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HEALTH INSTRUMENT DIVISIONS

REPORT FOR MONTH OF DECEMBER. 1949

By: H. M. Parker

Date: January 6, 1950

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HEALTH INSTRUMENT DIVISIONS

DECEMBER, 1949

Summary

The force increased by four. Three Class I Special Hazards Incidents were investigated. None of these involved significant radiation exposure.

Survey findings in the Operational Division, with some exceptions, were normal. The "special dissolving" resulted in greater contamination spread than had been anticipated. Air and vegetation samples collected by Development Division personnel defined the resulting pattern and magnitude of I^{131} deposition. Other routine monitoring samples were consistent with past findings.

In Bioassay, urine samples showed no confirmed positive results for plutonium but disclosed consistently high tritium oxide content in the samples from two individuals.

In biological monitoring, specimens collected during the month showed thyroid activities ranging from 1 to 300 $\mu c/kg$. - the latter represents about 80 times the maximum permissible limit of permanently maintained radioiodine concentration. This resulted from the high deposition of I^{131} in the special dissolving, and is a temporary condition.

Phase I of the Animal Farm is being accepted as opposed to Phase II, the sewage disposal plant, which does not meet operating specifications.

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Health Instrument Divisions

HEALTH INSTRUMENT DIVISIONS

DECEMBER 1949

Organization

The composition and distribution of the force as of 12/30/49 was as follows:

	100-B	100-D	100-F	100-H	200-W	200-E	300	700	P.G.	Total
Supervisors	1	1	3	2	9	3	14	6	0	39
Engineers	3	3	15	2	16	10	9	4	0	62
Clerical	0	0	1	1	1	2	3	4	0	12
Others	10	13	35	13	69	26	56	9	8	239
Total	14	17	54	18	95	41	82	23	8	352

This represents an increase of 37 people or 12 percent during the year. The increment is far below that projected because of

(1) inability to hire key specialists in soil science and meteorology
(2) delay in expected completion of laboratory facilities.

Number of Employees on Payroll	December 1949
Beginning of month	348
End of month	352
Net increase	4

Additions to the roll were one engineer, 6 laboratory assistants, one badge worker, 4 general clerks and a steno-typist. Removed from the roll were an assistant to the manager, a senior supervisor, 4 engineers, 2 laboratory assistants, and a general clerk.

General

Widespread contamination by I^{131} occurred as a result of a specially requested dissolving at short cooling time. The prediction that this could be accomplished once with negligible risk to personnel was supported by the experimental observations. However, the resultant activity came close enough to significant levels, and its distribution differed enough from simple meteorological predictions that the H.I. Divisions would resist a proposed repetition of the test.

Three Class I Special Hazards Incidents were investigated. Two involved failure to follow standard procedure, and the other failure to follow special work permit instructions. As the Special Hazards Committee is in no way a disciplinary body, it has been decided that such incidents will in future be reported

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informally, with a record copy to the committee. This change will be incorporated in a revision to Special Hazards Bulletin #6.

The following trips were reported:

1. HM Parker - Radiological Society of North America, Cleveland, Ohio.
2. ML Mickelson and GH Whipple, Jr. - read papers at Reed College, Portland, Oregon.
3. FG Tabb and RF Foster, U. of Wash. Fisheries Dept., Seattle, Washington.
4. LK Bustad - Washington State College.

Four members of the Los Alamos organization visited for discussions on plutonium hazards.

During the period covered by this report, all persons in the Health Instrument Divisions engaged in work which might reasonably be expected to result in inventions, or discoveries, advised that to the best of their knowledge and belief, no inventions or discoveries were made in the course of their work except as listed below. Such persons further advised that, for the period therein covered by this report, notebook records, if any, kept in the course of their work have been examined for possible inventions or discoveries.

Inventor	Title
None	None

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Annual Summary

Thirty seven Class I Special Hazards Incidents were investigated during the year. There was no formal Class II investigation.

In 1949, a record total of 1,708,976 pencil readings was made. Included were 22 significant readings between 100 and 280 mr. None was confirmed by a badge result. Thirty three readings above 280 mr were reported, again with no badge confirmation. These spurious readings are within statistical limits of coincidental pairing of defective pencils, and the total is in fact much lower than in previous years. Sixty three pairs of readings were lost. In those cases, investigation indicated no probability of significant exposure.

Badge processing fell to a total of 240,805 for operating personnel, and 63,388 in construction. The two-week schedule was maintained except in the 300 Area, which stayed on a weekly basis. The expected regulations of the National Committee on Radiation Protection have not yet appeared. The "legality" of the Hanford method, which is technically superior as well as more economical, will be tested when contrary recommendations are published.

For operations personnel, there were 2,836 badge readings between 100 and 500 mrep. Of these, 1,999 occurred in the weekly scheduled 300 Area. Twenty-eight readings above 500 mr were recorded. Of these, 16 were presumed due to defective film and one to heat. Four were traced to X-radiation which modified the calibration to give low residual readings. Four were legitimately produced in work on stack fans, and were confirmed by pencil readings. The remaining three occurred in the 300 Area and may have been true overexposures, properly subject to Class II investigation. The gamma-ray component was in each case less than 100 mr, and there is an uncertainty in the beta calibration in such cases. Informal investigation showed that in one case the badge was trapped in the straightmer for two hours, and in another case the badge itself was contaminated. The third case was presumably real, although others on the same work were not overexposed. One hundred sixty-nine readings were lost.

For construction forces, 209 readings between 100 and 500 mrep in two weeks were recorded. Although none of these is an overexposure, the readings are higher than should occur with subcontractor forces. Nineteen readings exceeded 500 mrep. Of these, 18 were ascribed to X-radiation, and one to defective film. Fifty six readings were lost.

