

RESEARCH PROGRESS REPORT
February 20 - March 20, 1957

OS-6 PUBLICLY RELEASABLE

OS-6 *JS 6/17/53*

REF: R-258

I. ADMINISTRATION (Thomas L. Shipman, Leader)

7 8:00
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A. General

The Health Research Laboratory, which houses the activities of the Biomedical Research Group and the Industrial Hygiene Group, occupies a somewhat unique position and holds a somewhat dubious distinction in Los Alamos in being the one building where, under proper auspices, uncleared members of the public may be permitted to view a scientist at work. The building itself is classified as a limited access area but it is obvious that the majority of the work done there is entirely unclassified. All trace of classified documents, etc., can be made to disappear into the building's vault on a few moments' notice. For this reason, properly accredited visitors may be taken on a tour of this building whenever it seems desirable.

The Health Research Laboratory was open to the public soon after its completion in 1953 and again at the time of the Laboratory's Open House in July 1955. From time to time, and by special arrangement, small groups of high school students have been taken on a tour of the building, and recently two rather large such groups have been accommodated. In celebration of the birthday of Thomas A. Edison, some 1200 students from the high schools of northern New Mexico were permitted to tour the building, and on March 9 this was repeated for approximately 500 students who visited Los Alamos as representatives of the New Mexico High School Student Council Association.

These visits mean considerable work on the part of the Groups involved but they are surprisingly gratifying and there has been complete willingness to do the necessary work, and even to devote an entire Saturday in what appears to be a very worthwhile effort at public relations. As was said above, it is a somewhat dubious distinction but the staff of the Health Division also regard it as a rather unique privilege. Furthermore, there can be no question but that this constitutes a very real and worthwhile service to the Laboratory and the

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B. Personnel (3/1 - 4/1/57)

1. New Hires

MURDOCK, Mary F.
BRINER, Dale E.

Per *Chas. Johnson*
(Personnel Director) General Monitoring (Date)

2. Terminations

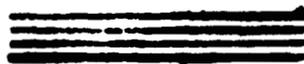
FOREMAN, Billie D.
MALMBERG, Carol R.

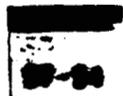
By *Chas. Johnson* 6/17/58
(Signature of person making the change, and date)

H-4 Radiopathology
H-4 Administration

FILE BARCODE

00131278




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

A. General

Morris Engelke went to Arco on March 13 and returned on March 21. He was to observe the GEANP (General Electric Aircraft Nuclear Propulsion) test of fuel elements in two phases: a) The elements were between 300 and 500 series of fission products and were to be burned at a temperature less than 2100°F. The fire was to be supplied by oil. There were two lines of thought. One thought was that the material would not be released at all and the other was that the material would be released at this temperature or less. b) Five thousand curie fission product fuel elements were to have been burned above 2100°F and a study made of the activity downwind. The weather did not permit testing of either of these items before Engelke had to leave; however, he witnessed sufficient activity to familiarize himself with subsequent reports on the experiment.

B. Incidents

1. On February 21, at 6:45 p.m., the top blew out of an induction graphitizing furnace in the Press Building. The furnace held D-38 but no contamination was disbursed. Two members of CMB-6 were involved but no one was injured.

2. On March 7, Jim Gallegher of P-1 reported a small Co⁶⁰ foil as lost and requested H-1's assistance. H-1 found the foil with a scintillation counter on the floor of the salvage warehouse. It had been left on a file safe that had been carried to salvage.

3. On March 7, a burst of tritium was released into the filling chamber room of Building 86 at TA-33, producing a general concentration of 800 $\mu\text{c}/\text{m}^3$ (4 hrs tolerance per week). It was thought that the tritium had been trapped between two vessels so that when one vessel was removed tritium was released. It was found later that one of the valves leaked at high pressure. The room was back to tolerance within 3 minutes after the ventilation was increased to 24 changes per hour. The highest urine sample was 11 $\mu\text{c}/\text{L}$. The guard station indicated no activity from the exhaust.

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C. Special Work

For _____
Signature of person making the change, and date

1. A series of talks was started on March 8 for Sigma personnel about radiation and associated factors involved with Sigma operations.

