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January 28, 1949

T. W. Hauff, Head
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7 pages

ANALYTICAL SERVICES - PILE AREA LABORATORIES

COPY 1 OF 1

In response to your request, pertinent facts are listed regarding the analytical services currently provided by the Analytical Section in the pile areas.

SCOPE OF WORK

The work of the Analytical Section in the pile areas may be classified into five categories as follows:

- (1) Analysis of pile process water.
- (2) Analysis of power plant (boiler) waters.
- (3) Analysis of drinking water.
- (4) Analysis of Columbia (non-process) and Yakima River water.
- (5) Preparation of reagents and standard solutions.

The scope of the work under each of these phases is detailed below:

1. Pile Process Water

The major part of the analytical program involves chemical analyses of the cooling water to the piles. As originally conceived, careful chemical control of the cooling water to the piles in the 100 Areas was established by the QIX Group of the Technical Department. This group worked out the permissible limits for the various components of the water, and during the intervening years, modifications to the program have been made in accordance with studies and requests of the interested groups. Examples of some of these studies are: (1) establishment of limits on dichromate and pH; (2) number of samples; (3) number of pump adjustments for dichromate and pH control; (4) trends in parallel pressure readings; (5) factors having the greatest influence on the activity of the process water; and (6) factors which cause film formation. At present, the pile process water is analyzed routinely for the following components:

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Iron
Dichromate
Silicates
Chlorine

Sulfate
Turbidity
Alkalinity
Calcium

Chloride
Magnesium
pH

Iron, silicates, and dichromate are checked against specifications within fifteen minutes after receipt of the sample in the laboratory. If the analysis shows them to be outside of the specification limits, the result is reported verbally and immediately to the Power or P Division supervision. If the analysis shows them to be within the specification limits, no verbal report is made. Results of all of the analyses are routinely reported on a standard daily report form.

In addition, microscopic examinations of the pile process water are performed. This involves: (1) classification of organisms and (2) determination of the total organisms per ml of water.

The magnitude of the analytical work on pile process water in the three pile area laboratories (185 buildings) is indicated by a tabulation of the December 1948 work volume statistics. These figures are representative of the present work load.

Division Charged for Work	Type of Analysis	Samples/mo.		Analyses/mo.		Man days Required/mo.	
		No.	% of Total	No.	% of Total	No.	% of Total
Power	Chemical	11236	84.4	18074	77.0	511	71.2
Power	Microscopic	70	0.5	500	2.1	44	6.1
P	Chemical	2044	15.1	4875	20.9	163	22.7
Totals		13350	100.0	23449	100.0	718	100.0

As shown by this tabulation, approximately 77 percent of the required man days per month are expended on the Power Division's pile process water analytical program.

The attached flow sheet sketch shows the points in the process where samples are obtained for analysis. This sketch also shows the routine sampling schedule.

2. Power Plant (Boiler) Water

Boiler waters from the power plants in all plant areas (100, 200, 300 and 700) are analyzed routinely in the 100 Area Laboratories for the following constituents:

Alkalinity
Chlorides
Phosphates

Hardness
Silicates
Sulfates
Solids

In addition, the water from the pile area power plants is analyzed for sulfites.

The magnitude of this work on boiler waters is indicated by the tabulation below:

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Division Charged for Work	Type of Analysis	Samples/No.		Analyses/No.		Man Days Required/No.	
		No.	% of Total	No.	% of Total	No.	% of Total
Power	Chemical	453	95.4	130	93.0	66	89.2
Community	"	22	4.6	146	7.2	8	10.8
Totals		475	100.0	276	100.0	74	100.0

All results are reported on a standard daily report form except the pile area power plant samples which are analyzed and reported in writing within four hours after receipt of the samples in the laboratory.

3. Drinking Water

The drinking water from the 300 Area and the various wells in the village of Richland are analyzed routinely in the 100 Area laboratories for: (1) alkalinity, (2) chlorides, (3) hardness, (4) silica, and (5) sulfates.

The magnitude of this work is as follows:

Division Charged for Work	Type of Analysis	Samples/No.		Analyses/No.		Man Days Required/No.	
		No.	% of Total	No.	% of Total	No.	% of Total
Power	Chemical	4	50.0	24	50.0	1	50.0
Community	"	4	50.0	24	50.0	1	50.0
Totals		8	100.0	48	100.0	2	100.0

The drinking water analyses are reported on a standard weekly report form.

