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**ORNL**
**CENTRAL FILES NUMBER**
67 - 1 - 8

DATE: January 9, 1967

COPY NO.

SUBJECT: Review of Aqueous and Gaseous Waste Handling and Disposal at ORNL

TO: A. M. Weinberg - H. G. MacPherson

FROM: Radiochemical Plants Committee

# RADIOCHEMICAL PLANTS COMMITTEE REVIEW OF AQUEOUS AND GASEOUS WASTE HANDLING AND DISPOSAL AT ORNL

The Radiochemical Plants Committee met on October 17, 1966, and reviewed the aqueous and gaseous waste handling operation by the Operations Division. Present were:

| Committee | Operators |
|---|---|
| P. N. Haubenreich, Chairman | H. H. Abee |
| T. A. Arehart | L. C. Lasher |
| E. E. Beauchamp | J. F. Manneschmidt |
| W. A. Bush | E. J. Witkowski |
| S. E. Dismuke | |
| J. S. Drury | |

Prior to the meeting the Committee was provided with various documents for study material:

1. "The Disposal of Radioactive Liquid and Gaseous Waste at Oak Ridge National Laboratory," ORNL-TM-282

2. "Radiochemical Waste Disposal Operations Report for the Month of July, 1966," ORNL-CF-66-9-15

3. Draft - "3039 Stack Area Emergency Control System"

4. Draft - "Description of ORNL Waste Disposal Operations"

At the meeting the operators provided additional information in the form of a general description of the waste operations. Slides of pertinent operations and data aided the Committee greatly during the discussion period.

## DESCRIPTION OF OPERATION

The goal of the liquid and gaseous radioactive waste management at ORNL is to dispose of waste as safely and economically as possible. The present approach is as follows:

1. Chemically treat the low-level liquid waste to precipitate the greater part of the radioactivity prior to discharge into the creek river system. Dilution in the river then reduces the concentration of radioactivity to levels well below the maximum permissible concentrations set by the National Committee on Radiation Protection and the International Commission on Radiological Protection.

2. Concentrate the intermediate-level liquid waste, dispose of condensate into the low-level waste system and inject the concentrate as cement grout into fractured strata below the water table.

3. Store the high-level liquid waste at the point of origin.

4. Filter and/or chemically treat all gaseous waste before discharge to the atmosphere to ensure that the radioactivity of the released gases is well below the maximum permissible concentration.

5. Monitor all waste streams to verify safe operation.

## Aqueous Waste

The process waste system is used for disposal of a large volume of water that is only slightly contaminated and water that may become contaminated through operating error or equipment failure. Approximately 1,000,000 gallons of this type waste is generated each day.

Process waste from the 4500 Area and facilities in Melton Valley (approximately 60% of the total), which seldom contains any activity, is collected in ponds and analyzed. If analysis shows activity, it is pumped to the chemical treatment plant; if not, it is drained into the creek drain system for discharge to the Clinch River. The rest of the process waste, approximately 350,000 gallons, which originates from the various processing facilities in Bethel Valley, averages about 0.1 μc/gallon and is drained to the chemical processing facility. There it is treated with lime, soda ash, and clay to precipitate the activity. An efficiency of 70-90% is attained in the removal of radioactive strontium, the governing contaminant. Surveillance of the process waste system is accomplished by nine monitoring and sampling stations. One is located at the inlet to the equalization basin where all the tributaries join, and the rest are in the main tributaries of the system. Pertinent information is continuously transmitted and recorded at the waste monitoring center.

Approximately 8000 gallons per day of intermediate-level waste (averaging about 0.05 c/gallon) generated by processing and laboratory facilities in Melton and Bethel Valleys are collected in 21 stainless steel tanks prior to pumping or jetting to a 170,000-gallon concrete storage tank. The ILW is then pumped to a 700-gallon per hour evaporator where a concentration factor of 20-40 is achieved. The concentrate is stored in a 170,000-gallon concrete tank until a sufficient quantity is accumulated to permit economical disposal by the deep well hydrofracturing method. This method has been tested and disposal of intermediate waste concentrate will begin in December, 1966. Two 80,000-gallon injections per year will be necessary. Before 1966 disposal was to seepage trenches.

Liquid levels of the tanks and control signals from the evaporator building are continuously transmitted and recorded at the Waste Control Center.

