[redacted]

H-DIV[redacted] PROGRESS REPORT

November 20 - December 20, 1957

REF: H- 271

Class:
H-1 - C RD
H-3 - U
H-5 - C RD
H-6 - OUO
H-7 - U

I. ADMINISTRATION (Thomas L. Shipman, M.D., Leader)

A. General Remarks

None.

B. Personnel (12/1/57 - 1/1/58)

1. New Hires

12/9 BASMANN, Norma Jean H-4 Radiobiology
12/16 JONES, Douglas Ray H-5 Field

2. Terminations

12/26 GALEOTTI, Joseph F. H-1 DP Sites Monitoring

3. Total Personnel

SM	65
Military	2
SCP	117
ASC	50
TOTAL	234*

*Includes 9 casual employees.

II. GROUP H-1, MONITORING (Dean D. Meyer, Leader)

A. General

1. Ray Pederson was assigned as a full time monitor at Pajarito Site on December 12.

2. Jerry Dummer went to the Nevada Test Site from December 3 through December 10.

3. Information on construction details for the five inch alpha scintillation survey meter was given to Naval Radiological Research Laboratory and to Oak Ridge National Laboratory.

Construction drawings for the continuous tritium monitor were furnished to Brookhaven Laboratory.

4. The Alternate Group Leader went to Pantex to monitor the igloo used in the Gravel Gertie test. The residual activity has decayed to a safe level and the AEC was informed that the igloo can be cleaned out and rebuilt without further health physics supervision.

[redacted]

5. The Group Leader went to Project Sugar to advise on health physics requirements in the disassembly of a MK-15 which had been damaged by fire in an airplane crash.

6. Advice was given to GMX- and W-Divisions in health problems associated with the disassembly of W-25 weapons.

7. Design requirements were furnished for an improved ventilation and waste disposal system at TA-33, Building HP-86.

8. The exhaust filters in the Building 12 Filter House were changed during the period of November 12 to 21. Supplied air suits and full face respirators were worn during this work. No above tolerance nose counts were recorded.

9. On November 26 a complete power outage occurred in the DP West area from 7:30 a.m. to 9:50 a.m. while a new power substation was placed in operation. No one was allowed in the plant area until power had been restored. There was no detectable surface contamination as a result of this [illegible] contamination was insignificant.

Philip Lang (Date) 1/7/58

B. Incidents

1. On November 23 [redacted] of P-12 was sanding a 200 μc Cm^{244} foil holder and, in doing so, contaminated benches to 2000 c/m and up [illegible] to his personal clothing. The laboratory equipment was successfully decontaminated by H-1 and his clothing is also being processed by H-1. [redacted] reported that his hair had up to 20,000 c/m and was washed in one of the laboratory sinks. Even though it appeared that no air-borne contamination took place, urine sampling was initiated. No contamination reached [redacted] home. Several constructive suggestions have been submitted to P-12.

2. On December 12 an explosion occurred at DP West in the Room 501 filtrate receiver. The explosion was due to the accidental mixing of nitric acid and alcohol in the filtrate vessel. Surface contamination was confined to a small area in front of the unit which was easily decontaminated.

C. Special Monitoring

1. A check was made for X rays from a Sherwood device located in W-7. No significant radiation was detected; however, film badges were issued to personnel and planted around the machine.

2. A machine called "Hydro" located in Pajarito Canyon outside Kiva No. 2 was operated for 18 minutes starting at 7:45 a.m. on December 12. Due to the short length of operation time, only a few strategic positions could be monitored for gamma and neutron radiation. The shortest tolerance time calculated was 18.5 minutes outside the Kappa Site Guard Station.

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3. A bearing on the recombiner blower located in the top of the Water Boiler was replaced. Radiation levels ran from 5 to 200 rad/hr. The highest pocket dosimeter readings were 320 mr to the body and 860 mr to the wrist.

4. The Ten Site RaLa cell was entered on December 16 for the first time since the shutdown. On the 17th some of the equipment was found to read as high as 100 r/hr at contact. Exposures to personnel went as high as 800 mr corrected dosimeter reading with one entry.