There were 446,409 alpha hand scores and 491,827 beta hand scores recorded. About one in 665 of the alpha, and about one in 985 of the beta scores were high. No attempt at reduction was recorded in 10% of the high alpha scores, and 19% of the high beta scores. Although all these figures show improvement from 1948, the educational process in this field is still incomplete.

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Thyroid checks for accumulation of I^{131} fell again to 2,599. Significant readings occurred only in connection with the special test.

The record of progress on the radioactive particle problem, the major concern of 1948, is disappointing. It must be accepted that the easy work in this field has been done, and significant further advances will be slow. At this review period, the major problems are plutonium hazards, emphasized by the Chalk River deliberations, the tritium hazard, waste disposal, and the perennial question of the necessary amount of improvement in the uranium metal fabrication.

To the best knowledge of the H.I. Divisions, another year has been completed without significant general body exposure or local external exposure to any individual. No serious case of ingestion or percutaneous transmission of active material is known. As in 1948, the divisions cannot be sure of the position with respect to inhalation of relatively insoluble active material. The consensus is that no unwarranted hazards have been encountered in this field.

Service work of the operational division, as estimated by total surveys again increased by 40%. The survey personnel was forced to increase 24%. This was offset by a reduction of 17% in personnel meter force for an unchanged work total, which was more economically consolidated.

In the Control and Development division, 16,736 laboratory samples mainly of water and vegetation were analyzed. There were 2,336 observations of active particle data. Instrument readings for air monitoring and the like totaled 44,600. Urine analyses totaled 16,206. Of those for plutonium, only one was proved positive. It was demonstrated that this resulted from a prior exposure at Los Alamos, and a useful check on W.Langham's elimination formula at a long-time interval was obtained.

The Biology division has accumulated the basic research staff during the year. Actual experimentation was strictly limited by successive postponements of the building program. At the year end, the experimental animal farm was completed and stocked. The main biology laboratory was about half finished.

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a beam of about 110 mr/hr was observed at the end of the tube as a result. Two grooved steel pieces were added to the front dummy train for this tube to prevent a recurrence.

The radiation beam at the top, far edge of the pile was unchanged at about 10 mr/hr (gamma).

P-10 Operations - 108 Building

Two damaged furnace tube caps were salvaged without undue exposure to personnel. Previously caps were discarded, but the incidence of loss increased to such a point that salvage was attempted.

Air samples drawn through calcium chloride at the building fresh air intake duct all showed no evidence of tritium oxide present. Calcium chloride samples placed 150 feet S.E. of the building also showed no contamination, but samples placed 150 feet N.E. of the building showed evidence of tritium oxide present. Those were exploratory tests, not yet quantitative.

100-D Area

Four instances of personnel contamination occurred during maintenance work in various portions of the building. In all cases, the contaminated skin areas were successfully cleaned.

High background counts on the Five-fold checker led to the discovery of contaminated air in the work area corridor. The source was traced to the "A" sample room drain and the condition was corrected when the door to the sample room was closed. Several high hand and shoe counts were recorded by personnel working in the sample room and a piece of filter paper suspended in the room for twenty minutes, free from touching any object, became contaminated to a maximum of 7,300 c/m.

Restrainer brackets were installed on the top, far side of the pile without contamination spread. The area was cleaned prior to the start of the job and control measures proved adequate.

Survey of express car (Milwaukee #1000) returned by the consignee with empty special request casks disclosed six pairs of contaminated cotton gloves, a contaminated mattress and a contaminated newspaper. An incomplete survey of the floor of the car revealed six spots of contamination present.

The radiation beam at the top, far edge of the pile showed a gamma intensity of about 2.3 roentgens per hour.

100-H Area

Evidence of a gas leak from the pile through porous or faulty concrete was

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evident in the minus 12 foot near reactor development room. Increase in this activity was noticed during regeneration of the gas in the purification drier rooms at which time the pile gas was under pressure.

Active gas was still prevalent on the top, the front face, and the far side of the pile. Trapped gas in the third safety headers on top of the pile showed dosage-rates up to 1.1 r/hr at 2 inches. All high airborne contamination samples were traced to back-up from the 1608 building sump through floor drains, or to the effluent line. Traces of airborne contamination were still observed around the Maintenance and Electrical shops in the form of vapor from the retention basin. Radiographs of air filter samples showed no particulate contamination.

Neutron surveys in the outer rod room showed no significant fluxes. Further investigation of the vertical T-seams at the #1 Experimental Level using fast neutron film and a proton recoil counter substantiated the presence of fast neutron beams from the seams, although in neither survey were the flux densities as great as previously indicated with a Nout and moderated BF_3 counter.

100-F Area

Maintenance work to the "A" regulating rod and the installation of a restraining bracket at the top, far edge of the pile were completed without undue personnel exposure. Extensive decontamination was done on top of the pile prior to work at that location.

Manipulation of samples in the "B" Experimental Hole was attempted at the same time the restraining brackets were being welded into place on the top, far side of the pile. Rags used to swab the manipulating rod were ignited by a spark from the welding. All personnel in the vicinity of the minor fire were wearing assault masks and an air sample being taken within a few feet of the fire showed 2.2×10^{-5} μc/liter for beta emitters. No personnel contamination was detected.

Three cases of hand contamination were reported following work in the discharge area and were easily reduced. The gamma dosage-rate in the radiation beam at the top, far edge of the pile was about 4 roentgens per hour.