2. A member of the General Monitoring Section accompanied a representative of the U. S. Geological Survey group while collecting water and soil samples and taking temperatures. The excursion covered Acid Canyon, Pueblo Canyon, Guaja Canyon, and Hamilton Bend Spring. The samples were taken to H-7 for chemical and radioactive

content analysis. Hereafter, H-1 is to take over this work.

3. The Photodosimetry Section started to change all of the records to comply with the IBM coding system in which the group, location, and remarks would all be indicated by coding.

4. A new listing of exempt quantities of radioactive materials that can be shipped by mail or REA exempt was compiled. The basis for these quantities was also established.

D. Special Monitoring

1. A radiation survey was conducted of the P-9 area after it had been reported that the highest flux that had ever been produced to date for an extended period of time was present. The reaction was a d(d,n) with a neutron target of 8 mev. The tolerance time in areas outside of the fence and north toward the new shop area was found to be unlimited with the exception of two spots near the accelerator that were as low as 27 hrs/wk. The flux was 5×10^9 n/steradian/sec. Only one position could be measured in the hallway of SM 18 which limited the exposure time to 7-1/2 hrs/wk.

On March 11, a T(p,n) reaction with a target energy of 4-1/2 mev and having the same flux reduced the tolerance to 11 minutes per week in the hallway. This was thought to be due to backward scattering.

2. Another irradiated thorium sample from the Cyclotron was machined by J-11 in ML Building. The milling machine was located in the hood and was viewed through a glass brick. The sample read over 100 rep/hr at contact and 9 r/hr gamma at one foot. No contamination was spread beyond the milling machine although the cutting tool read as high as 500 mr/hr with 10,000 c/m alpha. Dosage to personnel and air samples were all negative. The residue that had been machined from the thorium was taken to a lead shielded dry box. During the process the exhaust duct read as high as 80 mr/hr. Classification changed to ~~CONFIDENTIAL~~ **CONFIDENTIAL USE ONLY** by authority of the U. S. E. R. D. A.,

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

A. Accident Record

Manhours Worked		
Number of Disabling Injuries	3	17
Number of Days Lost	12	6,355
Frequency (Accidents per 1,000,000 Manhours)	3.3	3.0
Severity (Days Lost per 1,000,000 Manhours)	13	1,110

B. Industrial Accident Experience

On February 5, [redacted] SD-1, dropped a hammer on his left foot fracturing his left fourth toe. Lost time was five days.

C. Fires

On February 20, at SM-35, an induction furnace operating at 2400°F blew the graphite cover lid off the crucible. Pieces of hot material were scattered around the room. Damage was confined to the lid of the crucible, a section of rubber hose and the corner of a piece of plywood.

<u>D. Motor Vehicle Accidents</u>	<u>Jan. 1 to March 1, 1957</u>	<u>1956</u>
Miles Driven	275,532	1,829,960
Number of Accidents	2	22
Rate (Accidents per 100,000 Miles)	.73	1.20
Total Cost	\$ 92.29	\$2,310.69
Accident Cost per 100,000 Miles	\$ 33.50	\$ 126.00

There were no motor vehicle accidents involving Laboratory personnel. Classification changed to CONFIDENTIAL USE ONLY by authority of the U. S. E. R. D. A.,

E. General

1. In accordance with Regulation 0902 of the Atomic Energy Commission a property damage report is being submitted to LAAC on the ~~date of Feb. 12,~~ ^{signature of person making the change, and date)}
2. The Safety Office assisted in the indoctrination of monitors for Operation PLUMBBOB. About 30 J-Division personnel attended the lecture given by Austin Burch on "Safety Problems at the Nevada Proving Grounds."
3. Roy Reider gave a talk to Laboratory Staff Members of "Eniwetok" on March 5.
4. The Safety Office assisted in revising the GEM-Division Rules for Transportation of Explosives.
5. At the request of LAAC, the Safety Office now processes and issues Government Driver's Licenses to Laboratory personnel.
6. Roy Reider was appointed representative for the Laboratory for Spring Clean-Up Week.
7. A safety talk was made to the Security Inspectors as part of the AEC's retraining program.
8. The casting and machining of a uranium-lead alloy was reviewed by James Stearns for CMB-6.
9. The design criteria were approved for a high pressure test cell in a trailer at W Site (TA-41).
10. High pressure and high temperature press operation involving uranium hydride for CMB-6 was reviewed by this office. This installation is to be in the basement of the Cryogenics Building.

