron Source	760.00		706.98	
PuBe Neutron Sources (7)	434.05		402.88	
PuAl Wire	22.47		20.90	
PuAl Foil	0.30		0.28	
PuO_2	0.09		0.08	
Pu Plated Sources	< 0.01			
TOTAL	1216.91		1131.12	
19. COMPOSITION OF ITEM 16b.				
	0.00			
TOTAL	0.00			
20. TOTAL INVENTORY ON HAND *(Total of Items 18 and 19).*	1216.91		1131.12	
21. COMPOSITION OF ITEM 17.				
	0.00			
TOTAL	0.00			

22. TO THE BEST OF MY KNOWLEDGE AND BELIEF THE INFORMATION GIVEN ABOVE AND IN THE ATTACHED SCHEDULES, IF ANY, IS TRUE, COMPLETE, AND CORRECT.

19 APR 1969 — Alfred Kielwasser — Accountability Represent

(Date) *(Signature and Title)*

18 U.S.C., SECTION 1001; ACT OF JUNE 25, 1948; 62 STAT. 749; MAKES IT A CRIMINAL OFFENSE TO MAKE A WILLFULLY FALSE STATEMENT REPRESENTATION TO ANY DEPARTMENT OR AGENCY OF THE UNITED STATES AS TO ANY MATTER WITHIN ITS JURISDICTION.

GPO 958-255

U.S. GOVERNMENT PRINTING OFFICE : 1961 O—606849

EXHIBIT C-1

Form AEC-570
(Revised 1-59)

UNITED STATES ATOMIC ENERGY COMMISSION

MATERIAL STATUS REPORT

FOR SPECIAL NUCLEAR MATERIALS HELD UNDER LICENSE
PREPARE A SEPARATE REPORT FOR EACH LICENSE

Form Approved
Budget Bureau
No. 38-R114

RIS: YBN

1. REPORTING LICENSEE
a. Name: Naval Radiological Defense Laboratory
b. Address: San Francisco, California 94135
c. License No.: SNM-35
d. Period Ending: 31 MAR 1969

2. MATERIAL: (Prepare separate report for each material)	3. WEIGHT UNIT	4. TOTAL QUANTITY AND ISOTOPE DATA	
Uranium Enriched in the Isotope-235	Gram	a. ELEMENT	b. ISOTOPE
5. BEGINNING INVENTORY:		175.72	163.84
6. RECEIPTS:			
From / Shipper's License No.			
* Gulf General Atomic, Inc.		8.43	7.85
7. TOTAL RECEIPTS		8.43	7.85
8. PRODUCTION		0.00	
9. MATERIAL TO BE ACCOUNTED FOR (Total of lines 5, 7, and 8).		184.15	171.69
10. SHIPMENTS:			
To / Consignee's License No.		0.00	
11. TOTAL SHIPMENTS		0.00	
12. PROCESSING LOSSES, DISCARDS, ETC.:			
a. MATERIAL FOR WHICH THE REPORTING LICENSEE IS FINANCIALLY RESPONSIBLE		28.41	26.48
b. MATERIAL FOR WHICH THE REPORTING LICENSEE IS NOT FINANCIALLY RESPONSIBLE		0.00	
13. BURN-UP		0.00	
14. ENDING INVENTORY		155.74	145.21
15. MATERIAL ACCOUNTED FOR (Total of lines 11, 12a, 12b, 13 and 14).		184.15	171.69
16. DETAIL OF ENDING INVENTORY:			
a. MATERIAL ON HAND FOR WHICH REPORTING LICENSEE IS FINANCIALLY RESPONSIBLE TO THE AEC UNDER ABOVE LICENSE.		155.74	145.21
b. MATERIAL ON HAND FOR WHICH SOMEONE OTHER THAN REPORTING LICENSEE IS FINANCIALLY RESPONSIBLE TO THE AEC (Detail below)		0.00	
Name / License No.			
c. Total of a. and b.		155.74	145.21
17. MATERIAL IN POSSESSION OF OTHERS FOR WHICH REPORTING LICENSEE IS FINANCIALLY RESPONSIBLE TO THE AEC UNDER ABOVE LICENSE (Detail below)		0.00	
Name / Possessor's License No.			
TOTAL		0.00	

EXHIBIT C-5

COMPOSITION OF ENDING INVENTORY

FORM OF MATERIAL	ELEMENT	% OF ISOTOPE CONTAINED	ISOTOPE	REMARKS
18. COMPOSITION OF ITEM 16a.				
Metal Foil	110.94	93.22	103.42	
Solution (HNO_3)	30.06	93.22	28.06	
Metal Wire	3.76	93.18	3.50	
Metal Foil (1 mil)	1.52	93.17	1.42	
UC_2 Microspheres	8.43	93.15	7.85	
Metal Particles	0.99	93.14	0.92	
UO_2 Threshold Detector	0.04	93.14	0.04	
Plated Sources (3)	< 0.01		< 0.01	
TOTAL	155.74		145.21	
19. COMPOSITION OF ITEM 16b.				
	0.00			
TOTAL	0.00			
20. TOTAL INVENTORY ON HAND (*Total of Items 18 and 19*).	155.74		145.21	
21. COMPOSITION OF ITEM 17.				
	0.00			
TOTAL	0.00			

22. TO THE BEST OF MY KNOWLEDGE AND BELIEF THE INFORMATION GIVEN ABOVE AND IN THE ATTACHED SCHEDULES, IF ANY, IS TRUE, COMPLETE, AND CORRECT.

19 APR 1969 — Alfred Kielwasser — Accountability Representative

(Date) — (Signature and Title)

18 U.S.C., SECTION 1001, ACT OF JUNE 25, 1948; 62 STAT. 749; MAKES IT A CRIMINAL OFFENSE TO MAKE A WILLFULLY FALSE STATEMENT OR REPRESENTATION TO ANY DEPARTMENT OR AGENCY OF THE UNITED STATES AS TO ANY MATTER WITHIN ITS JURISDICTION.

U.S. GOVERNMENT PRINTING OFFICE: 1961 OF—605549

EXHIBIT C-6