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OS-6

HEALTH DIVISION PROGRESS REPORT

November 20 - December 20, 1954

REF: H-20

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

A. General Remarks

The studies on the urines from personnel exposed to fallout on 1 March 1954 have been completed. The final figures for the amounts of various isotopes present are essentially unchanged and it still appears quite correct to feel that even under the adverse conditions which were present at the time the hazard of external exposure is still the limiting factor. Of the isotopes absorbed internally, iodine was unquestionably the most significant. Other isotopes were certainly present but not in quantities great enough to be regarded as dangerous. A greatly improved quantitative test for Sr^{89} was developed. It has become obvious that our knowledge of the behavior of strontium in the body is sketchy, to say the least, and this subject will be pursued strenuously.

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By ... (signature of person making the change, and date)

Members of the Biophysics Section of Group H-4, working in collaboration with a group from Oak Ridge, another group from the Biophysics Branch of the Division of Biology and Medicine in Washington, and Dr. Herald Rossi of Columbia University, are preparing to engage in a project on neutron dosimetry at Operation Teapot. The preparation for this project has involved two principal phases:

1. The data and results from neutron dosimetry studies at previous test operations have been evaluated with great care. The emphasis of the proposed study is in part to confirm these previous ones, but even more to fill up the gaps in the spectrum.

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2. Intensive work has progressed both at Oak Ridge and Los Alamos in obtaining the necessary pretest calibrations. In this work the Godiva assembly, which had never been used in this way previously, has been a [redacted] valuable tool. It is hoped that the proposed project will not only provide answers to many of the questions for which answers are desired, but also will confirm or deny criticisms which have been directed at the work previously done.

B. Personnel (12/1/54 - 12/31/54):

1. New Hires:

12/6	KERR, Vernon N.	H-4	Organic Chemistry
12/27	VIGIL, Benito A.	H-1	DP West Monitoring

2. Terminations:

12/3	JOHNSON, Helen M.	H-1	Tech Area Monitoring
12/10	SERRANO, Virginia V.	H-2	Hematology
12/31	BARKER, Robert F.	H-6	Special Problems

3. Total Personnel:

SM	46
Military	4
RA	11
SCP	80
Military	1
ASC	29
TOTAL	171*

*Includes 2 casuals and 1 on leave of absence.

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

A. Incidents:

1. On December 17 at 4:15 p.m. in Room 15, M-Building, a rather large quantity of H-235 in acid solution spilled over onto the floor. The acid solution was being boiled when some ether was added causing the solution to boil over. The area read 20,000 c/m at contact and swiped up to 1000 c/m. The floor was temporarily cleaned, chalked, and roped off until the cleanup could be completed on December 20.

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2. On December 15 it was reported by H-5 that an extremely high Pu urine sample assay had possibly been caused by extraneous contamination within the building. A thorough survey of the H-5 work area gave no positive indications. Positive findings were found within two rooms occupied by H-4; however, the degree of contamination and manner of work does not seem to be the explanation to the high urine count. It now seems more likely that the high count originated from a sample that had been contaminated inadvertently and in turn contaminated the glassware of H-5. Monitoring the assay kits was to no avail. However, it was requested that all incoming kits be surveyed for possible contamination, inasmuch as the offending container may be back in circulation. Much of the glassware that had been used in the run has already been disposed of.

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Philip Lang
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B. General:

Carl Enloe and Dean Meyer left for [illegible] duty at the Nevada Proving Grounds on November 30 and returned on December 20.

1. Two members of the General Monitoring Section spent considerable time as consultants to Group CMR-8 concerning the processing of U-233 from solution form to metal. After the anticipated health physics problems had been thoroughly discussed, the first shipment was received and handled on December 14. The material was packaged in polyethylene containers which in turn had been placed in birdcage shipping containers from ORNL. The inside of the cages were heavily contaminated -- to infinity. It was thought that this activity originated from hypodermic needles being inserted into the side of the polyethylene flask for the purpose of equalizing the atmospheric pressure, thereby bringing contamination to the outside of the plastic container. It has been suggested that this operation be carried on from the top of the container in the future, and that the polyethylene flask be placed within a plastic bag to prevent contaminating the inner portion of the cage. The materials were transferred to the drybox without incident and the air sample read only 1/13 of tolerance. Technical

difficulties concerning stainless steel joints were encountered and will require a certain amount of refitting. From a gamma radiation standpoint the filtrate seems to carry over the majority of the activity and may build up to as much as 1/2 of the original activity. The first filtrate read approximately 60 to 80 mr/hr at contact. The metal will actually be made from the precipitate. Arrangements have been made with H-6 to measure in their extrapolation chamber approximately 500 grams on December 27, in order to give us the gamma emission at contact. This work may continue in the future on a production line basis.

2. High air counts up to three times tolerance were reported from the sludge room of the Waste Treatment Laboratory for the week of November 15 through 19. This was thought to be due to overfilling of the sludge cans and the subsequent cleanup. An attempt was made to rectify the overfilling and to wear respiratory protection during the cleanup. Some of the trouble was also found to be due to a filter queen running at 5.5 CFM instead of 4 CFM. The samples soon dropped to tolerance after the troubles had been rectified. An attempt was made to run hourly air samples; however, high humidity prevented successful operation. A bootie exchange station was also recommended.

3. A mixture of 1% U-233 with U-235 was worked in Room 118, Sigma Building. Surface contamination count data has been gathered for a report to H-5 to be included in their justification memo for possible future additional facilities required by CMR-6. The preliminary film measurements of the contact emission rate gave 65 mrep/hr.

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4. The Nevada test involving plutonium. Two tuballoy detonations were made with no positive findings. Due to wind direction only one plutonium detonation was completed. An area extending to a radius of 50 feet from the top of the bunker read up to 200,000 c/m by PeeWee. Approximately 0.6 square mile of area was contaminated with fallout to the extent of 1000 c/m per probe area on the average as measured by a PeeWee. Personnel entering the area with protective

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clothing picked up approximately 10,000 c/m, although their bodies received no contamination. Tape and tar paper devices were placed at measured distances for fallout detection. Air and dirt samples were gathered. The tests may continue during the early portion of January.

5. The experimental accelerator "Columbus" functioned for the first time, as far as neutrons are concerned, on December 8 using a 3 mev DD reaction.