IV. GROUP H-4, BIOMEDICAL RESEARCH (Wright E. Langham, Leader)

A. General

On Saturday, March 17, Groups H-4 and H-5 were hosts to the New Mexico Association of the State Student Council. Approximately 500 students and adults were shown through HRL Building. They were privileged to see the fire facility. and personnel of the two groups had set up twelve displays demonstrating the various phases of biological and medical research and industrial hygiene and engineering.

The Radiobiology program has not recovered from the consequences of the Salmonella infection in the mouse population. Chronic experiments are being terminated and the animals destroyed as fast as possible. The present colony will be eliminated by attrition by the middle of the summer. After that we will attempt to build the colony back to operating strength on a sounder, more disease-free basis. A pilot attempt to breed our own animals has been set up in the basement of the hospital.

Group H-4 in cooperation with the Federal Civil Defense Agency in Washington is now planning to participate in Operation Plumbbob. Our participation will include an attempt to learn more about the relative effects of bomb neutrons and gamma rays on animals. Payne Harris has been assigned to the project and the project has been assigned the number ~~CPDS 25-700~~ ^{classification changed to} CPDS 25-700 by authorization of the U.S. E.R.D.A.

Progress on the construction of the NaI Crystal Human Counter is running on schedule. One hundred and six tons of 2 inch ~~steel~~ ^{aluminum} plate were obtained from Apco Nevada for the construction of the shield. This steel is already in Santa Fe.

B. Research Progress

1. Biochemistry Section (Harry Foreman, Acting Leader)

a. Nature of Proteinuria Induced by Uranium in Rats. -- Paper electrophoresis studies indicated that increased protein excretion by rats after uranium injection consisted not only of increased albumin and alpha globulin normally found in urine, but also of an increase in the excretion of heavier beta and gamma globulins. At the height of protein excretion the electrophoretic pattern of proteins strongly resembled the serum protein pattern. These results suggested that the increased protein excretion was due to leakage across the glomerulus rather than excretion of tubular tissue detritus.

b. Biochemical Effects of Radiation. -- Studies of the effect of radiation on cholesterol synthesis confirmed previous findings that only cholesterol synthesis in the liver was affected. Results obtained by using C¹⁴-labeled acetate and tritium-labeled acetate correspond closely with each other. Liver cholesterol synthesis was markedly increased with increase in radiation dosage and was greatest

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also checked. It was found that after three years of operation the pressure drop on the main filter had built up to only 0.5 inches of water gage. The quantity of air exhausted through the system was still within 5% of that measured three years ago.

At the request of Group J-11, an inspection was made of the new Radiochemistry Building before its acceptance. Ventilation checks were made on all of the 61 chemical fume hoods in this building; an adequate air flow through all of the hoods but one was found. The air cleaning system for the dissolver room in this building was checked and found to be essentially as recommended. Considerable work is still necessary to adjust the bypass dampers on the hoods in order to obtain a satisfactory air flow at any setting of the hood door. Instruction was given to the contractor's personnel in the proper method of setting these dampers.

Several conferences were held with SD-2 personnel to discuss the hoods and air cleaning system for propulsion program work in Building 96 and T Shop. Since Group CMB-6 has asked for all of the available space in the Press Building, approval has been given for the Shops Department to move their propulsion operations into the old T Shop as soon as the present occupants move to their new building at TA-3. Reverse jet air filters will be provided to clean the air from the activities in T Shop.

Checks have been made on all of the hoods in the Administration Building and it was found that five hoods showed face velocities below recommended levels. These findings have been reported to Eng-4. In Building 96 at B Site, 12 hoods have also been checked and one was found to be below minimum standards.