5. At the new J-11 Building H-5 tested the Venturi Scrubber for water leaks and then an acid test was run involving the boiling of acid in the dissolving room hoods. The exhaust was then checked for acid and H-5 is of the opinion that had radioactive materials been used no significant contaminants would have been exhausted. The hoods have all been balanced by H-5. H-1 acted more or less as an observer of these tests but now have a better understanding of the mechanics involved.

D. Special Work

1. The surface dose from the U^{233} disc was remeasured. The coated reading was 52.5 r/hr and the uncoated, wrapped in 20 mil polyvinyl chloride, was 57.5 r/hr. These pieces of metal were cast one year and three months ago.

2. H-1 calibrated the 640 mc Co^{60} source.

3. Photodosimetry calibrated the following film types: Du Pont 1290 (Adlux), Du Pont 508, and Eastman Type 2 (a dual emulsion film in which the sensitive emulsion is scraped off for the high range readings). Exposures covered a range of 20 mr to 2000 r.

4. Photodosimetry issued and processed film badges for the 4926th Air Sampling Squadron (Kirtland) involved in NTS 58. They also processed and [illegible] approximately 80 special film badges which were [illegible] Building by Don McKown, H-1.

5. H-2 X-ray room was surveyed with film badges.

OVEREXPOSURES:

Name	Group	Area of Exposure	Radiation	Restriction Period
[redacted]	CMB-11	Pajarito	Neutrons	0-2 weeks
	SD-1	W-3	Tritium	4 months
	W-3	W-3	Tritium	4 months
	CMB-7	Unknown	Gamma	?*
	J-11	NTS 58**	Gamma	6 weeks
	H-1	Ten Site	Gamma	0-1 week

Classification changed to [illegible] by authority of the U.S.E.R.D.A. Philip Lang [illegible] (Date)
By [illegible] 6/7/78 (Signature of person making the change, and date)

*No restriction since the man works in an area supposedly free of radiation. He is now wearing pocket chambers and so far his exposure has been zero.

**[redacted] was on sampling aircraft operating out of Albuquerque; his film badge was issued by LASL. His total exposure for the operation was 1.79 rem. We understand

that several other Laboratory personnel received overexposures during the operation, but we have not received the official report from the Test Site. Their badges were furnished by Reynolds Company at Mercury.

III. GROUP N-3, SAFETY (Roy Reider, Leader)

A. Accident Record	Jan. 1 to Dec. 1, 1957	1956
Manhours Worked	5,536,663	5,717,855
Number of Disabling Injuries	18	17
Number of Days Lost	153	6,355
Frequency (Accidents per 1,000,000 Manhours)	3.4	3.0
Severity (Days Lost per 1,000,000 Manhours)	28	1,110

B. Industrial Accident Experience

1. On October 25, [redacted] an S Site Machinist, incurred an eye injury while machining the inside of an aluminum cylinder. [redacted] was wearing safety glasses but the chip entered his eye when he turned away from the work, allowing the chip to enter between the glasses and his face. Monogoggles are now used, giving complete eye protection. [redacted] received a "deep, extensive corneal ulcer". Lost time: 14 days. (Not previously reported for lack of information.)

2. On October 15, [redacted], SP-4 Driver's Helper, was helping unload a drum from a truck when he injured his left leg. As the 200-pound drum rolled from the truck to the hand-truck [redacted] was holding, the drum caused the handle of the truck to strike [redacted] on the upper left leg. Lost time: 5 days.

3. On December 5, two N-4 employees, [redacted] were injured while examining a new N-4 facility still under construction. As [redacted] and [redacted] walked through a door, construction employees unintentionally dropped a 40 pound bar joist they were using in erecting a scaffold. The joist struck [redacted] on the top of the head and [redacted] on the forehead. [redacted] received a severe blow and a 1/2 inch laceration and [redacted] the forehead. [redacted] returned to work within a few days but [redacted] is still off work.

C. Fires

No fires (other than the minor one discussed below) occurred in Laboratory facilities during the report period.

D. Property Damage and Minor Incidents

1. A voltmeter (Triplett Model 630) exploded while being used to test a 440 V circuit. Later examination showed that the instrument was properly set for this voltage range. The instrument has a range of 0-6000 volts. In dismantling the voltmeter it appeared that a short had developed in the selector switch; the resultant arc was of sufficient force to plate the interior of the Bakelite case

with brass, from the connector, and to break the case. The broken section of the case struck the operator on the head with sufficient force to momentarily stun him.