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Health Instrument Divisions

200 Areas, T and B Plants

General Statistics

	November			December			
	T	B	Total	T	B	Total	1949 Total
Special Work Permits	273	356	629	287	380	667	8,727
Routine & Special Surveys	440	521	961	493	472	965	12,245
Air Monitoring Samples	555	874	1429	572	670	1242	14,632
Thyroid Checks	167	94	261	122	77	199	2,599

Canyon Buildings

In the T Plant, monitoring assistance was required while taking four routine samples and one special sample. Personnel contamination was reported on two persons after leaving the crane cab and follow-up surveys of the cab revealed general floor and equipment contamination, most likely tracked in from the craneway. The crane way was reported generally contaminated and mops used in its decontamination showed surface dosage-rates up to 920 mrep/hr. When routine air samples showed excessively high fission product concentrations, it was discovered that a process run had been jetted into 17-1 tank from 16-3 tank with the cell blocks inadvertently off 17 L. The maximum air sample during this period showed 10^{-5} μc f.p./L and 5.5×10^{-10} μg Pu/cc. Twenty-six of the canyon air samples jammed the beta counters with a maximum surface dosage-rate of 170 mrep/hr being reported, which represented about 10^{-4} μc f.p./liter.

In the B plant, all Canyon Extended Special Work Permits were voided for the major part of the month due to excessive contamination on the deck. A great deal of decontamination work was done and it was possible to reinstate the Extended Special Work Permits. No personnel contamination occurred. The 17-3 sampler was repaired and the 18-4 agitator removed, welded and replaced without undue exposure to personnel. An "A" frame and adapter ring were found contaminated in the 272 B Maintenance Shop and follow-up surveys of personnel and equipment used showed the only contamination to be on the gloves worn. A "Regulated Flat Car" will be used for this equipment in the future to prevent recurrence.

Control Laboratories

In the T Plant, a total of 187 items, not regulated with respect to handling, was found contaminated on surveys by H.I. and Technical personnel. Two instances of product skin contamination and three of fission product contamination were reported and successfully decontaminated. Fifty-seven contaminated floor locations were reported and cleaned. A potentially serious minor

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injury occurred when a laceration of the palmar surfaces of the hand resulted from glass tubing manipulations with a rubber stopper. There was no contamination detected in the wound.

In the B Plant, a total of 192 items, not regulated with respect to handling, was found contaminated by Technical and H. I. personnel. Three cases of product and three cases of fission product hand contamination were reported and successfully cleaned Forty-one contaminated floor locations were reported and cleaned. High level protective clothing contamination resulted when a laboratorian tipped over a cone holder. No overexposure or skin contamination resulted.

Concentration Buildings

In the T Plant, routine cell surveys revealed an estimated total of 225 μg Pu with 120 μg reported on a flange in a pan under the E balcony. No contamination spread occurred on five inspection jobs and three maintenance repair jobs.

In the B Plant, with G.E. Cocoon placed on all tanks equipped with a shaft, the following table, based on 165 air samples, shows the estimated Pu discharge from roof vents.

	November	December
	μg Pu/24 hours	μg Pu/24 hours
A-cell vent	2.6	13.0
B-cell vent	3.8	7.9
D-cell vent	10.5	13.5

The cause of a tenfold increase during the period from December 1 to December 9, was not determined despite extensive, joint efforts of "S" and H. I. Divisions.

Stack Area

In the T Plant, a maximum dosage rate of 500 mr/hr at 2 inches from the sand filter inlet duct, was reported the day following the special dissolving. (December 3, 1949). At month end the reading at this point was back to the normal level of about 30 mr/hr.

Waste Disposal Areas

In the T Plant, two 100 gallon metal waste samples were taken from the 103-U tank without incident. Sandblasting of well car casks was continued when

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weather permitted. Attempts to obtain a 400 pound sludge sample from the 101-U tank failed when difficulty was experienced with the sampling equipment. Some high level contamination spread occurred but was confined to the equipment and paper surrounding the equipment. Decontamination is in progress.

In the B Plant, "S" Division routine surveys of the waste areas led to the eventual discovery of what appeared to be mouse feces in the vicinity of the 153-C diversion box. Uncorrected surface dosage-rates up to 7 rep/hr were reported. Samples were obtained for radio-chemical analysis by the H. I. Development Division and traps were set out in an effort to capture small animals in the vicinity by the H. I. Biology Division.

Special Dissolving

In the T Plant, a special run was dissolved the night December 2-3, 1949. Air samples taken on the roofs of the 271-T and 224-T Buildings during this period showed a maximum concentration of 1.3×10^{-6} μc f.p./L and below 1×10^{-11} μg Pu/cc. No increase in activity was found in building air filter samples. Ground contamination was general and numerous positive shoe counts were obtained with a maximum of 78 registers in 24 seconds reported. An announcement was prepared by "S" Division and H. I. to explain to personnel in the 200 Areas the nature, extent and reason for this increase in contamination.

Plant Laundry

Seventeen of the 102 spot and continuous air samples taken showed positive results with a maximum of 9×10^{-5} μg U/cc obtained. The maximum fission product concentration indicated was 1.4×10^{-7} μc/liter.

General

Three thyroid checks all for H. I. Divisions personnel showed iodine concentrations in the thyroid gland approximately equal to or slightly below the recommended tolerance levels. Those were all obtained in connection with the Special Dissolving. All other thyroid checks were below the warning level.

The Isolation Building

General Statistics	November	December	1949 Total
Special Work Permits	20	30	354
Routine & Special Surveys	321	311	3,614
Air Monitoring Samples	486	408	5,196

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Health Instrument Divisions

OPERATIONAL DIVISION

100 Areas

General Statistics

	November					December					1949
	B	D	F	H	Total	B	D	F	H	Total	Total
Special Work Permits	714	610	797	589	2710	784	622	893	486	2785	25,762
Routine & Special Surveys	456	393	442	411	1702	518	397	474	360	1749	19,511
107 Effluent Surveys	92	90	89	142	413	91	95	96	153	435	3,656
Air Monitoring Samples	84	106	101	70	361	108	85	100	132	425	4,952

Retention Basin Effluent

The activity of the water leaving the retention basin was as follows:

	100-B	100-D	100-F	100-H
Power Level (MW)	275	305	275	275
Average beta dosage-rate (mrep/hr)	1.2	1.0	1.1	0.7
Average gamma dosage-rate (mr/hr)	1.9	2.4	2.3	1.4
Average total dosage-rate (mrep/hr)	3.1	3.4	3.4	2.1
Average integrated dose in 24 hrs. (mrep)	74	82	82	50
Maximum integrated dose in 24 hrs. (mrep)	96	101	96	58
Maximum integrated dose in 24 hrs. (mrep) 1949	108	132	106	77

100-B Area

Pile and Associated Buildings

High level airborne contamination was discovered in the storage area, transfer area, monitor room and water sample rooms after several high hand counts were reported. The condition was corrected when the discharge area drain relief riser valve leading to the process sewer was closed, when a new water seal was installed in the #4 storage area drain, and water seals installed in the drains in the water sample rooms. All air samples showed the usual short half-lives.