B. Research and Development

1. DP West Stack Study

The detailed study of air and soil contamination from the DP stacks was continued during this period. Essentially all of the field work has now been completed, the analytical work on the tray samples is being carried on and the mass of data is being analyzed for compilation in a report.

2. Radiometric Uranium

Work is progressing on the method for the determination of uranium by counting methods. Extraction with acetylacetone and isolation of uranium by ion exchange techniques are currently being investigated.

3. Static Gas Chamber

A small chamber in which known concentrations of gas and vapors can be set up has been built and is ready for testing. It is planned to use this chamber for checking certain air sampling methods that require only a very small volume of air.

C. Miscellaneous

A method has been devised to check Chemox masks to determine whether there is any leakage of air past the rubber diaphragm. This work was initiated as a result of leakage being found in a mask assigned to GEX-2. All GEX-2 masks have now been checked and plans are to check all such masks on the subject at least annually.

Assistance was given to Group J-11 in measuring the noise level in their new Radiochemistry Building. Noise levels were measured in various parts of the new building, HRL Building, and CM Building. As a result of these measurements, it was found that the noise level in the new building was appreciably higher than that in the existing buildings having essentially the same ventilation arrangements. Group H-5 participated in a conference on this subject with AEC Engineering, Eng-2, and J-11. A consultant on noise problems was brought in and recommendations were made by him for reducing the noise level.

One member of the Group spent a week at the National Reactor Test Station in Idaho as an observer on air sampling techniques.

Group H-5 set up and manned exhibits for the benefit of a large number of students who were members of the State Student Council. HRL Building was opened for their visit and the exhibits created considerable interest.

D. Statistical Summary

1. Air samples collected or field tests made for:

Hydrogen Cyanide	24
Toluene	18
TMT	11
Zinc	3

2. Plans approved

4

3. Sanitation

Water samples collected

12

4. Analyses completed

Air

Beryllium	2
Cadmium	1
Lead	7
Trichloroethylene	11
TMT	10
Zinc	4

Biological (urine)

Americium	3
Mercury	4
Plutonium	253
Thallium	2
Trichloroacetic acid	16
Tritium	123
Uranium (fluoro)	95
Uranium (radio)	24

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Signature of person making this change (see Gate)

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Miscellaneous

Beryllium on swipes
Plutonium in soil

Uranium in fallout
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VI. GROUP H-6, RADIOLOGICAL PHYSICS (Harvey I. ... in classification (Date)

A. Special Problems

1. Work in Progress

a. The "debugging" of the program for numerical integration of neutron scatter equations for cosine law scatter has been halted. A preliminary study of experimental scatter data seems to indicate that they are adequately described by the previously integrated isotropic scatter equations. If this proves to be the case the cosine law scatter integrations will be abandoned.

b. Calculations of the X-ray and neutron production of a proposed linear accelerator for GMX-11 has been started in order to determine shielding and building requirements. Because of the very high instantaneous radiation rates to be expected, the instrumentation for measuring the radiations presents considerable difficulties.

c. A Hornyak fast neutron scintillator button of 2 inch diameter has been ordered to test it in a portable survey instrument. Because it is expected that the sensitivity of this small button will probably be lower than desired, we plan to have CMS-6 make us a 3 inch diameter button for further test.

d. One of the two Rudolph neutron survey instruments has not been in working order the entire month while the other one yielded some data at the Water Boiler. Much more information about its operation is still needed. However, because of the difficulty in keeping this type of instrument in operating condition, it is doubted that it will prove satisfactory as a routine monitoring device.

e. When dry air radon mixtures are pumped at a rate of 10 to 15 l/min through a 100 cc column of dry activated charcoal at room temperature the gas leaving the cartridge initially contains no radon. The radon concentration rises gradually till at about 10 minutes the radon concentration leaving the column is equal to that entering. This appears to be not a matter of saturating the charcoal because the time interval is independent of the radon concentration entering the column. This phenomenon might be termed an equilibration process. Further studies of the exact time course of rise of radon concentration in the gas leaving the column as a function of the radon concentration entering the column and the pumping rate through it are planned.