At present it is not known what preventive measures will be necessary to prevent similar occurrences.

2. A panel of a lucite box, housing a dissolver unit at DP West, was broken when nitric acid and alcohol reacted violently to pressurize the system. Due to an operator's error the nitric acid and alcohol were admitted to a large glass reservoir simultaneously. To prevent the recurrence, valve interlocks are being installed.

3. The dial plate was blown off a pressure indicator on a hydrogen fluoride line at DP West when an HF cylinder, under excessive pressure was turned on. The possibility of excessive filling was explored; however, after the cylinder was cooled it was found that the cylinder still contained excessive pressure leading us to believe that the excess gas was hydrogen formed as a result of an impurity in the HF or that HF had reacted with the cylinder.

Under consideration is the possibility of installing pressure indicators of greater capacity and pressure regulators.

4. A batch of vanadium powder and hydrochloric acid erupted or foamed over while unattended at night in Room 102, Sigma Building. The vanadium had been ball-milled, leached once, and was undergoing a second leaching to remove iron deposited in the batch from the steel balls. While this incident did not result in any loss or damage it is being written up since it is most unusual. Vanadium and HCl do not react. The first leaching should have removed all or most of the iron and should have resulted in a more violent reaction, if one were to occur, than the second leaching. It can only be presumed that the eruption was caused by unreacted iron and hydrochloric acid.

5. A filter cake of SiO_2 and PuO_2 with some carrier (Gulf BT-Oil) and contained in a stainless steel tray at DP West ignited when a hotplate, used in evaporating the carrier, was turned up too high. The fire was quickly extinguished with a fine water spray. The damage consisted of a warped lucite panel. Henceforth, the evaporation will be carried out at a lower temperature and a cover will be provided for quick smothering in the event of a similar fire.

E. Motor Vehicle Accidents

	Jan. 1 to Dec. 1, 1957	1956
Miles Driven	[illegible]	[illegible]
Number of Accidents	17	20
Rate (Accidents per 100,000 Miles)	1.19	1.2
Total Cost	$980.00	[illegible]
Accident Cost per 100,000 Miles	$64.00	$126.00

Classification changed to
by authority of the U.S.
Per Philip Laney
(Person authorizing change)
Jean Bichner 6/7/78
(Signature of person making the change, and date)

One vehicle accident occurred during the month: Driver misjudged distance and struck a post after stopping at a guard station. Damage cost: $83.00.

F. General

1. The first meeting of the newly organized Nuclear Criticality Safety Committee was held on November 25. The Committee decided on the scope of methods of operation of the Committee within the standards established by Mr. Bradbury in his Memorandum No. 10, dated October 28. The Committee also discussed three current problems submitted by Hugh Paxton.

2. A standard was written setting forth requirements and specifications for compressed air and air compressors for use in self-contained underwater breathing apparatus to be used at the Eniwetok Proving Ground.

3. A letter was written to J-Division suggesting improvements, for safety reasons, in facilities at the Nevada Test Site.

4. This Office reviewed and approved a brazing operation on beryllium hemispheres and involving fissionable materials.

5. Roy Reider was at the Nevada Test Site as Safety Consultant during Project 58 operations.

6. A member of the Group accompanied the AEC Fire Protection Engineer on surveys of the following sites: Sigma and D-Site Vaults, Ten Site, Incinerator Site, Waste Treatment, Radiochemistry Building, TA-33, GT Site, Anchor Site West, Anchor Site East, S Site, GMX-4 and 11 facilities at R Site, Bayo Canyon, Kappa Site, Q Site and Pajarito Site.

7. A member of the Group accompanied the GMX-Division Firing Site Safety Committee on surveys of firing facilities and procedures of GMX Groups 2, 4, 5, 6, 7, 8, and 11.

8. One or more members of the Group attended Project Officers' Meeting held here on December 3, 12, 18, 19 and 20. The purpose of the meetings is to acquaint support people with the purpose, requirements, safety aspects, etc., of experiments to be carried out during HARDTACK.