6. The use of respiratory equipment at DP West is being investigated by members of Group H-5. Suitable types of respirators to be worn by plant personnel will be recommended following this investigation. An order has been placed for 100 MSA Comfo respirators with ultra filters, which will probably replace the Willson 75CD.

7. MSA Multi-Use masks are being worn at all times in the 201 Evaporator, Unloading and Incinerator Rooms and in the 213 Unloading, Dissolver, and Evaporator Rooms at DP West.

8. The ventilation system in Building 5 at DP West is being checked by members of Groups H-5 and CMR-AE. Several over-tolerance air-borne contamination counts have been recorded in this area which are believed due to inadequate ventilation.

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Per Shirley Lang
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By Jean Lehner 6/12/78
(Signature of person making change in classification) (Date)

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

A. Accident Record

	1943	1944
Man-hours Worked	5,056,698	5,319,125
Number of Disabling Injuries	24	17
Number of Days Lost Time	6,522	182
Frequency (Accidents per 1,000,000 Man-hours)	4.7	3.2
Severity (Days Lost per 1,000 Manhours)	1.29	0.03

B. Industrial Accident Experience

1. On November 15, [redacted] ENG-3, received a strain and contusion of his left shoulder when he caught a pipe to keep from falling through the ceiling at the Physics Building. Lost time was 6 days.

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C. Fires:

1. There were no losses from Laboratory fires during this report period.

2. A near serious accident occurred on November 27 when [redacted] CMR-4, received first and second degree burns to the left side of his face and both arms when a hydrogen-air mixture ignited unexpectedly. [redacted] was using the Y-Building mass spectrometer to analyze H_2 - T_2 mixtures. Previously a practice run not involving T_2 but using H_2 in order to check the procedure was held. On the day of the accident, a successful run had been completed and the second run was nearly completed. The flash is believed to have occurred when the H_2 air mixtures reached various ignition points within the spectrometer. Fire was limited to two pages of a notebook which was lying on the desk of the spectrometer.

D. Motor Vehicle Accidents:	Jan. 1 to Dec. 1, 1954	1953
Miles Driven	1,541,032	1,732,599
Number of Accidents	22	36
Rate (Accidents per 100,000 Miles)	1.43	2.08
Total Cost	$3,912.56	$1,596.00
Accident Cost per 100,000 Miles	$ 252.00	$ 92.00

There were four motor vehicle accidents involving Laboratory personnel during this report period. Two were backing accidents and the other two occurred when parked vehicles rolled driverless into fixed objects.

E. General Remarks:

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1. The Safety Office has been working with the Sheet Department in establishing rules for the machining of zirconium.

2. The Safety Office, in conjunction with H-2, has given artificial respiration demonstrations to J-Division's electronics personnel who will be involved with test operations.

3. H-3 and AEC Industrial Waste Section are currently working out the safe disposal of cyanide solutions. Twenty-five gallons of potassium cyanide solution from the Sigma plating laboratory were delivered to the AEC Waste

Disposal Section. Various methods will be tried in order to establish a satisfactory neutralising process. Once a system has been devised, the Laboratory will no longer dispose of cyanide solutions by burying.

4. Richard Smith, fire protection engineer of the Atomic Energy Commission, Washington, D. C., visited the Laboratory in connection with fire problems of heavy elements.

5. In conjunction with representatives of the Test Manager, AEC, SFOO, details have been worked out for the air shipment of special assemblies from the Los Alamos Scientific Laboratory to the Nevada Proving Grounds during the forthcoming Teapot test program.

6. A special project has been initiated in conjunction with Group GMX-3 (S Site) to develop emergency procedures for all buildings in the Site and educate the employees accordingly.

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By Joan Lehner 6/14/78
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IV. GROUP H-4, BIOMEDICAL RESEARCH

A. General Remarks:

Gordon Gould made a project site visit for the U. S. Public Health Service at the Veterans Administration Hospital in Iowa City on December 3. On December 7 he visited the Laboratory of Physiological Hygiene of the University of Minnesota in Minneapolis. On December 6 he gave a lecture sponsored by the Department of Physiological Chemistry of the University of Minnesota School of Medicine entitled "Recent Studies on the Absorption, Biosynthesis and Metabolism of Sterols."

Payne Harris, Ogden Johnson and Jim Perrings made a trip to NPG to coordinate matters pertaining to H-4 participation in the spring tests.

Jake Spalding presented a paper on "Beta Burn Studies on Sheep" to the Physiology Section at the annual meeting of the American Society of Animal Production in Chicago on November 26. C. Lushbaugh was a co-author on the paper.

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Ogden Johnson attended the annual meeting of the Animal Care Society held in Chicago November 28-30.

Wright Langham visited the Organic Chemistry Department at Iowa State College to discuss with Dr. Henry Gilman progress he has made on his contract with the Division of Biology and Medicine of the AEC. He also went to Washington to serve on the DBM Screening and Planning Committee for biomedical projects in bomb test operations.

Dr. Herald Rossi spent 4 days in H-4 working with the Biophysics Section on the testing and calibration of Tissue Equivalent Ion Chambers to be used in Operation Teapot.

Donald Ott and F. Newton Hayes attended the Southwest Regional ACS meeting in Fort Worth in December. Donald Ott presented "Organic Solution Scintillators. I. Syntheses and Spectra." F. Newton Hayes presented "Organic Solution Scintillators. II. Properties and Applications."

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Dr. L. R. Lipsky of Yale visited with F. N. Hayes regarding scintillation counting of C^{14} and H^3.

Mr. Robert Corsbie visited with W. Langham and Payne Harris to discuss plans for Project 39.7, Operation Teapot.

Vernon Kerr joined the Organic Chemistry Section of H-4 during December.

LA-1728 was distributed December 9. This was by F. Newton Hayes and is entitled "Photomultiplier Testing for Low Energy Counters."

LA-1837 was distributed December 9. This was by Donald G. Ott and F. Newton Hayes and is entitled "Argon Treatment of Liquid Scintillators to Eliminate Oxygen Quenching."

B. Work Completed:

1. Results of Beta Ray Determinations on Urines from Personnel Exposed to the Fallout on March 1, 1954. (Written by Gordon Gould; work done by Molly Maree, Jean Sabine, Helen Miller, Harry Foreman, Ted Trujillo, Louise Larkins,

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Irene Boone, Sam Rothermel, Verda Strang, Phyllis Sanders, Jake Spalding, Bill Moss, Bill Schweitzer and Donald Ott):

The results are summarized as follows:

a. Three groups of urine samples were examined:

I. Four pools, 3 from natives on Rongelap and one from American Air Force personnel on Rongerik and Eniwetok, (also a number of individual samples from this last group), all collected on 3/16 to 3/19.