Special material testing equipment was installed in the "B" Experimental Hole and gas samples collected from the system at intervals. No appreciable hazard was encountered.

The lead shielding for P.C. tube #C453 was not replaced after a shutdown and

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Air Sample Results

Location	No. Taken	No. above 10^{-11} µg Pu/cc	Maximum µg Pu/cc	Remarks
Operating Cells	206	5	8×10^{-10}	SWP work, cell 3.
Control Laboratory	169	1	4.3×10^{-11}	Changing RC Can, Room 31.
Development Laboratory	16	0	--	
Duct	13	--	2.3×10^{-12}	

Operating Cells

Fifteen items, not regulated with respect to handling, were found contaminated by H. I. personnel. Two were above 20,000 d/m and one was above 80,000 d/m. Four instances of skin contamination occurred and were cleaned and two floor spots were found in cell 3 and cleaned. Some contamination spread occurred during maintenance work in cell 4 but was easily cleaned. The maximum levels of gamma radiation encountered were 48 mr/hr on PR containers; 2 mr/hr at the process hoods and 7 mr/hr on SC.

Control Laboratories

A total of 52 items, not regulated with respect to handling, was found contaminated on surveys by H.I. and Technical personnel. All were below 20,000 d/m. Two cases of product skin contamination were reported and successfully cleaned. Considerable floor contamination occurred in room 33 when 7 cartons of packaged contaminated waste ready for burial were returned and opened. About 4 µg Pu was spilled on the floor in room 36 when a standard disc was dropped. In addition, three other contaminated floor locations were found in laboratory rooms.

Technical Development Laboratories

During the reassembly of a modified hood in room 42, protective clothing contamination on one person led to the discovery of about 3 µg Pu on the floor. No further spread of contamination was found and air samples taken during subsequent cleanup all showed below 10^{-11} µg Pu/cc.

234-5 Building

General Statistics	November	December	1949 Total
Special Work Permits	165	152	1,088
Routine & Special Surveys	349	339	2,094
Air Monitoring Samples	1,086	1,118	8,378

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Air Sample Results

Location	No. Taken	No. above 10^{-12} µg Pu/cc	Maximum µg Pu/cc	Remarks
234 OP.	256	101	3×10^{-8}	Waste removal, room 228.
235 OP.	173	17	7.9×10^{-11}	Panel removed, hood 21.
Technical	256	53	8.9×10^{-11}	Sample vial dropped, room 134.
General	287	20	7×10^{-12}	Laundry room.
Ducts after primary filter	63	39	1.9×10^{-10}	234 Section.
26 inch Vacuum line	21	16	3.8×10^{-11}	
10 inch Vacuum line	18	--	--	
Stack breech	44	1	2.7×10^{-12}	

234 Building - Operating Section

Nineteen incidents of contamination spread, attributed to process leaks, maintenance work or process operations, occurred within the process rooms and an associated 6 floor spots were found in adjacent corridors and rooms. Seventeen major maintenance jobs involving work in Zone IV or on process lines were completed with contamination confined to work areas and protective apparel. The incident previously reported (November) as due to leaking flanges was later attributed to a faulty valve. Three cases of skin contamination were reported and successfully cleaned.

235 Building - Operating Section

Two incidents of contamination spread occurred within process rooms, both attributed to rubber glove changes. Two cases of skin contamination were reported and successfully cleaned. A cleaning hood was installed directly behind hood 21 without incident. This installation should result in a reduction in hand exposure since employment of an inert gas and powdered abrasive replaced a manual operation.

Technical Section

A total of 188 items, not regulated with respect to handling, was found contaminated and outside of hoods; 11 items read above 20,000 d/m and 5 were above 40,000 d/m. There were 28 contaminated floor locations reported in laboratory rooms and 13 contaminated floor locations reported in adjacent corridors. It is noteworthy to report no cases of skin contamination. In

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incident of contamination spread occurred during sample inventory, when a vial was dropped on the floor. About 10 μg of Pu were involved and some personnel protective clothing contamination occurred.

General Building

Five items, not regulated with respect to handling, were found contaminated; 2 were above 20,000 d/m and 1 above 40,000 d/m. The latter was a box of waste ready for the burial ground but stored in room 170 and showed approximately 50 μg Pu on the outside.

The 300 Area

General Statistics	November	December	1949 Total
Special Work Permits	146	166	2,344
Routine & Special Surveys	154	236	2,146
Air Monitoring Samples	177	178	1,774

Metal Fabrication Plant

Sixty-three of seventy-seven air samples taken were above 5×10^{-5} μg U/cc as follows:

Location	Number Taken	Number Above 5×10^{-5} μg U/cc	Maximum Conc. μg U/cc	Conditions
313 Building				
Canning & Dipping	3	0	--	--
Chip Recovery	17	16	3.3×10^{-3}	Operator's position at press.
Machining	9	5	8.1×10^{-5}	Roller turner lathes West of operators.
314 Building				
Melt Plant	5	5	2.6×10^{-3}	Sweeping in progress.
Main Room	40	35	4.4×10^{-4}	Routine operations, central sample.
Outside	3	2	1.6×10^{-4}	12 feet from burning table.