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The above phenomenon explains our earlier data in which it was shown that almost all the thoron is retained by the charcoal column for all reasonable air velocities and duration. If the equilibrium time is of the order of 10 minutes then thoron with a half-life of 54 seconds will decay to decay out before it could get out as thoron. The thorium β daughter isotope, remains on the charcoal and to date no means of getting it off has been found.

2. Work Completed

Ed Bemis participated in the training course for project monitors for the forthcoming Plumbbob operation.

The interpolation and extrapolation of the Compton and pair-production cross-sections for all Z's and energies from 10^2 to 10^4 e.v. completed and the numbers are being tabulated and typed in J-Division for presentation in a LA report.

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3. Meteorology Section (Orin W. Stopinski)

1. Work Completed

(Person authorizing change of classification)

a. Bayo Canyon. -- Field support for Bayo Canyon activities on February 21 and March 20. Sunday forecasts for Bayo activities were provided on March 8 and 10. The wind equipment has been reinstalled at Point Weather.

b. R Site. -- Field support for H-5 activities was provided at R Site on March 13.

c. Conference. -- O. Stopinski attended the Rand Conference on Fallout in Santa Monica, California on March 5-7.

2. Work in Progress

a. Data Reduction. -- Work has been continued in reduction of wind and temperature observations at DP West and Airport to hourly tabulations.

b. J-Division. -- Following the death of Leon Sherman, J-DC, this Section has been evaluating the progress of the work which he was doing, and making recommendations to J-Division relative to future plans.

C. Nuclear Field Test Section (W. R. Kennedy, J. W. Aeby)

1. General

a. The Plumbbob monitor training session was completed March 13. Excellent cooperation by members of Groups H-1, 3, 4, 5, and H-6 allowed us to get the subject matter across in an interesting manner.

b. The report on glove decontamination was completed and submitted for publication.

c. Several hot particles were caught on the continuous air monitor on the roof of SM-43. Only two were active enough to use for half-life studies.

#1 caught 2/28 0115 looks like La ¹⁴⁰
(Note: Rain caught 3/1 looks like La ¹⁴⁰)
#2 caught 3/3 0830 too soon to ¹⁴⁰
(Note: Three small particles were also caught in the afternoon of 3/12 but were not active enough for decay studies.)

2. Laboratory (B. F. Schnap)

a. Routine analysis of chemical waste from CM Building was made. All batches were released to H-7.

b. Drinking water and circulating water in CM Building and DP West were analyzed for alpha activity. Activity was found in circulating systems at DP West which have a past history of contamination. No other activities were detected. The system mentioned last month shows a decrease in activity.

c. Rainwater samples were concentrated and counted for gross alpha and gross beta activity. No significant alpha activity was detected. Beta activity was found in one sample collected in the large ~~of the~~ ¹⁴⁰ present for decay studies to be made. ~~to date, the activity appears to be La~~ ¹⁴⁰ by authority of the U. S. E. N. D. A.,

VII. GROUP H-7, INDUSTRIAL WASTE (C. W. Christensen, Chief)

A. Plant Operation

1. TA-45, Tech Area

By _____
(Signature of person making the change, and date)

Installation of 6-inch effluent lines from the flocculators to the settling basins was completed. The rate of flow controller was removed from the plant piping for overhauling or replacement. These modifications, together with the installation of a circulating pump in the effluent line from one settling basin has increased the average daily treatment rates from 90 gpm to 133 gpm. The maximum daily treatment rate obtained since alteration has been 125 gpm. Flow to the plant has been such that the normal daily operating time has decreased slightly. The additional treatment rate capacity indicates that excessive flows should be readily cared for.

Effluent quality has been good throughout the period. Both influent and effluent activity due to plutonium have been low during the period.

Eighty-five gallons of cyanide waste were delivered to the TA-45 plant for treatment on March 15. Assays of the two drums received indicated 4990 ppm CN in one drum containing 30 gallons of waste, and 10,600 ppm CN in the other containing 55 gallons of waste. The contents of these two drums were isolated in the northeast

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influent holding basin overnight and treated with 70 pounds of HTH (approximately 8 ppm Cl per ppm CN). The pH of the wastes was sufficiently high that there was little danger of HCN formation. Following treatment, the cyanides were diluted with the incoming raw wastes and allowed to pass through the final treatment process. On the first day after treatment no cyanides were present in the final effluents. On the second day one effluent tank (18,000 gallons) contained 1 ppm CN and the other 2 ppm CN. On the third day there was again no CN present in the final effluent.