II. Four pools from natives on Ailinginae and on Rongerik, Air Force personnel on Rongerik, and medical personnel on Kawjalein, all collected on 4/13 to 4/16.

III. Three pools from Japanese fishermen on the Fortunate Dragon collected on 3/28, 4/14, and 4/19.

b. Total beta activity was determined on dried urine samples and total nonvolatile beta activity on dry-ashed and wet-ashed residues.

Dried urine gave decay rates of 8 days from 3/25 until about 4/20 showing I^{131} to be the principal isotope present, and of 55 days from 4/20 through 8/1 showing Sr^{89} to be the predominant isotope during this period.

The total Sr^{89} content of the urine can be estimated from the above mentioned data. All of them give 0.01 to 0.02 μc/l or 0.005 to 0.01 μc/24 hr. Using the same assumption as for I^{131}, the body burden on 3/16 may be estimated as 10 μc of Sr^{89}. If the ratio of Sr^{90} to Sr^{89} is 0.1, the Sr^{90} body burden was about 1 μc.

The total beta activity values for the other groups were much lower; the relative activities of Sr^{89} can be seen from the table of counting rates for 100 ml aliquots of urines counted within a week.

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Urine No.	Personnel	Location	Dry-ashed c/m/100 ml	Date Counted
3/16	Natives	Rongelap	204	6/17
3/17	Natives	Rongelap	186	6/18
3/19	Natives	Rongelap	85	6/22
AM	U.S.A.F.		53	6/23
No. 40	Natives	Rongerik	47	
3/28	Jap. fish.	Fortunate	36	6/8
4/14	Jap. fish.	Dragon	36	6/16
4/19	Jap. fish.		32	6/22

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Thus, it may be concluded that the exposure of the Japanese fishermen to internal radiation hazard was about the same as the U. S. Air Force personnel and perhaps one fifth as much as the groups of natives on Rongelap. However, this comparison is rendered somewhat uncertain by the fact that the urine samples were collected one month later from the Japanese than from the natives.

Determinations were also made for I^{131}, Sr^{89}, Ru, Pu, and Ce by isolation methods. No cerium or Pu activities were found.

I^{131} was isolated from urine samples and identified by the decay rates. The specificity of the extraction methods together with the decay rate determinations leaves no doubt of the presence of considerable amounts of I^{131} activity in these urines. However, no method of extraction of I from urine quantitatively is known, so total content values are probably more accurately obtained from whole dried urine sample counting rates. Yield on extraction is thought to be about 60% and order of magnitude results may be obtained by assuming this yield.

Sr^{89} was obtained with observed counting rates up to 1000 c/m/sample and decay rates were checked by observations during many weeks. However, chemical yields were somewhat uncertain because of difficulties in the methods at the

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time these isolations were done. Sometimes the final yields were more than 100%, at other times extremely low.

Assuming a 50% overall chemical yield, one obtains a value of about 0.005 μc/l. of Sr^{89} for urine 316 a slightly lower figure than that obtained from whole urine without isolation.

Ca^{45} isolations were carried out on the first group of samples. The observed counting rates were in the range 3 to 54 c/m. Corrected for self absorption, decay, etc., gave values of about 2000 d/m/l as of Mar. 1, corresponding to 0.002 μc per liter or 0.001 μc/24 hrs.

Ba isolations were carried out on the first group of samples. Observed counting rates were in the range 31 to 150 c/m. Estimations for total activity corrected for decay and chemical yield, gave about 0.004 μc/l or 0.002 μc/24 hrs.

Ru. 500 ml aliquots were taken for Pu isolation. Observed counting rates were in the range 27 to 32 c/m. Estimated content for urine 316 was 640 d/m/l as of Mar. 1, uncorrected for self absorption. This figure is too small to be worth converting into microcuries.

The principal conclusions with regard to future episodes are that a) an aliquot of each urine sample should be evaporated to dryness (after adjusting pH to about 8-9 with NH_4OH) and counted for I^{131}, and b) an aliquot should be either dry-ashed or wet-ashed and the residue counted for Sr^{89}. More information on the rate of excretion of Sr^{89} by humans following a single exposure is greatly needed.

Satisfactory methods for isolation of Sr^{89} from large samples of urine are now available but it is questionable if it is necessary to go through this procedure under ordinary

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By Jean Fisher 6/24-77
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C. Work in Progress

1. Biochemistry Section (Gordon Gould)

a. Electrophoretic Study of the Combination of Fission Products with Serum Proteins. (Molly Magee, Harry Foreman, Gordon Gould):

Preliminary results on Sr^{89} have yielded the following tentative results:

1) at 30 minutes after intravenous injection, Sr^{89} was distributed among all serum proteins except albumin, with possibly a slight increase in the β globulin fraction. At 2 hours, there was an increase in concentration at or near to the γ globulin fraction.

2) Although Sr appears to be bound to protein during electrophoresis it was found to move during the staining and washing operations, making it imperative to do radioautographs on unstained strips.

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b. Absorption and Metabolism of Dihydrocholesterol (DHC). (Gordon Gould, Virginia Lotz, Edith Lillie):

Two experiments have been carried out to confirm the previously reported effect of dietary DHC on liver cholesterol concentration. In the first, plasma cholesterol levels were lower in the DHC fed animals (46.8%) than in the controls (71.4 mg %). Liver analyses were uncertain because of technical difficulties and the results are inconclusive. In the second experiment, a 2% DHC diet was fed for 10 days and the liver levels were found to be lower (2.17 mg/gm, range of 1.99-2.35) than in the control group (2.55 mg/gm, range of 2.16-3.25). The serum values were also slightly lower, 54.3% for the DHC group, 64.2 for the controls. Although this difference was not as marked as in the original experiment, the decrease in level does seem to be a definite and consistent effect and one not observed with sitosterol.

c. Tests of New Chelating Agents. (H. Foreman, C. Finnegan):

Two new chelating agents were tested this month and appear sufficiently interesting to be worthy of further investigation. Both were sent to us

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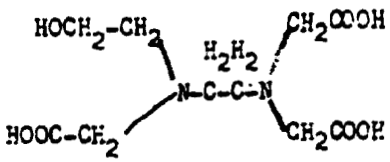
under trade names; Permakleer 80 and Permakleer SP; but from the information we have obtained from the manufacturer we gather the composition of Pk 80 is:



We do not know the structure of Pk SP.