Air sample results indicate the major source of air contamination to building 314 is the transfer of oxide from trays removed from the outgassing furnace to drums. Other significant sources of air contamination are loading of these trays, screening free metal from the open hearth burning table, and cleaning

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out of crucibles in the burnout room. A resurvey of the chip recovery operation served to verify time limits previously imposed.

Burial Ground

Another spontaneous fire occurred (see November report) in the burial pit. Full protective clothing including chemox masks was worn by fire fighters and no contamination of equipment or personnel was found. Investigation revealed that rags used in cleaning the chip recovery press were the probable cause. Procedures for the disposal of these rags were changed in order to eliminate recurrence of such fires.

Technical Building

Product contamination was found inside duct work removed during the installation of hood filters in rooms 96 and 98. The duct work was sealed as removed and no spread of contamination was found. An air sample result of 2×10^{-11} µg Pu/cc was obtained during this work. One instance of high level contamination occurred in room 98 due to a spill of fission products. Decontamination was successful. Continuous monitoring was provided during removal of dry waste in room 19 and during the opening of a sample in room 57. There were 18 high hand counts recorded for the period.

Cold Semi-Works Building

Some contamination spread resulted when an agitator and shaft were brought into the canyon from the underground storage area, without release. Readings up to 20,000 d/m were reported on the equipment; 4,000 d/m on gloves, but no skin contamination was found. Approximately 1,396 pounds of uranium have been discharged to the waste ponds. The total uranium in the 300 N crib was increased from about 96 to 157 pounds during the month. A total of six high hand scores were recorded and all successfully reduced.

Hand Score Summary

A total of 38,406 alpha and 38,401 beta hand scores were reported. About 0.1% of the alpha and about 0.16% of the beta scores were high. No attempted reduction was recorded for 7 high alpha scores, all in the 300 Area.

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PERSONNEL METERS

Pencils

	100-B	100-D	100-F	100-H	E&N 200	200-W	300	Total	1949 Total
Pencils read	9,200	10,226	14,782	10,490	17,235	26,958	35,563	124,454	1,708,976
Single readings (100 to 280 mr)	13	5	22	13	19	53	36	161	2,693
Paired readings (100 to 280 mr)	0	0	1	0	0	0	1	2	22
Single readings (Over 280 mr)	16	20	26	23	28	67	71	251	3,434
Paired readings (Over 280 mr)	0	0	0	0	0	0	0	0	33
Paired readings Lost	0	1	0	0	1	2	0	4	63

Neither of the two significant pencil results were confirmed by the badge result. Investigation of lost readings showed no possibility of an overexposure.

Badge Resume, Construction Areas

	190-D	Total	1949 Total
Badges Processed	202	202	63,388
No. of Readings: (100 to 500 mrep)	0	0	209
No. of Readings: (Over 500 mrep)	0	0	19
Lost Readings:	0	0	56

Badges

	100-B	100-D	100-F	100-H	200-E	R.H.T. 200-N	200-W	300	Total	1949 Total
Badges Processed	2336	1822	2374	1872	1956	501	3338	7227	21,426	240,805
Number readings (100 to 500 mrep)	5	3	4	10	25	1	36	149	233	2,836
Number readings (Over 500 mrep)	0	0	0	0	0	0	0	1	1	28
Lost Readings	2	1	1	1	1	0	0	2	8	169

The investigation of the result over 500 mrep showed no possibility of radiation exposure. Pencil results were zero and examination of the film showed it was not a radiation darkening.

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CONTROL AND DEVELOPMENT DIVISION

Site Survey

The number of routine samples processed this month was curtailed to allow full coverage of the "green run." The activities found in various water sources were consistent with past findings.

A series of small very active pieces of material (up to 3 rep/hour at a distance of about 3 inches with a C.P.) was found by the Survey Group near the "C" diversion box in the 200 East Area. Analyses of these particles indicated the presence of rare earths and strontium but no ruthenium. The particles are about the size of weed seeds or mouse feces. Further analysis and investigation is being carried out by the Biology Division, the Survey Group, and Site Survey.

On the night of December 2, 1949, one ton of metal with 16 days cooling was dissolved in the 200 West Area. At the time of the run Site Survey measured I^{131} air concentrations as high as 3×10^{-8} μc/liter averaged over a 24 hour period in the areas and 3.4×10^{-8} μc/liter over a four day period at Benton City. The cloud apparently blew back over the area the day after the run since scrubbers started on the 3rd at Benton City and Richland showed more activity than the one operating during the run. Pans of water at various locations near the areas picked up as much as 90 μc of I^{131} on a one square foot area of water.

Thirteen hundred and sixty-five vegetation samples were taken in an area extending from Klamath Falls to Kettle Falls and from Lewiston, Idaho to Portland, Oregon. The most active sample from the area within the 200 West fence contained 28 μc/kg. Activity exceeding 10 μc/kg was not uncommon inside the separation areas and along route 3 between the areas. The pattern of deposition is elongated in a northeast and southwest direction. The average activity in the Horse Heaven Hills near Kiona was on the order of 1.0 μc/kg with a maximum of 4.3 μc/kg at Kiona. Wahluke Slope deposition was in the range of 0.1 - 0.5 μc/kg with two small isolated areas on the order of 0.5 - 1.0 μc/kg. A long narrow strip of deposition between 0.1 and 0.5 μc/kg included the communities of Goldendale, Arlington, Plymouth, Walla Walla, Odessa and Moses Lake. A complete report on the data from this run will be issued.

For comparison, the permissible permanent concentration on vegetation is taken as 0.01 μc/kg. Where the concentration is not maintained, the initial permissible limit is at least 12.5 times higher, and is more probably about 50 times higher. The observed deposition is higher than was anticipated. The direct hazard to man depends on the atmospheric concentration, and this remained at acceptable levels.