9. In coordination with H-5, a procedure for [illegible] for Shops Department people.

Classification changed to [illegible]
by authority of the U.S. E.R.D.A.,
Per
(Person authorizing change in classification) (Date)
By 6/7/78
(Signature of person making the change, and date)

IV. GROUP H-5, INDUSTRIAL HYGIENE (Harry F. Schulte, Leader)

A. Evaluation and Control Work

1. Routine Exposures

During this month routine air sampling was carried on for beryllium, benzene, and mercury. All of the beryllium and mercury samples collected in the

breathing zone were well below permissible concentrations. Hourly samples for beryllium were also collected, and analyzed. These also were found to be below permissible levels. Several samples were taken close to the point of operation during the beryllium work in Sigma Building, and showed concentrations above tolerance but the ventilation provided prevented such concentrations reaching the breathing zone. At Pajarito Site water dripping on the beryllium blocks caused corrosion with formation of a white powder. During cleanup of this white powder high concentrations of beryllium were produced in the air and all operators wore respirators.

Three samples out of eight collected for benzene analysis at TA-9 showed excessive concentrations of benzene. This is a very intermittent operation but one expected to continue throughout the coming year. Urine samples for sulfate determinations are being collected and physical examinations will be made on the workers by Group H-2.

2. New Materials

During this period Shop 4 machined calcium without a liquid coolant. Recommendations were made for the safe handling of this material during machining.

3. Ventilation

All of the fume hoods at TA-48 were rechecked in cooperation with Eng-2 and Eng-4. All of these hoods had been improved and were found acceptable for use.

Ventilation measurements were made on 29 chemical fume hoods located at WD Site, TA-45. Of the hoods checked, five were found to be operating at below minimum standards.

As a result of an investigation of an odor in the basement of Building 34, TD Site, it was found that a hood in an adjoining room was operating essentially in reverse and nitro benzene from the hood was coming out into the room. This resulted from the use of an automatic carbon dioxide extinguisher which shuts off a damper in the hood above the blower. The switch and damper were reset and the condition was corrected.

B. Research and Development

1. Considerable progress has been made in evaluating the ventilation collecting and air cleaning system at TA-48. All mechanical defects have been discovered and remedied. The orifice flowmeters have been calibrated and standard digestions have been run using nonradioactive filter papers. Preliminary air cleaning efficiency tests have been made for the resulting acid atmospheres using sodium hydroxide spray in the venturi. More extensive efficiency tests will be carried on in the future. Writing of the Standard Operational Procedure for the system has

been started.

2. Two members of the Engineering Development Section visited the Army Chemical Center and Army Biological Warfare Laboratories to discuss problems associated with the design and evaluation of respiratory protective equipment. A great deal of new information was obtained as a result of these visits. Plans are now being made to make a detailed study of the feasibility of developing the Air Force oxygen mask for use at Los Alamos. Also preliminary work has started on a study to evaluate available full face masks.

3. The dust chamber was completed during the month and orifices have been installed and calibrated to measure the air flow from each of the two fans. An all-glass liquid droplet dispersing unit was built and used to feed iso-amyl acetate continuously into the chamber. Further work will be done to determine the distribution of air concentrations in various parts of the chamber.

C. Miscellaneous

A meeting was held with Group H-1 Section Leaders and a revised respirator program was adopted. Several changes were made in the types of respirators to be carried in stock and the new types should be available in January. Work has now started on testing of Group H-1 and Group H-5 personnel on the use of the respirators to be available under this new program. These men are being tested for tightness of face fit with various brands of respirators and the results will be made available to the Group and Section Leaders involved. Inhalation resistance tests have now been completed on all filter and chemical cartridge respirators to be available in stock. A one-day training course in the use of the Scott Air-Pak equipment was conducted by Mr. James Flannery of the Scott Aviation Corporation. Representatives from H-1, H-5, and W-Division attended the course.

Two trade name products were analyzed during the month and one of these was put on limited distribution since it contains 30 per cent benzene. These analyses are being performed with the new gas chromatograph which enables a solvent to be analyzed in a relatively short time.

Consultations were being held with various laboratory personnel on problems involving epoxy resins, aluminum silico fluoride, cadmium nitrate and on problems associated with the installation of a vibration testing machine. Information was given on the safe handling of these materials.

Group H-5 has been working closely with Group H-1 on problems associated with tritium handling at Building H-[illegible].