In a preliminary toxicity study in mice we found the LD_{50}^{30} for a single intraperitoneal dose was approximately 400 mg/kg.

The material was tested for its ability to effect excretion of Pu in the usual fashion in rats. In the first pilot study the experimental rats were given 320 mg/kg/d. The animals given Pk 80 died in 2 or 3 days and the animals given Pk SP in 3-4 days. The study was set up again using 80 mg/kg/d. All the animals survived the experiment. The Pu was given I.V. and the medication I.P. twice daily. The results are presented in Table I.

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Per TABLE I Philip Hong
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By Diane Fisher 6/11/78
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RESULTS OF Rx OF Pu BEARING ANIMALS

			Pk 80*		Pk SP*	
	Day	Controls	I.P.	Oral	I.P.	Oral
Urine	1	.53	7.40	1.88	7.2	1.06
	2	.17	2.80	.69	3.0	.38
	3	.10	.96	.38	1.2	.34
	4	.05	.60	.28	0.71	.20
	Total	.85	11.76	3.23	12.11	1.98
Carcass		4.15	3.19	4.0	2.3	3.0
Liver		7.34	5.8	7.12	5.45	8.76
Skeleton		44.60	41.39	41.40	38.75	36.30

* Results expressed in % of injected dose.

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It is of interest to note that Pk 80 (if we have this structure right) has already been used in humans in a dose level of approximately 10 mg/kg/d.

d. Triple Tracer Study. (H. Foreman, C. Finnegan):

In an effort to determine the cause of a variation in results of our triple tracer assays using the phosphate-glass technique, we decided that the likely sources of error were two-fold. First, there was a lack of adequate mixing due to the viscid nature of the samples and, secondly, the loss of activity due to the heating process.

We feel we have obviated these difficulties by using a mixture which requires much lower working temperatures (200-300°C.) and which is as fluid as water when it is heated. This mixture is poly-phosphoric acid containing 15% KNO_3 by weight. It yields hard, clear, glassy, homogenous samples when mixed with bone. We are now preparing mass absorption curves with this mixture.

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e. Effects of Varying Doses of [illegible] on the Cholinesterase (ChE) Activity of the Red Cells of Mice. (J. Sabine, H. Miller):

It was known from previous work (1953) that following a single dose of 300 r whole body radiation, there occurred a sharp peak in red cell cholinesterase on the third and fourth days post-radiation. This work has been extended in another dimension, to include observation of fourth-day values at doses from 15 r to 525 r. This response is obtained at 25 r and all higher doses. There is no systematic relationship between the mean values and the dose, possibly because the numbers of mice used were not large enough to being out a small dose-rate difference. However, when individual values are plotted for those doses for which relatively large numbers of mice have been used (36 to 64 at each dose) the appearance of the data suggest that the fourth day high value is a response which at low doses may or may not be made by any individual mouse, while with increasing doses more and more individuals do respond.

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At 25 r 25% of individuals were above the normal range; the rest were scattered through the normal range and resembled controls in their distribution. At 50 r 33% were above the normal range, and the distribution of the remainder showed a shift to higher values. At 300 r 65% were above the normal range and the shift was still more obvious. At 525 r (only 14 mice) the shift appears to be yet more marked.

Interpretation of the meaning of this finding cannot be undertaken without a great deal more investigation. On the basis of clinical work with human patients increased cholinesterase values are associated with hyperactivity of the bone marrow and the presence in the peripheral blood of an increased number of young cells, not necessarily accompanied by a reticulocytosis.

f. Clinical Studies of Red Cell Cholinesterase. (J. Sabine, H. Miller):

1) Acute Leukemia:

A child has been followed for four months. In September and October the disease was fully developed. Transfusions were required. The cholinesterase values were low-normal. In November a spontaneous hematological remission began and the patient's condition has improved markedly. The cholinesterase values began to rise before the presence of remission was otherwise established. During the past month the values have been at the upper limit of normal, and the hematocrit is maintained at around 40%. Reticulocyte counts are not impressive (1 to 3%). Although the total number of reticulocytes produced during the past six weeks has undoubtedly been large, the response at any given time is not sufficient to give a reticulocytosis. It has been proved previously that the high concentration of cholinesterase in young cells persists long after the reticulum has disappeared. The finding in this case, as in others, supports the view that the cholinesterase [redacted] more informative than the reticulocyte count.

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By [redacted] 6/4/74
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2) Erythroblastosis

A newborn baby with this condition was followed from birth until discharge from the hospital (2 weeks). On the first day of life the baby received a transfusion. Nevertheless the hematocrit fell rapidly and on the 10th day another transfusion was given. This was followed by a small rapid fall in hematocrit, then by a leveling-off at 35%. At this time the clinical condition was very good and the child was discharged. During the first week the red cell cholinesterase values were well below the normal (adult) range. On the first two days the plasma contained 3 to 4 times the amount of red cell type of cholinesterase found in normal (adult) plasma; this fell to a normal value on the seventh day. During the second week the red cell cholinesterase rose rapidly the titre increasing by 30% by the time the baby was able to maintain its own hematocrit level without transfusion. Reticulocytes at this time were 3%.

Here again the red cell cholinesterase was an early-appearing and valuable criterion in evaluating the physiological state of the bone marrow, the need for further transfusion and the prognosis.

3) Carcinoma of the Head of the Pancreas

Two cases have been studied. One was reported partially in October. Each had severe icterus and partially acholic stools. Each had cholinesterase values somewhat below the lower limit of normal. This finding was regarded as evidence against a hemolytic process and against a purely mechanical obstruction such as a stone in the common duct. It was thought more likely that a malignant process, (carcinoma or abdominal Hodgkin's), was the cause of the obstruction. In both cases laparotomy was performed and revealed carcinoma of the head of the pancreas.