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Lost readings were accounted for as follows:

Badges lost in area	5
Light struck	2
Overdeveloped	1

Investigation of lost readings showed no possibility of an overexposure.

Total badges processed 1949,	Operations	240,805
	Construction	63,388
	Total	304,193

In addition, 2,285 items of non-routine nature were processed bringing the 1949 total to 27,981.

On December 5, 1949, the Personnel Meters Section moved to the new Personnel Meter Building. The central accumulation of all permanent records now stored in various parts of the Plant will be completed at an early date.

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Geology

Water samples from wells 361-B-1, 361-B-9, and 241-T-361 had essentially the same activity levels that have been maintained for the last several months. The alpha activity in the 303 wells outside the 300 Area was below the significant level for the first time since the initial sampling in December 1948. A soil sample from the test hole #2 in the 200 East Area 5-6 this field was heavily contaminated with both fission products and plutonium. Concentration factors in this soil sample were 2700 for the fission products and 1900 for plutonium. Fission product activity in the sediments 20 feet beneath the 241-T second cycle crib increased from 50 milli-microcuries per kilogram to 350 milli-microcuries per kilogram due to jetting from the 112-T tank to the crib.

The water level in 5 wells all within the 200 West Area ground water mound have shown a sharp rise. The greatest change was in well 244-T-4, which has risen 3 5 feet in the last 3 months.

Meteorology

Forecasting:

	December, 1949		Year, 1949	
	Number Made	Reliability	Number Made	Reliability
Production Forecasts	93	80.5%	1094	[illegible].9%
24-hour forecasts	62	81.5%	730	[illegible].7%
Special forecasts	19	78.9%	134	[illegible].3%

The weather for December was featured by above normal temperatures, much below normal precipitation, and much above normal wind speeds.

Temperatures averaged 35.1 with a lowest reading of 10 on the 19th and a high of 60 on the 29th. Total precipitation was only 0.16 inch including only 0.7 inch of snow. Normal precipitation is about 0.86 inch of precipitation. Wind speeds were much above average, the highest speeds being recorded on the 17th, 25th, and 27th. The period from the 23rd to the 29th was one of almost continuous wind with a dust storm occurring on the 27th.

Bioassay

There were 511 urine samples analyzed for plutonium during the month. The blank samples and samples averaged 0.04 d/m with a 92% yield on the spiked samples. Three resamples were necessitated by high values during the month. Three

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groups of samples were reanalyzed because of low yields. Three resamples from previous high results were all less than 0 33 d/m.

One hundred and eighteen urine samples were analyzed for uranium on the fluorophotometer. The maximum individual result was 36 µg/liter.

Thirty-three urine samples were analyzed for tritium oxide at the 222-U laboratory. Of these samples seven were greater than the detectable limit of 1.2 µc/liter. Four successive samples from one man from the beginning to the end of the month gave readings of 1.7, 4.5, 10, and 4.8 µc/liter. Two other samples from one man about two weeks apart gave 4.4 and 4.8 µc/liter. The maximum permissible permanently maintained concentration is currently said to be 10 µc/liter.

Methods Development

The series of 12 urine samples spiked with Pu and analyzed in the Bioassay laboratory were measured by the use of alpha film this month. They indicated about 85% efficiency as compared to the alpha counters. The overall efficiency of the analytical and film techniques was about 67% indicating on the order of 0.33 tracks per minute in the emulsion for each dis/min in the sample. The background of the film was about 0.01 tracks per minute over the exposed area of 38.5 square millimeters, after a one week exposure.

At the request of the Survey Group sections of CWS filter paper believed to have low level plutonium activity as specks were exposed to NTA slides for 210 hours. Examination under the microscope indicated numerous points of alpha tracks ranging from complete fogging to groups of 50 - 100 tracks from a given center. A second film which caused darkening of X-Ray film at points was exposed with no appreciable centers of alpha activity present.

The effect of iron in the plating bath on the electrodeposition of plutonium was investigated in more detail. An apparent loss in yield occurs when more than 0.6 mg of iron is added. The average yield of 25 electrodeposited discs without iron added was 89.0% with a standard deviation of 3.9%. A successful electropolishing method for stainless steel discs has been developed and the effect of depositing on this disc is being investigated.

A standard sample of C-14, used for a half-life determination at Argonne, was sent by Dr. C. R. Hennig. Analyses of this sample by present techniques, using the correction factors for the counters as measured in this laboratory, check Dr. Hennig's value within 8.2%

A successful operation of the resin columns intended for the separation of fission products from urine was reported. Good separations were obtained, but the volume of eluant was too great for routine operations.

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An attempt was made to obtain an evolution curve from the 200 West Area stack during the "green run" of December 2-3, 1949. A good xenon curve was obtained but the I^{131} curve was poor due to unexpected removal of the iodine in the sample line from the 50 foot level. Data was also obtained on the solubility of xenon in olive oil and the efficiency of small hand scrubbers used by Site Survey. An analysis of the condensate drained from the sampling line indicated that about 50% of the iodine was present as free iodine, about 50% as iodide and <1% as iodate.

Work was initiated on investigations of procedures for extracting plutonium from the CWS filter paper used by the Operational Division for air measurements. Preliminary results obtained by placing a known amount of plutonium nitrate solution on a filter paper, drying, digesting in aluminum nitrate solution, and extracting with ethyl ether indicate a possible 90% yield. Further work to evaluate the effect of radon daughters and the chemical form of the plutonium is planned.

Methods Control

A summary of counting time on the low background Alpha Counters indicates that about 60 - 65 hours of counting time are available per day with eight sets in operation and one held as spare for maintenance. Consistent yields of 80 - 90% on the extraction of plutonium from water using nitric acid as the salting out agent and the stirrer pump for mixing have been obtained. More equipment is to be ordered so that a large number of routine evaluation tests may be made on the procedure.