Two members of the Group visited the Sandia Corporation and consulted with health personnel on various mutual problems.

D. Statistical Summary

1. Air samples collected or field tests made for:

Benzene	8
Beryllium (air)	147
Beryllium (surface swipe)	22
Mercury (labs)	4

2. Plans approved 6

3. Sanitation

Water samples collected	14

4. Analyses completed

Air

Beryllium	171

Biological (urine)

Americium	7
Gross beta activity	11
Lead	1
Mercury	1
Plutonium	192
Radium	1
Tritium	223
Uranium (fluorometric)	99
Uranium (radiometric)	11

Miscellaneous

Beryllium in respirator filters	2
Beryllium on swipes	23
Tritium in water	1

V. GROUP H-6, RADIOLOGICAL PHYSICS (Harvey I. Israel, Leader)

A. Special Problems (S. Shlaer)

1. General

The following persons were visitors to this Section on November 21 and 22: Thomas P. Turnbull and Alexander Gobus, representing the North American Philips Company, New York; Dr. Rudi Schumacher from Hamburg, West Germany, representing the C. H. F. Muller Company; and Stephen J. Knight, Jr., representing the Technical Equipment Corporation, Denver. The purpose of this visit was to investigate the cause for the unsatisfactory performance of the new 300 kv X-ray machine. The result of this investigation is that two more replacement transformers will be supplied by the North American Philips Company and placed into service by one of their representatives, probably Mr. Turnbull.

2. Work in Progress

a. The program for processing data from the 100 channel analyzer in H-4 has been debugged and will probably be completed and turned over to H-4 for

routine use during the week of December 23.

b. Work continues on the fast neutron dose albedo calculations using the Monte Carlo method.

c. For the purposes of monitoring fast neutron pulses at the Sherwood Project, several calculations and measurements were made on a commercial ionization chamber instrument (Nuclear Model 2714) to determine whether it could be used for such a purpose. On the basis of these considerations, modifications were made in the instrument. Initial success has been achieved in measuring the total neutrons emitted in the short bursts emitted by the Ixion, one of the Sherwood machines. Calibration of the instrument was made to the D-D neutrons from the Cockcroft-Walton of P-4.

d. A prototype of the Model 100-B, a new version of the standard Model 100 ionization-type instrument, was checked and found to have a negative response when only the case and not the ion chamber was exposed to radiation. The input resistors and electrometer tube were surrounded with an electrical shield to eliminate ion collection within the case. It is thought that this extra-cameral effect was the reason for the nonlinear response of the instrument as determined by P-1. New calibrations will be made and if these are satisfactory, P-1 will begin production of them soon.

3. Work Completed

The 704 program for calculating the dose rate ratio of fluorescent to scattered radiation as a function of energy of exciting radiation, thickness of fluorescent material, and angle of observation [redacted] to be used.

Classification changed to [redacted]
Per Lily Kang
(Person making the change in classification) (Date)
By Glen Lehner 6/7/72
(Signature of person making the change, and date)

B. Meteorology Section (Orin W. Stopinski)

1. General

O. W. Stopinski returned from Ft. Leavenworth, Kansas, on November 22 following ten days participation in outlining temporary field army procedures to be followed in the event of hostilities involving use of atomic weapons.

2. Work in Progress

a. Work has continued at an increased pace on reduction of local weather data. Wind tabulations have been completed and temperatures are being summarized.

b. Work has continued on plans for machine forecasting for the Pacific. R. Vogel, T-1, is now assisting in programming for data reductions leading to a test of regression equation forecasting of Pacific winds. Data are being prepared for machine runs which should begin immediately after the first of the year.

[redacted]

C. Nuclear Field Test Section (W. R. Kennedy)

1. General

a. The Committee to Evaluate Off-Site Radiation Dose at NTS, of which W. R. Kennedy is a member, met at the AEC Las Vegas Branch Office on the fourth and fifth of December. PLUMBBOB data is not yet complete, nor sufficiently processed at this time to assess dosages for the various communities surrounding the test site. Further work of evaluation will be done during December and January, and the Committee will meet again in February, 1958.

b. NTS Project 58 was carried out, firing on the 6th and 9th of December. W. R. Kennedy served as the Test Manager's Fallout Prediction Unit, and Fallout Advisor to the Test Director.

c. Precipitation samples and fallout samples contained little activity during the past month with the exception of December 13 and 14. Traces of activity were collected on these dates from the second shot of NTS 58.