4. Columbia (Non-Process) and Yakima River Water

Samples from the Columbia and Yakima Rivers are taken routinely as follows: (1) Columbia River, above 100-B Area and at Richland; (2) Yakima River, at the bridge to the "Y" and below the sewage disposal plant outlet. Analyses are made for the following constituents:

pH	Dissolved Oxygen
Alkalinity	Oxygen (biological oxygen demand)
Carbon Dioxide	Solids
Chlorides	Turbidity
Hardness	Chromium
Albuminoid Nitrogen	Silicates
Ammonia Nitrogen	Nitrates

The samples are procured by the Power Division and the results are reported by letter to the Atomic Energy Commission. Prior to January 10, 1949, the work was charged to the Industrial Medicine Division but since then the P Division has been assigned the charge based upon recommendations of the Accounting Division. There are 17 samples and 248 analyses per month, requiring 18 man days per month.

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5. Preparation of Reagents and Standard Solutions

Eighteen standard solutions and special reagents are routinely prepared for the Power Division for (1) spot-check boiler water analyses performed by them in all areas, and (2) for spot-check pile process water analyses performed by the Power Division in the pile areas. It is estimated that approximately 13 man-days are required per month to keep an adequate supply of these materials on hand to fulfill the Power Division's requirements.

Work Summaries

The distribution of the analytical work performed in the three pile area laboratories and the man days required per month tabulated in the work categories listed above are summarized below:

Work Category	Division Charged for Work	Samples/Mo.		Analyses/Mo.		Man Days Required/Mo.	
		No.	% of Total	No.	% of Total	No.	% of Total
Pile Process	Power Division	11236	81.10	18074	70.01	511	61.93
" "	" "	70	0.51	500	1.94	44	5.33
" "	P "	2044	14.78	4875	18.84	163	19.75
Power Plant	Power "	453	3.27	1930	7.48	66	8.02
" "	Community "	22	0.16	146	0.57	8	0.97
Drinking	Power "	4	0.03	24	0.09	1	0.12
"	Community "	4	0.03	24	0.09	1	0.12
Rivers	P Division	17	.12	248	.96	18	2.18
Prop. of Reagents, etc.	Power "	-	-	-	-	13	1.58
Totals		13850	100.00	25821	100.00	825	100.00

A survey of the above table results in the following summations:

Work Category	Samples/Mo.		Analyses/Mo.		Man Days Required/Mo.	
	No.	% of Total	No.	% of Total	No.	% of Total
Pile Process Water	13350	96.39	23449	90.11	718	87.01
Power Plant Water	475	3.43	2076	8.05	74	8.99
Drinking Water	8	0.06	48	.18	2	0.24
River Water	17	.12	248	.96	18	2.18
Reagents	-	-	-	-	13	1.58
Totals	13850	100.00	25821	100.00	825	100.00

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Division Charged for Work	Samples/No.		Analyses/No.		Man Days Required/No.	
	No.	% of Total	No.	% of Total	No.	% of Total
Power	11763	84.9	20528	79.5	635	77.0
P	2061	14.9	5123	19.8	161	21.9
Community	26	0.2	170	0.7	9	1.1
Totals	13850	100.0	25821	100.0	825	100.0

Methods of Analyses

The analytical methods are standard for water analyses, with technique modifications to fulfill the particular conditions. They involve colorimetric, titrimetric and general chemical procedures. Each method is simple enough to be performed by a non-technically trained employee, and most of the routine and special samples are analyzed by this type of personnel. Even though the methods may be performed by non-technically trained personnel, the degree of skill, aptitude, etc., required of the analyst by each analytical method varies since some methods are more complex than others. The degree of complexity of these methods may be classified into three categories as follows:

Classification

Description

I

Requires a high level of intelligence, patience, manual dexterity, inclination, etc. Method consists of 12 or more separate steps.

II

Requires normal intelligence, etc. Method consists of 5 to 12 separate steps.

III

Method consists of only 1 to 5 simple steps. (Simple test type method.)