A summation of the number of samples analyzed in December is as follows:

Laboratory	
Vegetation	1,775
Water	645
Solids	190
Fluorophotometer	134
Tritium Oxide	67
Miscellaneous	40
Total	2,851
Counting Room	
Beta Measurements	4,452
Alpha Measurements	2,278
Control Points	2,119
Decay Curve Points	517
Absorption Curves	17
Total	9,383

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The following summaries represent annual summations of routine work loads in the various groups:

Bioassay Group - 1949

Total urine analyses for plutonium	6,062
blank analyses	728
spike analyses	1,317
Total urine for fission product	4,089
blank analyses	692
spike analyses	676
Fluorophotometer analyses	2,182
Total number analyses	15,746

Counting Room - 222-U - 1949

Total alpha counts for samples	37,327
Total beta counts for samples	54,133
Total counts taken for control alpha sets	13,044
Total counts taken for control beta sets	6,630
Total number counts taken	111,134

Site Survey Group - 1949

Total Water Samples Taken		7,026
Drinking water	3,612	
Test Wells	677	
River water	1,252	
Waste water	1,169	
Rain water	316	
Air filter samples	2,006	
Detachable chambers (paired readings)	7,243	
Handpump air samples	58	
Film packets	1,711	
Vegetation On-Area	6,276	
Vegetation Off-Area	1,551	
Solids	1,529	
Mobile instrument surveys	31	
Portable instrument surveys	314	
Miscellaneous - Special surveys	30	
Total number Surveys and Samples		27,775

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Physics

Some more experimental work was required with the extrapolation chamber to obtain data for some corrections to the calculations on the dose rates from uranium and thorium. Measurements with the high pressure methane chamber indicate considerable difficulty in obtaining saturation conditions for recoil protons when the pressure is 300 psi.

The training for the personnel neutron monitoring program is well underway. Four girls were trained now and four more should be ready by the end of the first week in January.

Several Eastman NTA slides were exposed to the 100-H pile on the X-level and showed the existence of a beam one centimeter or less wide with a peak intensity of about 60 n/sec/cm^2 at the #4 T-seam.

Industrial Hygiene

A considerable portion of the time this month was used in study of non radioactive problems in conjunction with the Safety and Medical Divisions. This included studies of the use of nickel carbonyl in the 234-5 Building, ammonia exposures arising from the operation of two Ozalid machines in Reproduction Section, and the exposures to solvent vapors which would be encountered in the painting of the interior of a long pipe. The size distribution of the particulate material resulting from the machining of graphite was studied for Project Engineering.

Work was continued on the study of atmospheric contamination of the 314 building including some restudy of particle size where previous sampling was inadequate.

Instrument Development

An alpha scintillation probe was placed in experimental service in Building 234 after laboratory tests had shown its stability and uniformity of response to be acceptable. As submitted for field test, 18% geometry with negligible background and no microphony could be obtained using a standard poppy altered for the purpose. The greatest foreseeable difficulty with this probe is to obtain a light tight screen which transmits a good fraction of the incident alpha particles. Techniques for making such screens are being investigated.

A pressure ion chamber for monitoring highly active sheep thyroids has been obtained. This detector in combination with a stable D.C. amplifier is intended for use at activity levels which block G.M. counters. In addition, a fast quench circuit has been built to extend the useful range of the Geiger counter instrument. These steps will provide a fairly wide range of activities with which to obtain cross calibrations between the two detectors.

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Experimental pulse analyzer runs were made to determine the characteristics and difficulties with the present instrument. These were preliminary tests and may be taken only as a rough indication of performance. Curium, Americium and Plutonium, each present to the order of 1000 d/m were separated easily. However, there was evidence of instability in amplifier gain. This effect, that of chamber gas and pressure, and means for increasing resolution (best obtained so far was about 0.1 KeV at half maximum counting rate) still needs to be investigated

Work on a portable BF_3 neutron counter has been started. Most of the work has been concerned with a suitable "subminiature" amplifier, pulse equalizer and counting rate meter. With a medium sized (3/4" x 3½") BF_3 tube, 1 mv gives about 3 c/m, with no significant background.

A proportional counting system intended for counting alpha and beta particles simultaneously has been designed and tested in bread-board form. Separate alpha and beta amplifiers are used, but an alpha pulse is made to block the beta amplifier output until the multiple pulses produced have died out. A dead time of about 15 micro sec is required. This system sacrifices high speed operation to cancel the effect of overdriving the beta amplifier and does not give spurious pulses when the blocking gate is actuated.

Calibrations

The routine calibrations were:

RADIUM CALIBRATIONS	Number of Calibrations		
	November	December	1949 Total
Fixed Instruments:			
Gamma	340	394	4,902
Portable Instruments:			
Alpha	251	251	2,385
Beta	484	503	4,959
Gamma (Radium)	896	775	13,258
X-Ray Scanning	10	6	309
Neutron	7	43	378
Total	1,648	1,578	21,289
Personnel Meters:			
Beta	315	665	8,818
Gamma (Radium)	8,122	8,235	101,357
X-Ray	6,251	6,258	72,067
Neutron	--	--	13
Total	14,688	15,158	182,255
GRAND TOTAL.	16,676	17,130	208,446

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BIOLOGY DIVISION

Analyses Group

1. Plutonium Analyses in Tissue

It has been found that the efficiency of the lanthanum fluoride method for extracting plutonium decreases with increasing quantities of calcium and phosphorous. A bismuth phosphate coprecipitation followed by TTA extraction is presently giving yields up to 70% using spiked rat ash.

2. Adsorption of Plutonium on Surfaces

Apparatus and methods being used by biochemistry in their work on plutonium adsorption through the gut have been assayed for residual activities. Losses inherent have not been found significant.

3. Analyses of Active Particles

Other work necessitated a delay in the active particle analyses, and no progress was made in this problem other than a preliminary TTA analysis for plutonium.