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Per Ophelia Long (Signature of person making change)
(Date)

4) Disappearance of Red Cell Cholinesterase in Hemolysed Blood Transfused into the Original Donor (a lamb) [illegible]

Lucie Zehner 6-4-74

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It was found and reported previously that the red cell cholinesterase of hemolysed and reinjected blood disappeared within 15 minutes from the plasma of a normal lamb. This experiment was repeated with several intravenous injections of india ink during the week preceding the transfusion. Again, all of the cholinesterase was gone from the plasma within 15 minutes. Autopsy revealed a coal-black liver and spleen. This finding cannot be interpreted with any certainty at present. Although the appearance of the organs suggested that blocking of the reticuloendothelial system was probably largely complete, it cannot be stated from this experiment that the RES was unable to phagocytize the fragments of red cells presented to it.

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2. Biophysics Section (E. C[redacted]):

a. Monkey Counter. (J. [redacted]):

The pulse height has not changed over the past month, following the initial decline previously reported. Since the present pulse height is adequate, no further investigation of this effect is planned. The detector has been moved to the H-5 counting room in the basement. A suitable lucite cage for holding the monkeys while counting has been constructed.

b. T.E. Ion Chambers. (J. Saveg, J. Larkins):

Herald Rossi spent several days with us testing the prototype chambers for the Nevada tests. Several difficulties were uncovered which will be rectified by redesign. Tests were conducted using both 250 KVP X ray and fission neutrons from Godiva. In the latter experiments Godiva was operated as a reactor and at 45 μsec burst levels. Under all conditions the chambers failed to give adequate measurement of radiation dose.

The graphite pile has been moved to the source room in the basement because of the pending construction in the sub-basement.

Tests on premixing of tissue equivalent gases indicate that there will be no fractionation on filling the chambers.

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c. Rabbit Eye Circulation. (E. Anderson with K. Woodward, and C. Rothermel):

Measurements have been made of the time of clearance of Na-22 injected into the anterior chamber of the rabbit eye. Half-times of 70 to 90 minutes (with one run giving a low value of 33 minutes) have been obtained. The method seems capable of considerable precision. One eye treated with pilocarpine showed an increased turnover rate, the half-time dropping from 74 to 57 minutes on washing with pilocarpine.

Measurements have been begun on the normal intraocular pressure and on changes produced by adding or removing saline. Only preliminary results are available so far, indicating a normal pressure of about 25 mm Hg and a volume coefficient dP/dV of about 1.6 mm Hg/μl. The P-V curve seems to be reversible and linear up to perhaps 40 μl added saline (about 3 x normal pressure).

d. X Ray. (F. Worman, L. Larkins):

1) All H-4 radiat[illegible] and standards have been moved into room B-142 for storage. A card file has been prepared and a permanent record will be kept on all of these to keep account of all their arrivals, movements and locations.

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2) Work has been started on the preparation of a ceric sulfate dosimeter to be used in the determination of high radiation dose levels.

3) Chest X rays have been taken on all of the monkeys to assist in the discovery of any possible tuberculosis in the colony.

4) A large number of exposures have been made on the Maxitron during the past months including animal studies, bacteria, ceric sulfate dosimetry and exposures of the ionization chambers prepared by Dr. Rossi. Total tube time to date amounts to 214 hours and 2582 exposures.

3. Radiobiology Section (Payne S. Harris):

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a. Determination of RBE with the Use of AKm Mouse Leukemia in Various Strains of Mice. (I. Boone, B. Rogers):

Strong A strain of mice were exposed to various doses of X ray and thermal column exposures to determine an RBE. Twenty mice per point were exposed to 100, 200, 250, 300, 350 and 400 r or rem. Twenty-four hours after radiation the mice were injected with AKm leukemia. Adequate leukemic-injected and radiated controls were included in the study. $LD_{50}30$ for leukemic takes was between 300-350 r or rem. The data is to be subjected to a complete probit analysis.

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b. Studies on the Cell Surface [redacted] (E. Rogers, I. Boone):

In the growing Lactobacillus cells all the C^{14} nicotinic acid in the medium is converted to Coenzyme I and II. Cells were grown for 18 hours in the presence of 0.1 microgram non-labeled nicotinic acid per ml. They were washed and resuspended in a 0.04% glucose-saline mixture to which 1 microgram of C^{14} nicotinic acid had been added. At the end of one hour of incubation at 37°C, approximately 50% of the labeled nicotinic acid had been adsorbed and converted to Coenzyme I by the cells present. Microbiological assay of the saline supernatant indicated that the remaining 50% of the C^{14} labeled compound was nicotinic acid.

c. Pre-Test Calibrations for Operation Teapot. (F. Harris):

Further runs have been made, using Godiva as a source, to study film badge response to fast neutrons. In this study film packets were contained in lead during and after exposure. Other packets were dropped into lead at varying times after completion of exposure. Results were generally similar to those previously reported on other film pack exposures. In the arrangement used this time films exposed in air were above the lead container, therefore, scattered radiation from the floor was eliminated. A rough comparison with

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previous work indicates that floor scattering may contribute 1/2 to the total dose. When packs were dropped into lead at varying times up to 15 minutes after the exposure was complete the results indicated only a small portion of added dose. The added dose was about 6% of the total given during the true exposure. The results indicated that the additional exposure occurred very early after the assembly was separated as there was no detectable difference between 3 minutes and 15 minutes post exposure in the badge response.

d. Animal Calibrations for Teapot. (J. Furchner, W. Schweitzer):

A comparison of the effect of radiation alone and radiation preceded by cold stress on the weight changes in the spleens and thymuses of CFI female mice is being made in order to establish the possibility of eliminating expensive heating of exposure containers during Operation Teapot. The mice are placed in cages and exposed to cold in an aluminum test exposure device over night. After exposure to cold, the mice are exposed to X-irradiation. The weight changes in the spleens and thymuses of these mice are compared with relevant weight changes in mice exposed to X-irradiation only. Changes in body weight are also being compared. At present it looks feasible to eliminate heating elements from the exposure containers during the field operations. This is not a definitely established point, however.

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By [illegible] 6/11/78
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e. Toxicity of High Concentrations of Tritium Gas. (K. Lundholm, E. Anderson, W. Langham):

To date two groups of 12 mice each have been exposed to the inhalation of a 10% concentration of T_2 in oxygen.

The first group was exposed for 2 hours. Analysis of their urine indicated that they received a total body exposure of about 15,000 rep from the absorption of T_2O created by auto-oxidation of the tritium-oxygen mixture. All animals died in 3-4 days. The second group was exposed for only 15 minutes in 10% T_2. These animals lived about 8-12 days and analyses of their

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urines showed that they received a dose of total body radiation from absorbed T_2O of about 1500 rep.