2. Laboratory

a. Routine analyses were made of CM Building waste, drinking water and cooling water. Similar analyses were made of cooling and drinking water at DP West. Rain and rinse samples were checked for fallout activity.

b. Test well and surface water samples collected by the USGS in the Los Alamos area were analyzed for plutonium.

c. A preliminary study of the Bandelier tuff and soil from Ten Site Mesa indicates that the soil is 1 1/2 to 4 times as efficient an adsorption media for plutonium as the tuff. The variation in efficiency is due to differences in acidity of the plutonium bearing solution. Studies are in progress to determine the total adsorption capacity of both types of soil material.

d. Samples of sand and soil have been collected from various stream beds draining our area and are in process of being assayed for gross activity. A determination of particular nuclides will be made if any activity is found.

[redacted]
Classification changed to
by authority of the U.S.E.R.D.A.,
Per Philip Lang
(Person authorizing change in classification) (Date)
By Jean Lebsack 6/7/78
(Signature of person making the change, and date)

VI. GROUP H-7, INDUSTRIAL WASTE (C. W. Christensen, Leader)

A. Plant Operation and Research

1. TA-45, Tech Area

Operation has been generally routine. Flow has continued to be relatively high but there have been no extreme peaks and no overtime operation has been required. Both raw waste and effluent gross alpha activity have been unusually high. However, effluent Pu has been uniformly satisfactory.

[redacted]

The new raw waste rate controller has been installed. Its capacity is adequate for any reasonable treatment rate and it has greatly improved control of treatment by maintaining a uniform raw waste flow rate.

A solenoid valve has been installed on the discharge line of the caustic tank at the neutralization basin. The valve is actuated by a pH measuring unit and it will permit more accurate neutralization of raw waste than is practical by manual operation. It will also, of course, operate at night and at other periods during which no operating personnel are present.

There was no excessive air or surface contamination of operating areas during the period. Air Counts in the sludge room were high on two occasions initially but recounts were well under permissible limits.

2. TA-21, DP West

Flow to the DP West plant has been moderate by present standards although it continues to be higher than that of similar periods during past years. Activity in raw waste has been higher than usual but no recirculation or special treatment has been necessary to produce effluent of [illegible]

Air and surface contamination of operating areas has been no greater than usual.

3. TA-35, Ten Site

Nearly 50,000 gallons of waste were treated during the period. However, waste production was almost equal in volume and available waste [illegible] space does not provide a satisfactory margin of safety. Plant operation has been seriously hampered by excessive activity in all waste in all tanks. The high activity was due to a series of unfortunate incidents and accidental discharge of RaLa. Rotation of operating personnel has been necessary in order to avoid excessive exposure to radiation. The high radiation in operating areas has also prevented satisfactory maintenance of equipment. High activity in the waste is primarily due to $barium^{140}$-$lanthanum^{140}$ but it has not been possible to retain such waste for an adequate decay period.

The extremely high activity in all tanks (Gross β about 500,000 c/m/ml) prevented the operation of the ion exchange plant because the radiation level near the tanks would be extremely high making the area untenable. It was necessary, therefore, to chemically treat the waste in two of the tanks. This was done by recirculating the waste water and adding iron, soda ash and lime. This resulted in the formation of a sludge which carried most of the activity and settled to the bottom of the tanks. The result was a clean waste with about 5000 c/m/ml in one case and 20,000 c/m/ml in another and it was possible to operate the plant again.

Obviously this type of treatment cannot be continued indefinitely else the storage tanks will soon be full of sludge. Preliminary plans have been made for a small chemical treatment plant to remove the gross activity from the wastes. The sludge could then be removed to a remote area for storage and decay prior to disposal. Two 25,000 gallon water tanks at DP East are available for this project so the cost of the plant will be minimal. Preliminary laboratory tests indicate that the chemical treatment method is feasible on most types of waste and these tests will be continued to determine the most efficient method. One further consideration for the installation of a chemical treatment plant is the fact that plutonium is not removed efficiently in the ion exchange plant (probably due to the presence of complexing agents such as soap, citric acid, etc.) but it can readily be removed chemically.