4. Assistance to Zoology is being continued and included the preparation of radioiodine solutions and of a thyroid phantom.

Aquatic Biology Group

1. Effect of Pile Effluent on Aquatic Life

Chinook salmon eggs of the monitoring tests which hatched early this month in water containing 5 percent effluent that had been refrigerated, showed no increase in mortality, while eggs-held in a like concentration of effluent which was not refrigerated (about 1°C higher) showed mortalities significantly above normal. In other groups, mortalities among the young fry has been normal except in the highest concentration of effluent water (10 percent).

Specific activity of the young salmon fry is from 12 to 25 times that of the water in which they are being held.

2. Biological Chains

The amount of activity in trout being held in a 5 percent concentration of green effluent water decreased during the month due to colder water temperatures. The group which is also being fed food containing algae from the 107 basin has nearly 5 times as much activity as the groups not receiving the active food.

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The addition of 15 p.p.m. of disodium phosphate to pile effluent water has consistently reduced the amount of activity accumulated in small carp by about 50 percent. At the end of 49 days, the amount of activity accumulated in the fish was not appreciably different than that accumulated at the end of the first 24 hours.

Trout which have been fed the carp reared in the effluent containing the disodium phosphate are slightly less active than those feeding on carp reared in straight effluent water. Trout held in river water containing 15 p.p.m. disodium phosphate have accumulated slightly less activity from radioactive carp than have trout held in straight river water. This test is being somewhat handicapped by the slow feeding rate of the trout resulting from the cold temperature of the water.

3. Radiobiological Survey of the Columbia River

An abnormally high level of the water in the Columbia River prevented sampling of the bottom organisms during the first half of the month and permitted only restricted collecting during the latter half.

Although the activity of the water in the river remains at about the same level as last month (2×10^{-3} beta μc/liter at Hanford), the activity of the aquatic organisms with the exception of the plankton continues to decline with the water temperature. In most forms, including the fish, the specific activity was only about half that found during November.

Biochemistry Group

1. Performing blood chemistry procedures for the animal farm is continuing on a routine basis until the unit can be turned over to the Zoology group.

2. Deposition in Lungs of Active Particles

Specific activities in lungs of rabbits exposed to stack gases for periods from 50 - 70 hours were about 0.7 beta μc/kg wet tissue.

3. Gastro-intestinal absorption of plutonium

The experiment to determine whether any differences exist in the rate of gastro-intestinal absorption and in the rate of deposition of Pu^{239} in male and female rats was started on December 5, 1949. Five male and five female rats are presently receiving daily doses of 400 lambda of a plutonium (+ 4) nitrate solution at a pH of 2.0. One gavage outfit consisting of a 1 ml. syringe, a graduated lambda pipette and a rubber catheter, all coated with silicone to prevent adsorption of the plutonium solution, is used for all 10 rats and also to deliver 400 lambda of the plutonium solution on several counting plates which are dried overnight. The number of d/m found on these plates is assumed to be equal to the number of d/m of plutonium administered to the rats. An average

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daily dose of 9,000 d/m has been counted on the plates. Four rats, two males, and two females are receiving oral daily doses of 400 lambda of water using a similar gavage outfit; these will serve as controls. It is planned to continue the daily administration of plutonium for an additional 10 weeks. The carcasses will then be analyzed for the presence of plutonium.

Botany Group

1. Separations Area Control Plot

A summary report of findings in Russian thistle growing in the 200 East R-3 Danger Zone is being prepared. Additional data on soil contamination is being collected and germination rates of seeds collected from contaminated plants are being observed.

2. Agricultural Field Station

Soil samples from the treatment area averaged 0.02 beta μc/kg. All trees infested with Western Virus have been pulled and piled for burning.

3. Translocation of Radioelements in Plants

Work, preliminary to a study of the absorption and translocation of iodine by plant tops, has shown that almost all of the beta activity on artemisia tridentata (sage) from 200 West Area can be extracted by cold alkali and sodium metabisulfite. Contamination of plants by airborne radioiodine appears to be caused by adsorption rather than translocation.

4. Peas and wheat plants placed inside and outside the 614 buildings in 200-E and 200-W on December 2 showed increased activity above those placed in 100-F, 100-B, and 3000 Areas.

Average beta activities (μc/kg)

	200-West		200-East	
	Outside	Inside	Outside	Others
Peas	1.0	0.1	2.1	0.01
Wheat tops	1.7	0.1	2.2	0.01

Physiology Group

1. In service to other groups, photomicrographs and radioautographs have been prepared for botany.

2. Like biochemistry, this group is operating the blood morphology unit for the animal farm until a satisfactory routine procedure is set up.

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Zoology Group

1. Toxicology of I^{131}

Arrangements have been made for final acceptance of Phase I of the Experimental Animal farm.. Phase II has been inspected and cannot be accepted until numerous deficiencies are corrected. Preliminary tests of filtered effluent by the Public Health Section of the Medical Division indicate it is unsafe to empty into the river at the present time due to high chlorine demand and settleable solids.

The training, breeding, and conditioning of the sheep are progressing satisfactorily.

2. Biological Monitoring

Emphasis was placed upon the collection of birds and mammals from arbitrary locations on and near the reservation during the month. A total of 68 animals were assayed for I^{131} in the thyroids. For birds and mammals the maximum activity was about 300 beta $\mu c/kg$, with respective averages of 87 and 160 $\mu c/kg$ thyroid. These animals were taken from the north slope of Rattlesnake Butte, including Benson and Snively Ranches and Rattlesnake Springs. Lowest activities on the reservation were found in animals collected from the 300 Area. In the region from Benton City to Prosser, birds sampled showed an average of 12 $\mu c/kg$. Mallard ducks from LaCrosse and Kennewick had less than 0.5 μc deposited/kg thyroid. Maximum activities observed in specimens collected occurred during the week of December 18.

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H M Parker