Creeks and streams making up the watershed of the Bethel and Melton Valleys are continuously monitored (six locations) as they flow into White Oak Lake. Also, a monitor at White Oak Dam continuously records the activity released into the Clinch River. The calculated activity in the Clinch River due to ORNL discharges is considerably below 2% MPC - normally less than 1% MPC.

## Gaseous Waste

Radioactive gaseous waste produced by the Laboratory from a wide variety of sources is discharged to the atmosphere from seven locations. These are the 3018, 3020, 3039, HFIR, MSRE, 2026 stacks and 5505 facility. Ventilating air from operating areas passes through roughing and high efficiency filters before discharge. Offgas from vessels and glove boxes passes through two sets of roughing and absolute filters; and, in certain areas where there is a likelihood of gaseous activities, acidic vapors, organic vapors, etc., the offgas also passes through caustic scrubbers and/or activated charcoal filters to provide initial decontamination and/or neutralization.

All ventilation and offgas systems use electric blowers for normal operation. Backup systems are provided at each stack area to supply ventilation in the event of an area power failure. All backup systems provide service equal to the primary systems with the exception of the steam-driven ventilation system for the 3039 stack, which provides 60% of the normal 150,000 cfm operating rate.

All gases are monitored prior to release to the atmosphere. Information from the monitors in each area is telemetered to the Waste Monitoring Control Center, where it is recorded or indicated, and kept under 24-hour surveillance. An annunciator system alarms in the event of an abnormal occurrence.

## COMMENDATIONS

The Committee feels that the ORNL Waste Handling Group should be commended for the many improvements to the waste handling systems, whose effects are so evident in the great reduction in the activity released to the Clinch River and to the atmosphere over the past several years. The improvements include:

1. Discontinuance of pit and trench disposal of intermediate-level waste

2. Program for concentration of ILW for ultimate disposal by hydrofracturing

3. Monitoring of all gaseous discharges with 24-hour surveillance

4. Better use of the blower systems at 3039 stack and complete automation of the controls

5. Reduction in process waste volume to the Chemical Treatment Plant through the use of a collection pond system for the 4500 area

## COMMITTEE RECOMMENDATIONS

In executive session after the review, the Committee suggested two items which it felt should be given further consideration:

1. The Operations Division should update ORNL-TM-282, "The Disposal of Radioactive Liquid and Gaseous Waste at Oak Ridge National Laboratory," to include the recent improvements.

2. The Laboratory should re-evaluate the adequacy of the 3039 stack emergency ventilation capacity. Presently the normal stack load is approximately 150,000 cfm, but in the event of a power outage, the emergency capacity is only 90,000 cfm. Previous reviews indicated that the 90,000 cfm would provide ventilation for an orderly shutdown of facilities and would maintain them in a "safe" condition until normal ventilation could be re-established. However, in view of the increased amounts and higher specific activity of radioactive materials presently handled by the facilities serviced by the 3039 stack system, the Committee feels that the situation should be analyzed again. If such a study shows that the reduced emergency ventilation is inadequate, it should be increased.

On the basis of the review, the Committee believes that the liquid and gaseous waste handling system and its operation do not constitute any undue risk to the health and safety of the public. The Committee therefore recommends approval.

Paul N. Haubenreich

P. N. Haubenreich, Chairman
Radiochemical Plants Committee

PNH:TAA:bb

[Laboratory Records]

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DATE ISSUED: JAN 31 1968

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ORNL
CENTRAL FILES NUMBER
68 - 1 - 41

DATE: January 24, 1968

COPY NO.

SUBJECT: Review of Aqueous and Gaseous Waste Handling and Disposal at ORNL

TO: A. M. Weinberg; H. G. MacPherson

FROM: Radiochemical Plants Committee

# RADIOCHEMICAL PLANTS COMMITTEE REVIEW OF AQUEOUS AND GASEOUS WASTE HANDLING AND DISPOSAL AT ORNL

The Radiochemical Plants Committee met on November 29, 1967, and reviewed the aqueous and gaseous waste handling operation by the Operations Division. Present were:

| Committee | Operators |
|---|---|
| J. S. Drury, Chairman | L. C. Lasher |
| T. A. Arehart | J. F. Manneschmidt |
| R. E. Brooksbank | E. J. Witkowski |
| S. E. Dismuke | |
| R. W. Schaich | |
| A. D. Warden | |

Prior to the meeting the Committee was provided with the following documents as study material:

1. "Review of Aqueous and Gaseous Waste Handling and Disposal at ORNL," ORNL-CF-67-1-8.