Using the above classification, the analytical methods for each of the constituents analyzed in each work category may be tabulated as follows:

Constituent	Skill Classification	Percentage of Total Analyses	Constituent	Skill Classification	Percentage of Total Analyses
Iron	II	15.97	Sulfate	II	2.94
Dichromate	II	21.93	"	I*	.43
Silicates	II	23.78	Turbidity	III	.30
"	I*	.43	Alkalinity	II	4.09
Chlorine	III	.94	Calcium	II	.31
Chloride	II	.70	Phosphate	II	1.07
"	I*	.71	"	I*	.26
Magnesium	II	.31	Hardness	II	.44
pH	II	17.07	Carbon Dioxide	II	.17
Microscopic Analysis	I	5.06	Albuminoid Nitro-		
Dissolved Oxygen	I	.21	gen	I	.17
Oxygen (DO)	I	.17	Ammonia Nitrogen	I	.17
Chromium	I	.17	Solids	II	1.09
Sulfite	II	.94	Nitrates	II	.17
			Total		100.00

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* Power Plant waters from 300 and 700 Areas are more complex since the concentration of the constituents varies considerably.

As shown by the tabulation, the bulk of the analysis, e. g. 91.0%, requires a normally intelligent individual with a medium level of skill, patience, aptitude, etc. Only a small percentage (1.2%) of the analyses are of a simple test type. Approximately 7.8% require a high level of aptitude, etc.

PERSONNEL

The supervisory and working force assigned to the analytical program in the three pile area laboratories is described below:

There are seven supervisors, with functional assignments as follows:

Area Supervisor, 185-B, 185-D, 185-F Laboratories

Senior Supervisor

Shift Supervisor, A Shift

" " " B "

" " " C "

" " " D "

" " " Special assignments

There are thirty-eight personnel performing actual laboratory work functions:

1. Chemists (technical training)

One chemist on straight days in each laboratory; total - 3.

One chemist per shift, dividing time between the three laboratories;
total - 4.

Total number of chemists - 7.

2. Technicians (not technically trained)

Two technicians per shift in each laboratory; total - 24.

One technician per shift dividing time between the three laboratories;
total - 4.

Two technicians on straight days for microscopic studies; total - 2.

One technician on straight days for general clean-up dividing time
between the three laboratories; total - 1.

Total number of technicians - 31.

These personnel figures may be summarized as follows:

<u>Classification</u>	<u>Supervision</u>		<u>Laboratory Working Force</u>		<u>Total</u>	
	<u>No.</u>	<u>Man-days/Mo.</u>	<u>No.</u>	<u>Man-days/Mo.</u>	<u>No.</u>	<u>Man-days/Mo.</u>
Supervisors (technical training)	7	152	-	-	7	152
Chemists (technical training)			7	152	7	152
Technicians (not technically trained)			31*	673	31	673
Totals	7	152	36	825	45	977

* Includes one clean-up technician.

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Duties and Responsibilities of Personnel

The technically trained personnel have the following duties and responsibilities:

1. Act as shift leader or acting supervisor during absence of a shift supervisor.
2. Assist the supervisor in planning special and regular work assignments.
3. Assist the supervisor in safety and housekeeping programs and inspections.
4. Review and approve analysis reports.
5. Determine and maintain operating efficiency of laboratory instruments.
6. Prepare and distribute standard solutions for check on reagents, equipment condition, techniques and methods.
7. Check standard colorimetric curves as per schedule or when results indicate curve deviations.
8. Prepare or arrange the preparation of special solutions required in the laboratory or by other groups and divisions.
9. Work on special problems or analyses of the laboratory which are beyond the capacity of the non-technical personnel.
10. Organize and follow training of new personnel assigned to a shift.
11. Perform routine analyses when required.
12. Assist in the preparation and conduction of group meetings of a shift.

The non-technically trained personnel have the following duties and responsibilities:

1. Perform control analyses.
2. Perform analyses of non-repetitive nature for which methods and procedures are developed.
3. Prepare and standardize, when necessary, reagents required in the laboratory.
4. Perform general maintenance on spectrophotometers and pH meters such as cleaning or changing bulbs, setting and checking wave length, balancing, cleaning and changing electrodes.
5. Assist in the training of new personnel.
6. Assist technically trained personnel on special problems.
7. Clean equipment and general housekeeping.

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COSTS

As shown by the personnel and work distribution tabulations, 825 man-days laboratory working force per month are required. The total salary cost for these 825 man-days is approximately \$11,320, including shift differential and isolation pay. This figure does not include (1) the material costs, which are small, and (2) the I.E costs, which in the Analytical Section for the period from September 1, 1948, to December 31, 1948, average 152% of the applied labor costs (and which include the supervisory costs charged to Code 102 in accordance with general plant procedure). Thus, the salary cost per month for the divisions for which work is performed is as follows:

<u>Division</u>	<u>Salary Cost/Mo.</u>
Power	\$8720
P	2480
Community	<u>120</u>
Total	\$11320

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