So far it has not been possible to perform the experiments in such a manner as to eliminate T_2O as the limiting factor of survival. This accomplishment is necessary in order to estimate the role of T_2 beta radiation in producing direct damage to the lung mucosa.

The exposure cage has been redesigned to permit the use of more water absorbants and to permit better control of experimental conditions.

A lethality study has also been run on mice using known amounts of tritium water injected intraperitoneally. These lethality data will be used for comparison with T_2O lethality data in which the tritium water is taken in via the lung during the breathing of a 10% tritium gas mixture. The LD^{30}_{50} for tritium water given intraperitoneally seems to be that amount which delivers a dose of approximately 850 rep in the 30 day period.

4. Radiopathology Section (C. C. Lushbaugh):

a. Histopathology of Radiation Damage. (C. Lushbaugh, J. Wellnitz):

A pathologic review of the Eniwetok material was begun.

b. Additional Biological Test Systems for Determining the Relative Biological Effectiveness of Various Kinds of Radiation Available at Los Alamos. (J. Spalding, P. Harris, L. Hughes, D. Hale):

1) The Broad Bean as a Test System for Studying Biological Effectiveness. (J. Spalding, P. Harris):

A preliminary experiment was done exposing the bean roots to tritium. The results of this study appear to indicate that the LD^{50} for the bean root with the beta rays of tritium is about the same as it is for X-radiation. "Effect of X-Rays on the Broad Bean Root" has been completed.

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2) Cytologic Study of the Effect of Radiation on the Broad Bean Mitosis. (D. Hale, C. Lushbaugh):

Following the completion of the effect of 540 r on the mitosis of the bean root tip this experiment was repeated on 400 r but is still incomplete.

3) Luminescent Bacteria. (L. Hughes, C. Lushbaugh):

Attempts to enumerate the number of bacteria producing light in a given situation by use of the densitometer showed that very few bacteria were required for our electronic system to count.

Preliminary experiments were done in order to see whether or not the growth of this bacteria could be limited quantitatively by limiting the carbon or nitrogen in the media. Additional observations were made upon the effect of a fixed dose of 10,000 r on subsequent generations of bacteria. The effect has proven to be quite variable but to become decreasingly effective.

5. Organic Chemistry Section. (W. H. Langham)

a. Synthesis of Organic Scintillators. (D. Ott, V. Kerr):

The following compounds were prepared for testing as liquid solution scintillators: 2,5-diphenylthiophene, 2,2'-(5-phenylbioxazolyl), 2-(4-tolyl)-5-phenyloxazole, and 2-(4-biphenylyl)indole. The syntheses of intermediates in the preparation of p-terphenylindole and 4,4'-bis(2-indolyl)-biphenylyl are in progress.

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b. Liquid Scintillation Counting. (W. H. Langham)

Consecutive counting of mixed isotope samples containing H^3 and Na^{22} has been successfully carried out with the room-temperature version of the Model 530 Coincidence System. Samples have been derived from whole blood and from plasma. One milliliter aliquots treated with alcohol to precipitate proteins have had the resulting dilute alcohol solutions combined with alcohol-saline protein washes to make up a final solvent composition of 1.5 ml water,

25 ml alcohol and 63 ml toluene. The HTO is detected with 6% efficiency and a background of about 80 c/m. The Na^{22} efficiency at its much lower gain setting is 70% with a background again of about 80 c/m.

c. Relative Pulse Height Measurements. (F. N. Hayes, V. Kerr):

The first three of an expected large number of potential scintillation solutes have been received from Dr. Henry Gilman, Iowa State College, and tested as 3g/l toluene solutions without further purification. The LA RPH values obtained were: tetrabenylfuran, 0.55; N-phenylcarbazole, 0.24; and P-phenylphenanthridine, 0.03.

d. Pharmacology of Oxazole Quaternary Salts. (B. Rogers, N. Hayes, D. Ott, C. Lushbaugh):

Investigation of the hypothermic action of tosylate salts of oxazoles in mice has been continued. The salt of 2-(1-naphthyl)-5-phenyloxazole has continued to give the most interesting results. The following table gives a typical set of data showing the effect of a dose of 1 mg per 10 g body weight on the body temperature of mice as a function of time after injection.

	Time after Injection (min.)									
	0	20	40	60	100	200	300	400	500	600
Body Temperature C°	37	32	28.5	26	25	24	25	29	31.5	33

Toxicity studies have been run on the salts of several oxazoles and these compared with similar studies with Thorazine. Dose response curves have also been determined on at least three of the more interesting compounds.

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V. GROUP H-5, INDUSTRIAL HYGIENE (H. F. Schulte)

A. Beryllium

The Beryllium Shop operated six days during this period. A total of 31 air samples were collected and all concentrations were below the permissible level.

One member of the Field Section made a two-week health survey of the T-315 test at the Yuma Ordnance Test Area. A total of 8 air samples and 6 swipe samples were taken and a report will be written in the near future. Since reasonable precautions were taken during the operation, it seems probable that no hazardous exposures were encountered.

The extensive literature review on the beryllium problem is continuing. Conferences have also been held with representatives of CMR and GMX Divisions to make arrangements for running specified tests on beryllium compounds. It seems probably that most of the test requirements can be performed at Los Alamos.

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B. Uranium

Fabrication of oralloy has been resumed in Sigma Building and the operation is being followed closely. Of 13 breathing zone air samples collected, 10 have been over permissible limits while 6 general air samples were below these limits. During rolling, drawing, and inspection of oralloy enriched with U^{233}, 23 out of 28 breathing zone samples were over permissible limits while none of the 16 general air samples were above limits. A report is being prepared containing detailed recommendations for handling this material. This enriched oralloy has caused far greater surface contamination in Room 118 than had ever been encountered previously. The operators wore respirators during all operations and 24-hour urine samples were collected. These will be analyzed by the new extraction method. This method which has been developed recently by the Laboratory Section involves extraction with dibutyl phosphate and subsequent plating and counting of the uranium. The results obtained, to date, are much more

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promising than any method previously tried. It is hoped that after five years of experimentation this method may at last provide at least a working procedure for the evaluation of enriched uranium exposures. The increasing use of a variety of uranium isotopes makes it absolutely necessary that some counting procedure for uranium analysis be available.