2. "The Disposal of Radioactive Liquid and Gaseous Waste at Oak Ridge National Laboratory," ORNL-TM-1832

3. "Radioactive Waste Disposal Operations Report for the Month of July, 1967," ORNL-CF-67-9-10

The review was held with the operators to discuss the status of the ORNL waste handling program since the last review, which was conducted October 17, 1966. The main points of discussion dealt with:

a. The effectiveness of the program

b. Additions and improvements

c. The problem areas

## REVIEW OF OPERATIONS

### Program Effectiveness

A review of the monthly radioactive waste disposal operations reports since the October, 1966, review indicates continued good control and minimal release of activity to the environment. The average percent of $MPC_W$ in the Clinch River due to ORNL discharges for 1967 was less than 1%. The total activity released in the gaseous waste — mainly $^{131}I$ and not including rare gases or other nonadsorbable species — averaged approximately 2 curies per month for 1967. ORNL's permissible $^{131}I$ release should not average more than 52 curies per year.

The deep well hydrofracturing method for disposal of intermediate level waste concentrate, in the form of concrete grout, by injection into

fractured shale strata (approximately 850 feet below surface), functioned as well as expected. Approximately 294,000 gallons of ILW concentrate were disposed of in this fashion in three separate injections without incident.

Additions and Improvements

A number of improvements have been or will in the near future be incorporated into the ORNL radioactive waste handling systems.

1. An 860 cubic-foot weigh tank has been added at the Hydrofracturing Site to facilitate weighing and mixing of cement, clays, and fly ash preparatory to forming a grout with the intermediate level waste concentrate.

2. A 300-foot section of the 2-inch ILW steel pipeline to the Hydrofracturing Site, in the area where it crosses White Oak Creek and runs through swampy ground on either side of the creek, will be replaced with stainless steel. The advisability of this change is based on the high corrosion rate of steel pipe in this area and the danger of a leak or rupture in the pipe which would discharge ILW concentrate into White Oak Creek.

3. A new alpha monitor capable of differentiating between alpha radiation produced by process particulates and environmental radon or thoron will be installed in the 3039 stack system by January, 1968. This monitor will supplement the existing system.

Problem Areas

Two items in this category were discussed at some length during the review:

a. At the October 17, 1966 Radiochemical Plants Review, the Committee requested that the Operators determine the adequacy of the emergency ventilation capacity at the 3039 stack. As was indicated at that time, the emergency turbine driven fan capacity was 60% of the normal monitor driven capacity of 150,000 cfm.

   Based on the Operators' evaluation of the problem and discussion at this review, the Committee feels that the emergency capacity should be brought up to the full stack ventilation capacity. The latter would be determined by actual measurement.

b. The need for a spare evaporator was considered, but the consensus of the Committee, based on a solution pH of 10-13 and temperature of ≈ 212°F, was that significant corrosion of the evaporator (304L) was highly improbable.

   It was felt that a spare evaporator was not required and if a leak did occur, the evaporator could be replaced in about a six-month

period. During this period, with stringent control of the amount of ILW generated, the ILW would be stored in the Tank Farm. In the event the Tank Farm could not handle the full amount, the Trench Disposal System would be reactivated for a short period of time.

## COMMITTEE RECOMMENDATIONS

In executive session after the review the Committee noted that a previous Committee recommendation of updating ORNL-TM-282 to include all improvements has been accomplished and is now published as ORNL-TM-1832.

The Committee also noted that the Operators had studied the 3039 stack ventilation system and completed a preliminary design and cost estimate of the additional emergency ventilation requirements.

On the basis of the review, the Committee believes that the liquid and gaseous waste handling system and its operation do not constitute undue risk to the health and safety of the public, but feels that the emergency ventilation capacity at the 3039 stack should be brought up to the normal ventilation capacity as soon as possible.

Based on the above, the Committee therefore recommends approval.

J. S. Drury, Chairman
Radiochemical Plants Committee

JSD:TAA:bb