X-822

OAK RIDGE NATIONAL LABORATORY
Operated By
UNION CARBIDE NUCLEAR COMPANY
UCC
POST OFFICE BOX P
OAK RIDGE, TENNESSEE

EXTERNAL TRANSMITTAL AUTHORIZED

ORNL
CENTRAL FILES NUMBER
56-5-70

COPY NO. 49

DATE: May 8, 1956

SUBJECT: "Vacuum Sweeper" Tests for HRT-CP

TO: R. B. Lindauer

FROM: R. H. Winget

16. C. B. Graham
17. C. W. Gray
18. C. C. Griess
19. C. J. Hairston
20. C. N. Haubenreich
21. C. W. Hill
22. C. J. Kochanadel
23. C. H. Kanks
24. C. I. Kaplan
25. C. R. Kasten
26. C. S. Kitzes
27. C. B. Kramer
28. C. A. Kraus
29. C. A. Kraus
30-32. C. B. Lindauer
33. C. I. Lundin

50. T. H. Thomas
51. D. S. Toomb
52. V. [illegible]

Photostat Price $ 1.80
Microfilm Price $ 1.80

Available from the
Office of Technical Services
Department of Commerce
Washington 25, D. C.

NOTICE

This document contains information of a preliminary nature and was prepared primarily for internal use at the Oak Ridge National Laboratory. It is subject to revision or correction and therefore does not represent a final report.

435 001

DISCLAIMER

To: R. B. Lindauer

From: R. H. Winget, Jr.

Subject: "Vacuum Sweeper" Tests for HRT-CP

Date: May 8, 1956

INTRODUCTION

The HRT-CP Design Review Committee recommended that a means be provided for preventing gross contamination of the shielding water by removing the water in the immediate vicinity of the newly opened flange requiring maintenance. The Committee suggested using a pump to provide suction close to any opened flange. This is called the "vacuum sweeper" technique. This report summarizes the results of tests conducted in cell B of 7500 to determine the best conditions for installing such a system.

SUMMARY

Since a pump requires maintenance, it was thought that the 2" Penberthy jet already installed in the sump of cell C could be modified to provide suction for a portable vacuum system. The normal 2" suction line of the jet was changed to a 1" suction line and a second 1" suction line was added running parallel to the cell floor and mounted 90° from the normal suction line. With 80 psig steam to the jet, a 16.5 gpm flow rate was attained through an 8-1/2" diameter 1" stainless steel tubing suction ring with 24 equally spaced holes with a total cross sectional area of 1.58 inches^2. This flow was in addition to the flow through the 1" normal suction of the jet. By modifying the jet, no valves were necessary to operate either the portable suction side of the jet or the normal suction side of the jet since both will be used simultaneously. The minimum flow recommended for the "vacuum sweeper" technique by Unit Operations was 10 gpm as compared to 16.5 gpm obtained in this system. Potassium permanganate dye used to simulate activity was pulled through the ring without any difficulty in a mockup of flange breaking in cell B of 7500.

PROCEDURE AND RESULTS

The existing 2" Penberthy jet located in the sump of cell B of 7500 was modified by replacing the normal 2" suction first with a 1-1/2" line and then by a 1" line and adding a second 1" suction line parallel to the cell floor and at an angle of 90° from the normal suction line. In this manner shielding water would be removed from the cell via the normal suction line along with the locally highly contaminated shielding water from a particular flange via a portable suction ring. Thus, under the correct conditions, enough

flow could be obtained around the newly opened flange to prevent contamination of the entire tank of shielding water and would eliminate the use of a pump as well as any valves to shut off either of the two suction lines from the jet. An 8-1/2" diameter suction ring was fabricated from 1" stainless steel tubing (0.065" wall thickness) with 3/16" holes spaced one inch apart around the inner circumference of the ring. A six inch length of pipe was welded into the ring to provide a connection for the flexible tubing. (See Fig. 1.) A void space of 2-1/2" along the circumference opposite the tee was provided to allow the ring to be placed over a pipe and then lowered over the flange. About 20 ft of 7/8 in. i.d. heavy wall tygon tubing was connected to the suction ring and to the 1" side suction of the modified jet. In this manner the ring could be moved to any position in the cell. The jet was covered at all times by about a foot of shielding water to prevent air inleakage into the normal suction side of the jet which would reduce the efficiency of the jet. Several variables of the system were tested and the results of these tests are shown in Table 1.