An extensive air sampling and urinalysis program was initiated in T Shop. Urinalyses are now being run on all operators in T Shop on Friday evening and Monday morning samples and, in addition, five operators have been submitting daily urine samples. Two of these men are being followed very closely with breathing zone air samples in an effort to correlate urine analysis and air analysis data. A large percentage of the breathing zone air samples have run well over permissible levels. These men are being followed very closely because of the restricted ventilation and the high work level in this shop at present. Final plans have been approved for the improvement of ventilation and other conditions in T Shop.

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C. Plutonium

At the request of Group H-1, we have been co-operating in studying the respirator program at DP West and in investigating the cause of a number of excessively high room air counts. A tentative report on the respirator program, ventilation changes, control of nickel carbonyl, hydrogen fluoride, and improvements in the air sampling program has been prepared and discussed with H-1 and CMR-11. This has involved a rather thorough study of conditions in several operating rooms in DP West.

A very highly contaminated urine sample was received and analyzed and, as a result, about 40 urinalyses had to be discarded. These samples were contaminated, or at least results rendered suspect, because of the presence of the very highly contaminated sample. All counters had to be cleaned and glassware used in the analysis were discarded and replaced. This was the most highly

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contaminated sample ever received and caused a very considerable delay in the urinalysis program. A recheck on another sample from the same operator showed only normal levels of activity.

Several conferences were held with representatives of CMR Division in order to explain the present method of evaluating urinalyses for plutonium.

D. Mercury

A survey was made to determine the extent of a possible mercury exposure to K-4 personnel at Pajarito Canyon. Mercury concentrations several times permissible limits were found and recommendations made for the installation of a local exhaust hood.

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E. Sodium Hydride

Croup CMR-6 has handled several pounds of sodium hydride during this period. This has been milled and blended with lithium hydride by the Powder Metallurgy Section and, in the near future, it will be necessary to machine pressed parts from this blend. Sodium hydride is even more irritating than lithium hydride and is more hazardous from a fire standpoint. Practically all work is being done in dry boxes with an inert atmosphere. Sodium hydride collects moisture rapidly until it forms a puddle on the floor of the dry box. This makes the operation more difficult and increases the dermatitis problem.

F. Particle Trajectory Study

Further data has been obtained in the study of the trajectory of large particles falling in the vicinity of an air sampler. The data are now being studied in an effort to generalize them to permit application to air pollution studies. Theoretical work on this problem is now being reviewed.

G. Miscellaneous Exposures

Recommendations were made for the proper method of machining hemispheres made of potassium chloride, calcium fluoride, and sulfur at M-1 Building. An inspection was made of a Teflon welding operation in the main shop building

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and multi-service masks were provided.

Advice was given on precautions to be taken during machining of zirconium. The health problem is minimal but the fire hazard is at least equal to that involved in machining magnesium. Group H-3 was advised of this activity. Air samples were collected in Building 340 at S Site to estimate the exposure to butyl acetate. All concentrations found were below the permissible level, but a definite nuisance exists during peak concentrations.

At the request of the Zia Company, an investigation was made of the cause of dermatitis on a Zia plumber replacing the Duriron sewer lines in the new Physics Building. No specific agent was identified but acids and organic mercury compounds are suspected. Group H-5 consulted with Group H-1 on the radon gas exhaust problem of Group P-

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H. Ventilation

Several new ventilation systems were planned during this period and others have been installed. These include the new ventilation installation in the Technical Shop, and the ventilation and air cleaning systems for the new Radiochemistry Building, and the new Sigma Building. At TD Site three new hoods have been recommended and plans discussed.

Several conferences have been held for the best means of exhausting a soldering bench in the basement of P Building. An acid fume scrubber has been designed for use by Group P-12. A new Reumlin local exhaust hood has been installed in the welding shop at SM-39. Should this flexible unit prove successful, it probably will be installed in other welding booths in this shop. Slot-type ventilation has been recommended for welding and soldering work in Shop 4 where some soldering will be done on cadmium-plated metal.

A number of changes have been made or recommended in the existing exhaust systems. These include the grinding room in Shop 8, Building 380 at S Site, Building 370 at S Site, the cut-off saw in Sigma Building and the hood system

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in HRL Building. A number of old systems have been checked and, where necessary, improvements have been recommended. These include Building 202 at S Site, Building 410 at S Site, the Laboratory Building at TA-9, the [redacted] Shop, and Building 34 at TD Site.

I. Operation Teapot

Members of the Test Operations Section participated in a 10-day training course for off-site monitors at the Nevada Proving Ground under the auspices of the U. S. Public Health Service. The Section provided equipment, training material, and instruction during part of the course. Operational procedures for Teapot have been reviewed and discussed with the individuals responsible for carrying them out. More detailed discussions on equipment were carried on at Los Alamos during a visit of a representative of the Off-site Group.

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J. Respirator Program

During this period, an educational film on the development and use of respirators entitled "The Air We Breathe" was shown in the HRL Seminar Room to all members of Groups H-1 and H-5. It was also shown by the Zia Safety engineer to approximately 65 of their supervisors and the Fire Department showed the film at each of the various fire stations. At all except the fire stations, a representative of H-5 was present to give further details and answer questions on respirators.

The SP-3 catalogue of safety equipment has been revised by Group H-5 and the revisions were accepted by SP-3 for inclusion in future catalogues. The new revision will list all respirators and masks with the filter cartridge or cannister to be used listed with the appropriate unit. A similar list will be used by H-5 to give approval by telephone on respirators being checked out from stock. In this way it will be possible to recommend respirators by catalogue number and eliminate previous confusion in the issuance of the proper equipment.

A talk on respirators was also given to Group CMX-5. The respirator program of CMR-11 is now being reviewed and, in the near future, a similar review will be made of respirator requirements at other sites, [redacted]larly in CMR Building, Sigma Building, and at DP East. Methods of [redacted]proper respirator fit are now being studied and will include work in the H-5 laboratories as well as inquiries on methods currently being used in industry.

K. Miscellaneous

The educational program regarding the safe use of solvents is progressing satisfactorily. Two drums of Vythene (methyl chloroform) have been ordered for issuance by Chemical Stock. The Shops Department and other large users of carbon tetrachloride have found Vythene to be a satisfactory substitute. In addition, the Group is now engaged in the identification of the constituents of 18 trade name solvents carried at SM-30 general stock. Analyses have been completed on "Lightning" paint remover which was found to contain 32% benzene. Other paint removers are also being analyzed.