Background activity in the treatment unit and storage tank areas has been substantially reduced and is not unreasonably high at present. However, exposure of personnel familiar with plant operation is [illegible] that additional exposure must be strictly limited.

B. Laboratory Section

1. Project Green Thumb

The first phase of project Green Thumb has been completed and the data analyzed. This phase comprises a study of the uptake of Sr^{90} by crops (lettuce, alfalfa, and mixed grass) growing in the presence of varied concentrations of calcium. The three crops grown were lettuce, alfalfa, and mixed grass; the calcium concentrations varied from 15 to 181 mg per 10 grams of soil. In all, thirty plots, 25 square feet, [illegible] 1 1/2 feet deep, were planted in replicate (with the exception of one plot which was left fallow for the 1957 growing season). The Sr^{90}-Y^{90} concentration was held constant at about 1000 cpm/10 grams of soil.

Chemical analyses have been made on plant extracts from three cuttings of each crop for calcium, strontium, potassium and sodium. In some cases crop silicon and associated activity have also been determined. Sufficient activity was found in the silicon fraction to warrant its combination with the soluble plant extract when total activity was determined.

At the time the third cutting of crops was made in late September and early October, soil samples were also taken at depths of 4, 8, 12, and 18 inches. The soil was assayed for available Ca and for Sr^{90}.

In all cases when Sr^{90}/mg Ca ratios in the plant were plotted against calcium concentrations in the soil, curves were obtained which indicate a decreased uptake of Sr^{90} by the plant with increased available Ca in the soil. This was true

in all three cuttings and with the three different crops. In general, there was a break in the curve as the 60 to 90 mg value of soil Ca was reached. Concentrations of Ca above these values have less effect per unit on the uptake of Sr^{90} than did concentrations below these values. It is possible that at higher concentrations of Ca some physiological changes take place in the cellular structure of the absorbing organs which influence the Sr/Ca ratio in the plant. However, there was no apparent effect on the plants since top crops from the various plots were comparably healthy. However, there was less total growth on the plots treated with higher concentrations of calcium.

Since Sr^{90} concentrations were uniform in all plots, what has been observed may be a "dilution effect" of Ca on Sr. From the present data, it is not possible to explain the observation with any degree of certainty. The curves tend to level off as the 181 mg calcium per 10 grams of soil level is reached indicating that further additions of calcium would have little effect on the Sr uptake.

There was some indication of the leaching of calcium late in September after the second cuttings were harvested. After the heavy rains, the area outside the plots took on the characteristic appearance of an alkaline soil. Therefore, the results from the cuttings were plotted against calcium found in the soil at the time of third harvest. The curves for the three crops have slopes similar to those obtained for the first two crops but were somewhat steeper. Since the soil calcium data indicated some leaching, it would be of interest to determine whether the reduced uptake of Sr in the third cutting plants was due to [illegible] calcium in the root or to soil calcium. This cannot be [illegible] obtained to date.

It should be noted that preliminary experiments with Ca leave some question as to the availability to the plant of calcium as determined by the Ammonium acetate leach method. This method is being investigated further.

Data were available from the above study which allowed the calculation of approximate discrimination factors for Sr and Ca. This factor is a ratio of soil Sr per unit of soil Ca to plant Sr per unit of plant Ca. As plotted, a ratio of one (1) would indicate neither concentration of nor discrimination against Sr by the plant; a ratio of less than one (1) indicates discrimination against Sr and more than one (1) a concentration of Sr. Libby has reported a discrimination against Sr in the "plant". Our results indicate that "plant" must be defined since grass discriminates against Sr, alfalfa concentrates Sr, and lettuce does neither; in the last case the ratio is one (1.0). Curves have been drawn for the three cases and the slopes of the lines determined. In the case of grass the slope is 0.82,

alfalfa - 1.12, and lettuce - 1.0[illegible]. These values were derived from statistical averages but are not intended to imply absolute values, since the results were quite scattered. However, they do indicate a trend and support the assumption that different plants differ with respect to discrimination against Sr.