Table I Summary of Tests

Steam Pressure Supply to Jet, PSIG	Size of Normal Jet Suction	Size of Side Jet Suction	Rate from Ring, gpm
55	1-1/2"	1" a	5.6
55	1"	1" a	7.2
55	1"	1" b	9.4
80	1"	1" b	12.8
70	1"	1" b	11.8
55	1-1/2"	1" b	7.2
70	1-1/2"	1" b	8.1
80	1-1/2"	1" b	9.2

[a] 1" suction reduced to 3/4" pipe by elbow (tygon connected to 3/4" pipe)

[b] 1" suction, no elbow (tygon connected to 1" pipe)

As seen from Table 1, a maximum flow of 12.8 gpm could be obtained by using 80 psig of steam for the jet and both suctions 1" pipe. The combined flow of the two suction lines operating simultaneously was not measured due to lack of time and equipment; however, visual observation of the flow from the jet using the two inch suction line with no side suction compared to the combined flow from two 1" suction lines showed no great difference in total flow. A large drop in total flow using this system would not be acceptable since this jet removes the last 12" or so of the shielding water following operation of the dewatering pump. Although Unit Operations recommended a minimum flow of 10 gpm and 12.8 gpm was obtained, the suction ring was modified to obtain an even greater flow. The total cross sectional area of the 24 holes was increased by a factor of 2.4 which increased the flow through the ring from 12.8 gpm to 16.5 gpm. Details of the modified ring are shown in Fig. 1.

After finding the condition for maximum flow through the ring, a test rig was set up using potassium permanganate dissolved in water as a dye to simulate activity escaping from a flange. The suction ring was placed over an open flange and the permanganate solution was fed out through the flange via tygon tubing. The permanganate solution was removed from the flange satisfactorily via the suction ring without spreading out into the cell.

RECOMMENDATIONS

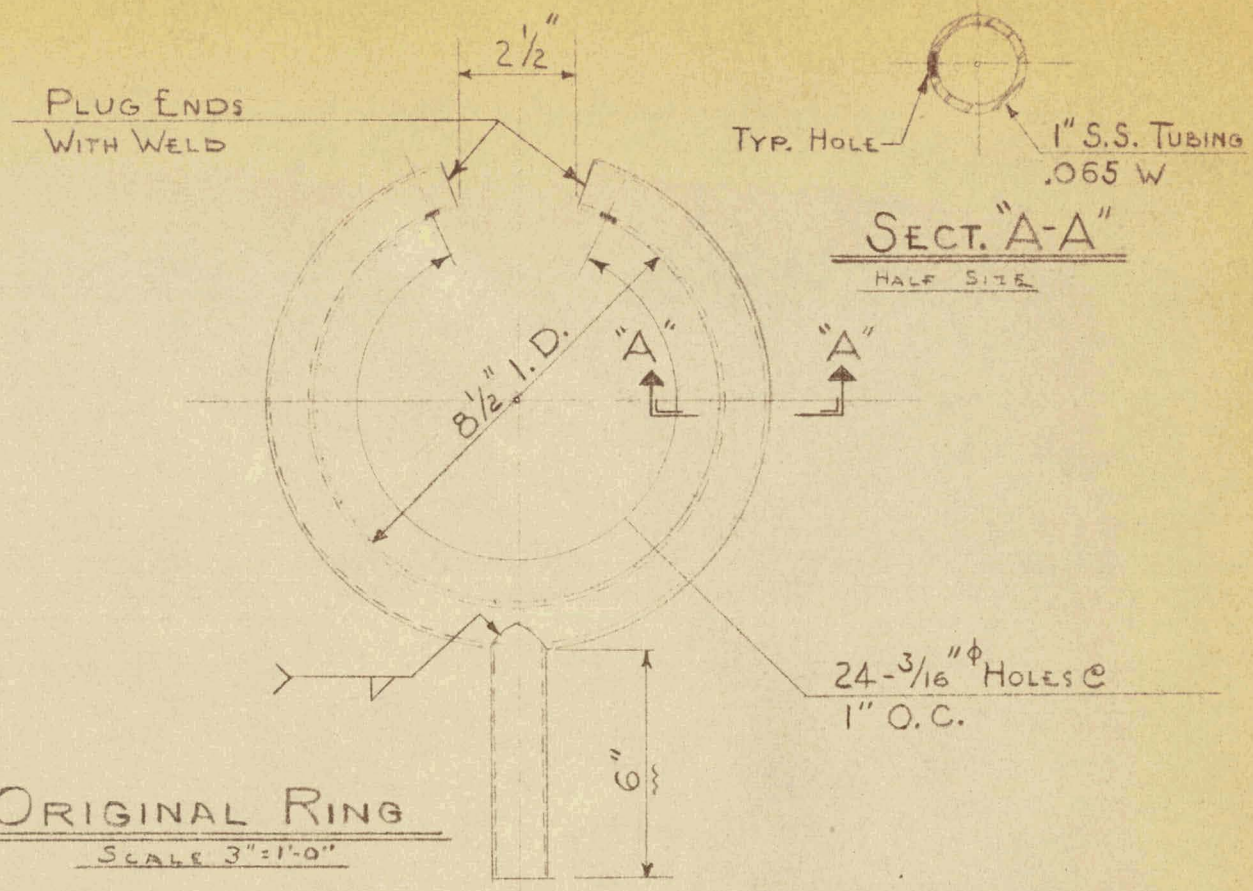
On the basis of these tests, it is recommended that the jet in cell C be modified with a 1" normal suction line and 1" side suction line. The side suction line should be run to the wall of the cell parallel to the floor and then rise vertically via an 8" radius bend rather than an elbow to terminate in a 1" flange with the bolt nuts welded in place just as is being done in all of the chemical plant flanges. The mating flange should be connected to 20' of 7/8" i.d. heavy wall tygon tubing which terminates with the suction ring. When the tygon tubing deteriorates either from use or radiation damage, a new flange with new tygon tubing and suction ring can be installed on the permanently mounted flange suction connection.