Assistance has been given to the Los Alamos High School on a project involving the use of radioactive tracer materials. Off-project monitoring was performed following one Bayo Canyon experiment; contamination was found to be negligible.

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The problem of dust control [redacted] with the Zia Company and plans for dust control equipment were reviewed. Discussions were held with Group H-4 on plans for setting up a program of toxicity investigations. Group H-4 will do the animal experiments and Group H-5 will secure the materials to be tested and give further assistance on particular tests required.

Two members of the Group presented talks at a Health [redacted] Seminar on the subject of "Lithium Compounds - Engineering and Health Aspects."

One member of the Group gave a talk and lead a discussion before the

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Los Alamos Police Department on "Assistance Rendered by a Crime Laboratory to the Police Department."

Plans for publishing the collected analytical proced[redacted] Group H-5 as a Los Alamos document are proceeding. All methods are being [redacted] carefully and some revisions are being made to permit wide circulation of this manual.

The revisions of Room 142 at HRL Building were completed and work on heavy metals, enriched uranium, and other analytical procedures are now being carried out there. The fluorometric uranium apparatus has been moved to Room 138 and the fractionating column to Room 140.

L. Statistical Summary

1. Air samples collected or field tests made for:

Beryllium	45
Butyl acetate	4
Enriched uranium	68
General atmosphere samples (outside HRL)	15
Mercury (labs)	2
Normal uranium	124
Plutonium (cascade impactor)	2

2. Plans approved 7

3. Water samples 14

4. Analyses Completed

Air

Beryllium	38
Uranium	6

Biological (urine)

Actinium	5
Americium	3
Lead	1
Plutonium	236
Polonium	25
Tritium	178
Uranium (fluorometric)	370
Uranium (radiometric)	43

Miscellaneous

Solvent analysis of type cleaner, paint remover, etc.	2

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VI. GROUP H-6, RADIOLOGIC PHYSICS (T. N. White):

A. Special Problems Section (S. Shlaer and H. I. Israel):

1. General:

a. S. Shlaer attended the Radiological Society meeting in Los Angeles from 6 - 11 December.

b. R. Barker has received and accepted an offer from the AEC Isotopes Division, Oak Ridge, Tennessee, as a Field Representative of the Radiologic Safety Branch. The termination date has been set for December 31, pending clearance transfer.

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2. Work in Progress:

a. The revision of the General Handbook for Radiation Monitoring was given to the printers on 2 December, and will be completed before January 55.

b. A review of the literature has been made in preparation for the writing of a chapter in the Non-Destructive Testing Handbook. A partial bibliography has been prepared.

c. Plans have been made to obtain a sample of U-233 in the near future for measurements of the surface dose rate to give H-1 some figures for estimating hand exposures at DP Site.

d. A closed system for generating thoron from a boiling solution of thorium nitrate has been constructed and is being tested. Techniques are being developed for purposes of increasing air concentrations of thoron.

e. A new method of charging the high-intensity arc, which consists of loading the carbon from a solution of activated copper in nitric acid, has been tried and appears to be satisfactory.

f. A new method of starting the arc by striking the arc with a tesla coil and the associated circuitry has been developed, and is still being tested.

g. The 150 KVP X-ray machine and the associated equipment has been

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moved to and set up in G-Building. Various pieces of equipment are being constructed to simplify the alignment of the components so that greater reproducibility of measurements can be obtained.

3. Work Completed:

a. The surface dose rate from a tuballoy source belonging to AFSWC in Albuquerque was measured at the request of Paul Crumley.

b. The surface dose rate from seven beta-ray sources covering an energy range from 0.5 to 2.3 mev was measured in the extrapolation chamber. Capt. Kaericher and Lt. Nicholson of AFSWC in Albuquerque employed these sources in calibrating the energy dependence of an ion chamber.

c. The revision of the chapter on Monitoring Instruments has been completed, and the manuscript has been sent to the editors.

B. Meteorology Section:

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By Ben Stoner 9/5/78
(Signature of person making the change, and date)

1. General:

a. The Weather Section underwent a military inspection of 22 November and received a clean bill of health.

b. Furnished weather support for CMX-5 Bayo operations on 2 and 9 December.

c. Furnished Mr. Machta, U. S. Weather Bureau, with bomb cloud data for previous NPG operations.

d. Furnished Hal Plank, J-11, with Upshot-Knothole wind data.

e. Majors Stopinski and Newgarden visited the NPG to furnish weather support for a CMX-6 operation. Major Stopinski, who will participate in Teapot, was indoctrinated and taken on a conducted tour of the Satellite Weather Stations. Major Newgarden also gave a two-hour lecture for the U. S. Public Health Service on the part the Weather Team and the Fall-Out Prediction Unit will play in support of Teapot.

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C. Nuclear Field Test Section (William R. Kennedy):

1. General:

a. The Test Manager has requested the Group Leader [redacted] serve as Fall-Out Advisor for the next test and to head a Fall-Out Prediction Unit. One member of the Field Test Section and one member of the Meteorology Section will be working with this Unit.

b. Sample fall-out problems are being run by our method for comparison with others at a meeting in Washington next month.

2. Laboratory Activities (A. O. Dodd and B. F. Schnapl):

a. Soil samples were collected and analyzed for alpha activity in Los Alamos Canyon. Stream bed samples showed essentially background activity with one exception which was approximately 4 times background. Samples were also taken in Los Alamos Canyon just below Omega Site and analyzed for beta-gamma activity. Slight activity was found just below a septic tank outfall. Specific analysis for Ba and Sr failed to identify it as either of these elements.

b. Samples of soil were taken from Mortendad Canyon and analyzed for beta-gamma activity. Activity was found in samples taken in the small draw below Ten Site, but not in Mortendad Canyon proper.

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Per Philip Lang (Person authorizing change in classification) 6-5-97 (Date)
By Joan Fehner 6-5-97
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c. Samples of soil taken at various depths from the old D-Building Site showed definite amounts of plutonium per gram of soil.

d. Drinking water and cooling water in CMR Building and at DP West Site were analyzed for alpha activity. None was detected in drinking water. Traces were found in cooling water systems having past histories of contamination.

e. Approximately 300,000 gallons of chemical waste from CMR Building were sampled and assayed for alpha activity. All results were low enough to allow movement to the Waste Treatment Plant.

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

clA - H-Div. Files (following circulation to H-Div. Group Leaders).

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