The three crops were also grown in the presence of high $Sr(NO_3)$ and one crop (lettuce) was grown in the presence of $CaCO_3$. Preliminary data indicate that when the Sr concentration is high (16 mg/10^3 grams soil), grass and alfalfa neither discriminate against nor concentrate Sr; lettuce may discriminate against Sr under the above conditions. Further, lettuce grown on $CaCl_2$ plots indicates neither discrimination against nor concentration of Sr. There is an apparent concentration of Sr in the plant when the Ca source is $CaCO_3$. It is possible that the $CaCO_3$ added was not solubilized or was not available to the plant, and thus its inhibitory effect on Sr entering the plant has not been observed. The analysis of these data is incomplete at present. However, it would appear that the absorption of Sr from high Sr soils follows a pattern different from the absorption of Sr from low Sr soils. Sr^{90}/Ca ratio as well as total Sr^{90} in plants in the high Sr plot was as high as that in the control plot indicating that stable strontium has no diluting effect similar to that observed with calcium.

The practical application of these results to problems concerning fallout is not clear. At present one may conclude that with certain crops the application of calcium to the soil may be beneficial in reducing the ratio of Sr^{90} to Ca in the crop. However, it should be emphasized that although [illegible] against Sr, it also shows a Sr/Ca ratio that is higher than that in alfalfa by a factor of 2.

2. Environmental

Thirty-six USGS water samples which represented a backlog from the months August, September, and November, were brought to the Laboratory the first part of December and assayed for gross alpha, plutonium, and uranium. Results indicate normal conditions with the possible exception of flood flow in Pueblo and Los Alamos Canyons where the gross alpha and uranium counts may be high. A comparable situation did not occur in 1957, hence there is no true basis for comparison.

The radiochemical analysis for radio-strontium and gross beta on laundry samples indicates normal operation with radio-strontium accounting for 1/8 to 1/2 the total gross beta activity.

3. Ten Site Samples

Samples were again received from the Source Preparation Group at Ten Site for determination of the efficiency of their chloride separation of

radio-strontium. Preliminary results indicate that about 99.5% of the strontium was removed. More nearly absolute values await confirmation. It is interesting to note that the total strontium in this particular source was about 100 times that determined in a similar source received from Arco about six months ago. This indicates that the Arco separation process is not always uniform and it will probably be necessary to determine strontium on all sources. It is encouraging, however, that the chloride separation step at Ten Site does remove most of the strontium. Although 5 - 10% of the source is lost in this process it is felt it will be worthwhile.

4. Clay Fixation Studies

The problem of evaluating the degree of fixation in fine clays by the method of leaching has been employed here and elsewhere since the Soviet fixation idea has been under experimentation. One troublesome problem in such an evaluation is a good measurement of the clay surfaces so leaching can be expressed per unit of surface area.

A gravimetric method of surface measurements by use of polar liquids was found in the literature by Dyal and Hendrix and a modified refined version of this same method by Bower and Gschwend.

This gravimetric method as described for a number of types of clays and soils appears to give comparable results to those by the Brunauer-Emmett-Teller theory which employs the adsorption qualities of an inert gas such as nitrogen at low pressures. This latter method is being used by other groups in the Laboratory to measure surface areas but it is extremely difficult and time consuming. One of our clay samples will be measured by this method when it can be scheduled. This method is to weigh a polar liquid remaining on a clay sample after having been subjected to vacuum drying at less than 0.1 inch of mercury over several hours. The liquid used is double distilled ethylene glycol which has uniform spreading qualities in a monomolecular layer of 1 square meter for 3.1×10^{-4} grams of liquid.

Four types of clay, raw and fired to 1200°C have been measured. The surface areas of the unfired clays show considerable differences from clay to clay. However, in these early investigations the four fired clays are very similar in surface areas after firing, and all very much reduced from the unfired state. This is probably due to the glazing or vitrification which has been considered before but at no measurable amount. There is one disturbing factor using this method on fired clay samples; that is the extreme accuracy which is required in weighing. A 2-gram sample will retain only a few tenths of a milligram of liquid. Experiments will be continued to determine the reliability of the method. It may be necessary to use larger samples or obtain a more sensitive balance.

C. Miscellaneous

A conference was held with personnel at TA-33 concerning the disposal area for tritium wastes.

Plans were approved for the installation of a water cooled welding machine in the Delta Building.

Jan. 15, 1958

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Health Division Leader

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