2. TA-21, DP West.

High volumes of flow to this plant have continued, requiring daily operation throughout most of the period. Some of this flow is due to the operation of new equipment within DP West.

Effluent quality has been good with the exception of one tank which had to be recycled through the plant.

The vacuum sludge filter has been operating satisfactorily daily.

Approximately 250-300 gallons of iodide waste were received at the DP West plant on March 15. This waste was fed daily into the plant at about 30 gallons per day starting on March 16. The analysis of the iodide waste revealed 40,100 ppm I₂ and gross alpha count of 7000 c/m.l.

3. TA-35, Ten Site

All equipment for series operation of two resin columns was installed during the period. The old resin was placed in column #1 and new resin in column #2. Two runs of series operation were made, treating a total of 43,000 gallons of waste, all of which was discharged to the canyon. Part of these runs were for overnight periods. For the most part the equipment and controls are operating dependably, although there are minor difficulties still to be eliminated.

Pretreatment of wastes with acids has resulted in better quality effluents, and control of the acid feed has been improved considerably. Sufficient data are not presently available to verify the conclusions of the experimental work on the effects of pH on effluent quality.

The newly installed equipment for treatment of the sludge produced from resin regeneration was used for the first time. ~~CONFIDENTIAL~~
sludge mixtures in 55 gallon drums which can be easily handled ~~CONFIDENTIAL~~

B. Research and Development

1. Plant Operation

a. TA-21, DP West. -- Preliminary work was done to determine a means of conditioning sludge prior to treatment on the vacuum filter. ~~CONFIDENTIAL~~

of work done in this area, there is some indication that adjustment of pH with either NaOH or lime may aid in increasing filtration efficiency and rate.

b. TA-35, Ten Site. -- Work has continued on a large scale to determine the most economical method of operation of the two plants at Ten Site. For some as yet unaccountable reason the results on the plant operation are not nearly so good as are the laboratory scale operations. This may be due to either one of two factors: length of contact time of the acid with the waste or in the control of addition of acid at the Ten Site plant. Experiments in the laboratory indicate that the Sr⁹⁰ MPC can be met quite easily over some 500 column volumes but this experience has not been borne out in plant operation. One other anomaly is that apparently the addition of inert strontium in the order of 25 ppm has no effect on the removal of Sr⁹⁰. This is in contrast to work reported here several months ago in which inert strontium appeared to increase removals of Sr⁹⁰. This work will be continued to try to improve the Ten Site plant operation.

2. Clay Fixation Studies

Samples of the calcined waste from Arco were mixed with clay and some Sr⁹⁰ spike without binder or compression and fired to 1200°C. On leaching these samples with tap water it was found that a mixture of 40% Nepheline Syenite retained most of the activity with only 110 ppm being leached out. Another clay, Albany Slip, showed 3870 ppm leached after 7 days.

Work is proceeding in firing spiked samples of aluminum nitrate wastes with varying proportions of clay to determine the retention of activity in this type material.

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3. Tuff Cores

Cores 1 and 2 have received about 1000 cpm/L. concentration of 1×10^6 cpm/L. These cores are still retaining 97 to 98% of the applied activity. Three hundred liters of water are approximately equal to 75 years of rainfall or over 1100 inches of water. All of the activity is being held in a cone of 7 inches length.

Strontium is not as tightly bound by tuff as is shown by cores receiving Sr⁹⁰ spike. About 80% of the spike is being held after the passage of only 105 L.

