HW-7-2346

HW 4.159 **DECLASSIFIED** [redacted] RECORD CENTER FILE 719099

FILE

Route List

1. O. J. Davis 2715 JUL 11 '62
2. R. H. Wilson 3746
3.
4.
5. RECORD CENTER FILE

REPOSITORY PNL

COLLECTION Dietary Studies

BOX No. N/A

FOLDER N/A

DATE 9-11-45

SUBJECT Status of Problem of Measurement of the Activity of Waste Water Returned to the Columbia River

TO S. T. Cantril

FROM H. M. Parker

COPY NO. 6-B

300 N

BEFORE READING THIS DOCUMENT, SIGN AND DATE BELOW:

O. J. Davis 2-15-54

THIS DOCUMENT IS PUBLICLY AVAILABLE

INVENTORIED AUG 8 1951 DOCUMENT AUDIT AND INVENTORY UNIT

DECLASSIFIED

1140349

[redacted]

[redacted] DECLASSIFIED

Class. DECLASSIFIED (Change to .....)
By authority of TID-1116
Page 504 5-15-56
By ATOMIC 4-3-57

1. Extra
2. Extra
3. Extra
4. Extra
5. Extra
6. Extra
7. Extra
8. Extra

September 11, 1945

TO: S. T. CANTRIL

3 6
8 B

STATUS OF PROBLEM OF MEASUREMENT OF THE

ACTIVITY OF WASTE WATER RETURNED TO THE COLUMBIA RIVER

Introduction

The process waste waters become temporarily radioactive, and are held up in the Retention Basins until the activity is mainly exhausted. The activity of the water is measured at three points in each basin -- the inlet end, an intermediate point, and the exit end. The reading at the exit end defines the safety of the water, and the inlet and intermediate readings are used only to detect a possible flow of excessively active water before it reaches the exit, so that the process could be stopped and the water held up longer. This has never been necessary in practice. The water released from the basins has always been considered safe for humans or fish to swim in. It is further diluted before return to the Columbia River by mixing it with other waste water free from activity. The water returns to the river by underwater pipes to be released in mid river and have the maximum chance to mix with the river water to further reduce the already safe concentration of radioactivity.

DEFINITION OF LIMITS

The tolerance dose for complete immersion in active water is 0.1 International Roentgen per 24 hour day. This corresponds to an average dosage-rate of 4.17 mr (milliroentgens) per hour. This limit is the normal value for the radiation of the human body. It is understood that published evidence indicates that fish are less sensitive to radiation.

MEASUREMENTS AT THE RETENTION BASIN EXITS

The radiations in the water are of two kinds:

(1) Non-penetrating radiations, called Beta rays,

(2) Penetrating radiations, called Gamma rays.

DECLASSIFIED
[redacted]

This document contains information affecting the National Defense of the United States within the meaning of the Espionage Act, 50 U.S.C. 31 and 32, as amended. Its transmission or the revelation of its contents in any manner to an unauthorized person is prohibited by law.

6

The penetrating rays are potentially more dangerous and the measurements of the two components have therefore always been made separately. The definition of limits includes both equally and is thus conservative. The penetrating component is read by means of an ionization chamber suspended over the exit end of the basin. The radiation produces an electric current in the chamber, and this current is amplified and continuously recorded on a control panel in the operating building.

The non-penetrating component is continuously monitored at the Retention Basin, but the printed record is maintained there since it is not necessary to follow the changes of both components minute by minute.

The average dosage-rates for the period January - August 1945 have read as follows:-

AVERAGE DOSAGE-RATES IN MILLIROENTGENS PER HOUR

MONTH	Non-penetrating Radiation	Penetrating Radiation	Total Radiation
January 1945	0.4	1.4	1.8
February	0.4	1.9	2.3
March	0.4	1.6	2.0
April	0.6	2.2	2.8
May	0.7	2.1	2.8
June	0.6	1.8	2.4
July	0.6	1.7	2.3
August	0.6	1.8	2.4

Reference to this table indicates that the average dosage-rate has not exceeded 67 per cent of the permitted limit. It will be noted also that there has been a slight downward tendency in recent months, indicating that the process has been stabilized and that future results should be in this range or lower. It will be seen also that the penetrating component has always been within 5 per cent of comprising 77 per cent of the total radiation, which explains why it is not necessary to watch both components continuously.

CONTROL MEASUREMENTS

In addition to the recording observations, readings have been taken throughout the operating period with portable measuring devices to check the primary readings and to make extra tests. Very good numerical agreement has been observed throughout. In the field of extra tests, the portable instruments have been immersed at different depths in the basins to check the theoretical variation from point to point (all primary records are referred to the maximum possible reading in the water). The possibility of local currents of water in the basins producing erroneous results on the recording chambers has been carefully studied.

A small degree of channelling has been found possible, but it seems to be such that the recorded activity would read slightly too high, and never too low.

1140351

DECLASSIFIED

H M Parker - S T Cantril [redacted] 9/11/45

DECLASSIFIED

FATE OF THE WATER AFTER LEAVING THE RETENTION BASINS

The water from the basins is first mixed with all other inactive plant wastes. The dilution is variable but on the average the activity at this point is 70 per cent of the basin activity or less than 50 per cent of the tolerable activity. The water is returned to the river by an underground pipe to a mid-stream point where it emerges with considerable turbulence to promote mixing and further dilution. Fifty feet from the mixing point, the activity is only 10 per cent of the tolerable value, and at 1000 feet there has been a further dilution by a factor of 10.*

Activity measurements have been made routinely at points down river as far as Pasco. Away from the immediate vicinity of the return flumes to the river, the activity has never been found to be in excess of 0.01 mr/hr, or about one-four hundredth of the tolerable value.

DECAY OF THE WATER

It has been stated that the process water becomes temporarily radioactive. The function of the Retention Basins is to hold up the water from the process until most of the activity has been lost. This stage occupies about six hours. The activity falls by a factor of 20 during this period. Thereafter it becomes weaker at a slower pace, and falls by a further factor of 10 in two days. It is clear that away from the plant area the water activity would become negligible by decay alone without benefit of river dilution. The two factors together definitely limit the problem to the local area near the plant.

About 1 per cent of the activity of the released water does not decay rapidly. The disposition of this component is being followed closely. Objects exposed to the water can pick up a coating of this activity, and one has to determine whether or not this could ultimately accumulate to a dangerous concentration. Various materials have been immersed in the Retention Basins for long periods. The greatest activity acquired in this manner to date has been approximately 2 mr/hr or one-half of the tolerable value. It will presumably follow that accumulation from the weaker activity in the river itself will be insignificant. This has been tested by mud samples and is to be continued as a long-range experiment. Similarly the possibility of absorption of the active materials in fish is to be followed.

H. M. Parker, Chief Supervisor
H. I. Section

HMP:swc

RECEIVED
SEP 14 1945
TOO AREA
CLASSIFIED FILES

* These dilutions will probably have some seasonable variations still to be studied. These figures were obtained in March at a time of low level in the river.

1140352

DECLASSIFIED