As an alternate recommendation, a lead plug could be fabricated to cover the sump along with a suitable tool for removing the plug when both suction lines of the jet were required. By isolating the normal jet suction line, the flow through the suction ring could be increased over the present 16.5 gpm.

R. H. Winget

R. H. Winget
Process Design Section
Chemical Technology Division

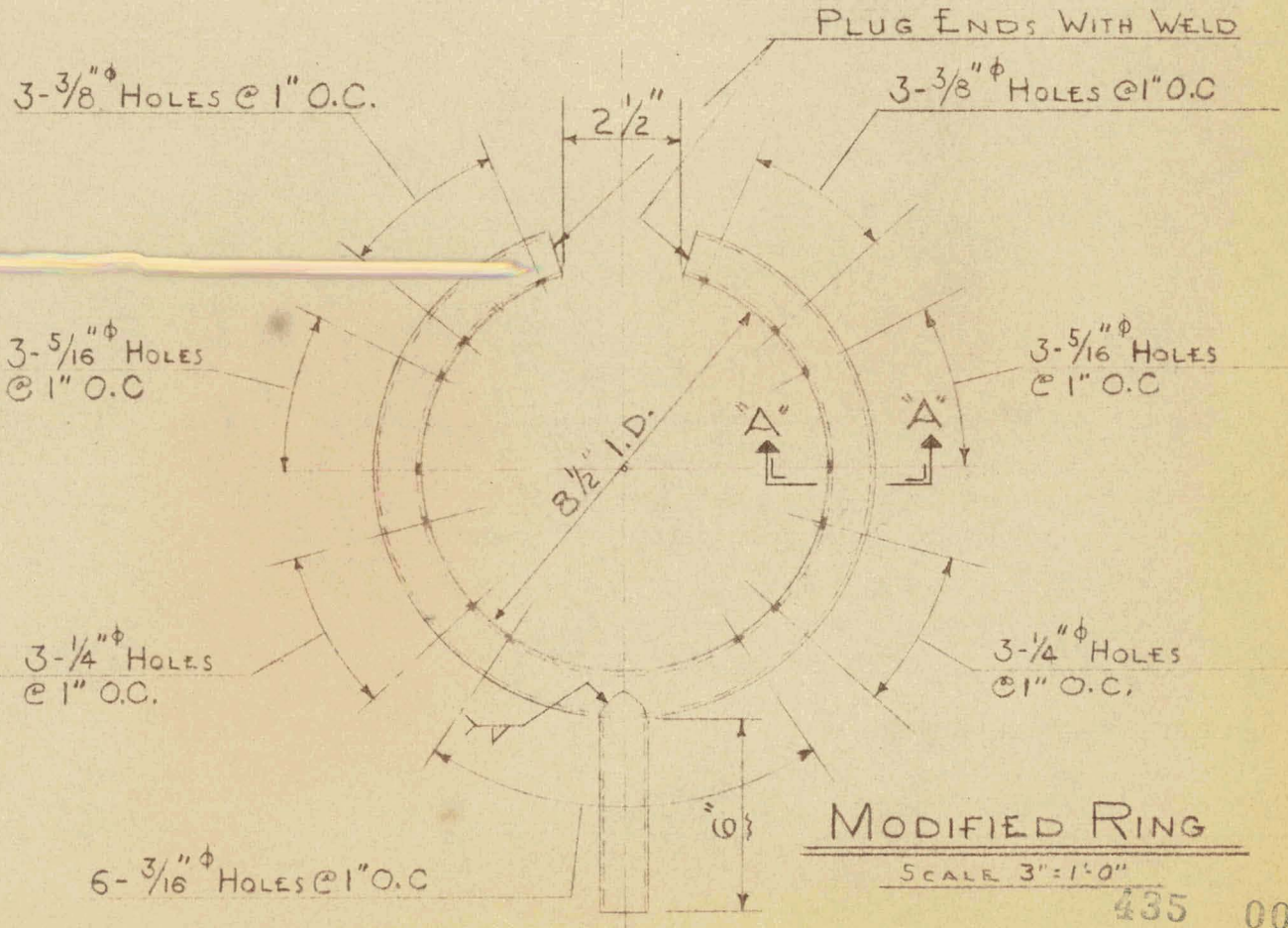
RHW/nh



TYP. HOLE — 1" S.S. TUBING .065 W

SECT. "A-A"
HALF SIZE

ORIGINAL RING
SCALE 3" = 1'-0"



MODIFIED RING
SCALE 3" = 1'-0"

435 005

FIGURE I

SUCTION RINGS A-26377