It has been noted in previous reports that cesium is also tightly bound to tuff. Core #11 which had received a total concentration of 6.2×10^7 cpm was dismantled and autoradiographs made. Film exposed the Cs¹³⁷ to be concentrated at or near the surface of the core. The core was sectioned latterly and counts taken from weighed samples at 1/2 inch intervals. About

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454,000 cpm/gm were found at the surface; the count dropped to 2000 cpm/gm at the 1/4 inch depth and to 200 cpm/gm at the 3/4 inch depth. There was no appreciable activity below the 1-1/2 inch depth. It would appear that Cs is tightly bound and does not move readily through the tuff even after the application of over 200 inches of water. Recovery of Cs from the tuff has been low, often less than 50%, with nitric acid, sodium cyanide, citric acid, carbonic acid and hot water. This poses a serious problem whenever Cs assays are to be made on soils.

Cores which are alternately leached with distilled water and tap water show a marked difference in effluent quality with regard to both mineral analysis and radiological assay. Tap water may leach as much as 40 to 50 times the amount of nuclide as is leached by distilled water. In like manner, Ca, Mg, and Na are found in higher concentration when tap water is used as a leach. It is recognized that part of this increase may be attributed to concentrations found in tap water. When the latter is applied as a leach, some silicon may be removed from the water by the core.

Since rain water will contain some CO₂ and since the concentration of CO₂ will normally increase as the water percolates through the soil, some of the cores were leached with water partially saturated with CO₂. In the case of a core which had Sr⁹⁰ applied, CO₂ in the leach water increased the concentration of the nuclide in the effluent. In one case the increase was about 100-fold followed by a gradual decrease with continued application of leach water containing CO₂. Carbon dioxide does not seem to affect the release of Pu or Cs in like manner: in fact, there has been no observable increase in rate of removal of these two nuclides.

One 18-inch core which has received Pu, Sr⁹⁰, Cs¹³⁷, was dismantled after receiving 82 L of mixed spike. No appreciable activity had been observed in the effluent. Autoradiographs with and without shielding and with alpha track emulsion film are being made in an attempt to determine whether different nuclides locate at different positions in the tuff.

Other cores have been set up to continue the cesium studies. One core shows no activity in the effluent after the passage of 100 L of water containing 1.0 x 10⁷ cpm/ml, again indicating the higher retention of Cs.

4. Laboratory

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A study of magnesium assay by flame photometry was attempted. The flame analysis is accurate within the desired range and, with some modifications, may be used for other elements. However, the photometer attachment for the Beckman D.U. Spectrophotometer may not be sensitive at the wave length required. A newer, more sensitive hydrogen-oxygen photometer may be required.

Twenty-four USGS water samples and 15 Acid Canyon soil samples have been run in the past period. In addition, routine laboratory work has continued on Laundry waste, Los Alamos water samples, Ten Site and DP wastes.

5. Project Sunshine Studies

H-7 is working with H-4 in an attempt to determine relative travel of Cs^{137} and Sr^{90} through soils. Previous work done here and elsewhere indicates that the Cs^{137} will be held in the top inch or so of soil and that Sr^{90} might penetrate several inches into the soil. If this premise is true, then fallout studies could be simplified by sampling only the top inch of soil and analyzing for Cs^{137} .

Two soil columns 1 inch in diameter and 4 inches long were made up with local soils with about 10% by weight of Gooch Asbestos added to increase permeability. After passing tap water through the column for stabilization a Cs^{137} spike in tap water was run through the column. The beta count in the spike was in the order of 1.7×10^4 c/m/ml. One column received about 66 inches of water while the other received about 16 inches. There was no detectable activity in the effluent from either column. These columns were taken to H-4 for radioautographs and the results indicated that all of the activity was retained in the upper 1/4 inch of soil.

It is planned to set up another series of columns with Sr^{90} and a mixture of Sr^{90} and Cs^{137} . Analyses and radioautographs will then be made to determine the relative penetration of the two isotopes. Later it is planned to repeat this work on soil samples received by H-4 from the 5 test farms under test in Project Sunshine. Further work will probably include ion exchange capacities as well as soil analyses for recovery of the two isotopes from the soils.

A small garden consisting of about 25 separate plots each 5' x 5' is to be set up in the area north of Bldg. 35 in TA-21. Soil will be brought in, spiked with Sr^{90} and Cs^{137} and the available calcium concentration will be varied from calcium deficiency to large excesses of calcium. An additional plot will have a relatively large amount of inert strontium added to it. Alfalfa, sweet clover, and lettuce will be grown in these plots to determine the effect of the various additives on Sr^{90} and Cs^{137} uptake. This work is being done by Mr. Carl Freeman of the Zia Parks Department is also assisting in setting up the garden plots.

Samples from the area tentatively chosen for supply of the soil were analyzed for total and available calcium. The available calcium was determined to be about 21 grams per sq. ft. per 2-1/2 inch depth which is about the "average" soil as reported by Libby. The total calcium was about four times this value.

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Since it will be difficult to remove calcium from this soil, an effort is being made to find an area which is calcium deficient in order to carry out this project as planned.

Extractions and Recoveries of Nuclides from Soils. Several attempts have been made to extract cesium from soils and tuff which have had Cs spike percolated through them. In the past, irregularities in recovery have been traced to lack of homogeneous distribution of the Cs¹³⁷ within sample. In one case it was determined that over 464,000 cpm per gram were associated with the upper surface of tuff, whereas at a depth of 3/4 inch only 200 cpm/gm were found. As might be expected, samples taken along the length of the core showed marked variation.

Elution has been attempted with nitric acid, hot water, sodium cyanide, carbonic acid, and citric acid; hydrochloric acid has also been used to treat the extracted residue. Of the methods tried, none seems to give satisfactory recoveries of known Cs spikes. The problem requires further investigation.

Continuous reflux extraction reported previously proved to be too slow. Extraction by tumbling in a ball mill with 6N HNO₃ was tried. Milling time was set at 4 hours and about 60 rpm. A total of 5300 grams of soil in 1500 gram batches was tumbled with 3500 grams of balls and 1 L of acid per batch. Two extractions were made with acid followed by two hot water extractions. Difficulty was encountered in filtering. Four hours of tumbling resulted in a powder so fine it would neither filter nor settle. It was also difficult to decant the supernate even after 8 hours settling. A basket centrifuge proved unsuccessful, hence the extracts were centrifuges in 250 ml bottles and the residue returned to the ball mill. The tumbling time was cut to 2 hours to avoid fine material that centrifuged with difficulty. The combined extracts and washings were concentrated by distillation. The residual acid was removed by formaldehyde treatment and the residue further concentrated. On concentration, a brown precipitate was obtained which was filtered off. The solid residue was slurried in water and counted in the gamma counter. The total count on the solid fraction was calculated to be about 150 cpm gamma.

The liquid fraction was concentrated to 150 ml, in which the appearance of a thick, brown syrup. Its total count was about 480 cpm gamma. This is a ratio of about 3 to 1 in favor of the liquid.

If the gamma activity is assumed to be all Cs¹³⁷, the figure of 600 cpm appears to be unreasonably high. This work will be checked at a later date.

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Beta and alpha counts will also be run on precipitate and supernate. This is to be followed by a separation and determination of Sr, Cs, Pu, and Y.

If the Cs is as tightly bound to the floc as indicated, there is some question as to the efficiency of extraction by this method. At present, there is no way of knowing whether all nuclides have been removed from the soil without extensive repeated extractions of large volumes of soil.

C. Laundry Section

Arrangements were made with the property representative of CMB-F Division to draw cheesecloth from the Supply and Property Department, and issue same at DF West and at SM-29. This will relieve H-7 of the charges on about 400 bolts per month at about \$4.50 per bolt. H-7 will continue to supply cheesecloth at Sigma Building and other locations throughout the project where an alternate supply channel does not exist.

D. Meetings

C. W. Christenson attended the Nuclear Congress meeting in Philadelphia March 11-15. On March 14 he visited Mr. J. A. Lieberman and Mr. John Newell of the Engineering Branch of the Division of Reactor Development, AEC Washington, to discuss the awarding of a contract to Colorado College of Mines for research on fixation of radioactivity on clays. He also helped arrange a meeting to be held in Washington sometime in June to discuss clay fixation of radioactive wastes.

E. Visitors

Mr. Conover, Mr. Weir, and Mr. Abrahams of the USGS Office in Albuquerque visited the Group on March 5 to discuss various aspects of environmental studies and soil studies.

T. L. SHIPMAN, M.D.
Health Division Leader

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