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HUNTER,R.S. Indiana & Michigan Electric Co.
RECIP.NAME RECIPIENT AFFILIATION
DENTON,H.R. Office of Nuclear Reactor Regulation, Director

SUBJECT: Forwards response to request for addl info re NUREG-0737, Item II.B.1, "RCS Vents."

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INDIANA & MICHIGAN ELECTRIC COMPANY

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June 28, 1982
AEP:NRC:0584A

Donald C. Cook Nuclear Plant Unit Nos. 1 and 2
Docket Nos. 50-315 and 50-316
License Nos. DPR-58 and DPR-74
NUREG-0737, ITEM II.B.1, REACTOR COOLANT SYSTEM VENTS
REQUEST FOR ADDITIONAL INFORMATION

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Mr. Denton:

This letter and its attachments provide the response to the request for additional information on the Reactor Coolant System Vents contained in Mr. S. A. Varga's letter of February 24, 1982.

This document has been prepared following Corporate procedures which incorporate a reasonable set of controls to insure its accuracy and completeness prior to signature by the undersigned.

Very truly yours,

R. S. Hunter
Vice President

/os

cc: John E. Dolan - Columbus
R. W. Jurgensen
W. G. Smith, Jr. - Bridgman
R. C. Callen
G. Charnoff
Joe Williams, Jr.
NRC Resident Inspector at Cook Plant - Bridgman

A044

ADDITIONAL INFORMATION ON REACTOR COOLANT SYSTEM VENTS

ATTACHMENT 1 TO AEP:NRC:0584A

The following are the responses to the additional information on Reactor Coolant System Vents (RCSV) requested in Mr. Varga's letter of February 24, 1982.

Response to Item 1.

To effectively remove the decay heat from the Reactor Coolant System we have Emergency Operating Procedures for Natural Circulation, 1-OHP 4023.001.008 for Unit 1 and 2-OHP 4023.001.008 for Unit 2. These procedures provide the Operator with guidelines and instructions on Reactor Temperature - Pressure Control to prevent formation of voids in the upper reactor head level. The procedures specify time intervals for reducing RCS and Steam Generator pressures during the Natural Circulation phase of the cooldown. The operator can control the circulation flow, including flow through the Steam Generator U tubes by monitoring the provided instrumentation.

Response to Item 2

A (3/8) inch diameter flow restriction orifice is provided in both the Reactor Vessel Head Vent and the Pressurizer Head Vent. As the calculation shows in Attachment 2, the maximum postulated flow through each of the orifices is 147.2 gpm. From the centrifugal charging pump flow characteristic curve, also attached, it can be seen that the pump flow is 250 gpm at the system operating pressure (approximately 5200 ft. of water). Thus, enough margin exists between the capacity of one charging pump and the maximum postulated leak rate through one orifice in each vent path.

Response to Item 3

(a) The entire RCS Vent System is classified as Seismic Class I. Figures 1 and 2 of this Attachment 1 show the location of the second normally closed valve.

(b) The piping, valves and orifices in the RCS Vent System are designed to 2485 psig at 650°F.

(c) The following are the materials of construction in the RCS Vent System:

Piping - A376 Type 304 and/or Type 316, Stainless Steel
Valves - SA-182 Type 316 Stainless Steel.

As per the ASME Code, Section III, Appendix I, the above materials are acceptable for use as part of the Reactor

Coolant Pressure Boundary. Fabrication and cleaning controls were in accordance with an approved specification. The Vent System does not have any insulation on it. The Vent system piping thickness is 0.25 inch and thus does not require a C_v test as per the ASME Code, Section III, Subsection NB, Table NB-2332 (a)-1. The RCS Vent System is fabricated and tested in accordance with SRP 5.2.3.

(d) The RCS vent system consists of two subsystems (Pressurizer Vent & Reactor Head Vent) each of which consists of two parallel flow paths with redundant fail closed isolation valves in each flow path. Isolation valves in one flow path are powered by train A and the valves in the second flow path are powered by train B. The system is designed such that any single failure would not prevent the operation of the vent system.

The only piping on top of the Reactor Head is a 3/4" line to the reactor vessel level instrumentation. Since this line is smaller in size than the reactor head vent, the dynamic effects associated with the postulated rupture of this line would not prevent the operation of the RCS head vent system.

The only potential missile from other sources in the reactor head area would be a control rod. If a control rod became a missile its energy would be dissipated by the missile blocks above the reactor vessel head. Furthermore, rupture of a control rod drive mechanism would result in a loss of coolant accident far more serious than a break of the RCS vent system.

The piping to the Pressurizer Safety Valves and the Power Operated Relief Valves is the only piping in the vicinity of the Pressurizer Vent. If this piping ruptures, or a valve stem blows out, a high point pressurizer vent would not be required. Any gases that would have been collected inside the top of the pressurizer would be discharged through the break.

Response to Item 4

The D. C. Cook Reactor Coolant Vent system design is such that two valves connected in series must be opened to create a flow path. Each vent valve is provided with its own position indication and its own two position control switch. The prevention of inadvertent actuation was considered in the selection and location of these control switches.

The following Procedures and Administrative Controls are employed to prevent the inadvertent actuation of the RCS Vent system:

During the fill and vent operations, (OHP 4021.002.001), for both Units 1 and 2, the following valves are required

to be verified closed and their respective breakers racked out: (1) NSO-061, 062, 063 and 064. These are the Post-accident vent valves for the pressurizer vent system. (2) The Reactor Head Post Accident Vent Valves NSO-021, 022, 023 and 024 are verified closed and their respective breakers racked out.

In addition, all the above mentioned high point vent valves have a Shift Supervisors Red Tag Clearance placed on their racked out breakers. The clearance states,"The power is being removed from these valves to prevent inadvertant actuation and will remain off until authorization is received from the NRC". The Clearance tags were placed on Unit 1 on November 10, 1981 and Unit 2 on October 14, 1982.

Response to Item 5(a) and 5(b)

The Reactor Vessel Head Vent and the Pressurizer Head Vent discharge into the upper volume of the containment at elevations 660.0 ft. and 673.0 ft, respectively. This will insure adequate dilution of the combustible gases, if any, released during a design basis accident. Since the vent discharge points are located in the upper volume of the containment, components essential to a safe shutdown of the Reactor will not be subjected to a direct jet due to a discharge from the Vent system.

Response to Item 6

All of the displays, alarms and controls added to the control room for the RCS Vent System will be considered in the human factors analysis required by NUREG-0737 Item I.D.1., "Control Room Design Review".

Response to Item 7

(a) The entire RCS Vent system is designed to withstand a safe shutdown earthquake.

(b) The only missiles that can be postulated from the failure of an RCS vent system components are the valve stems from the solenoid operated isolation valves. It is highly unlikely that these valves would fail in this manner.

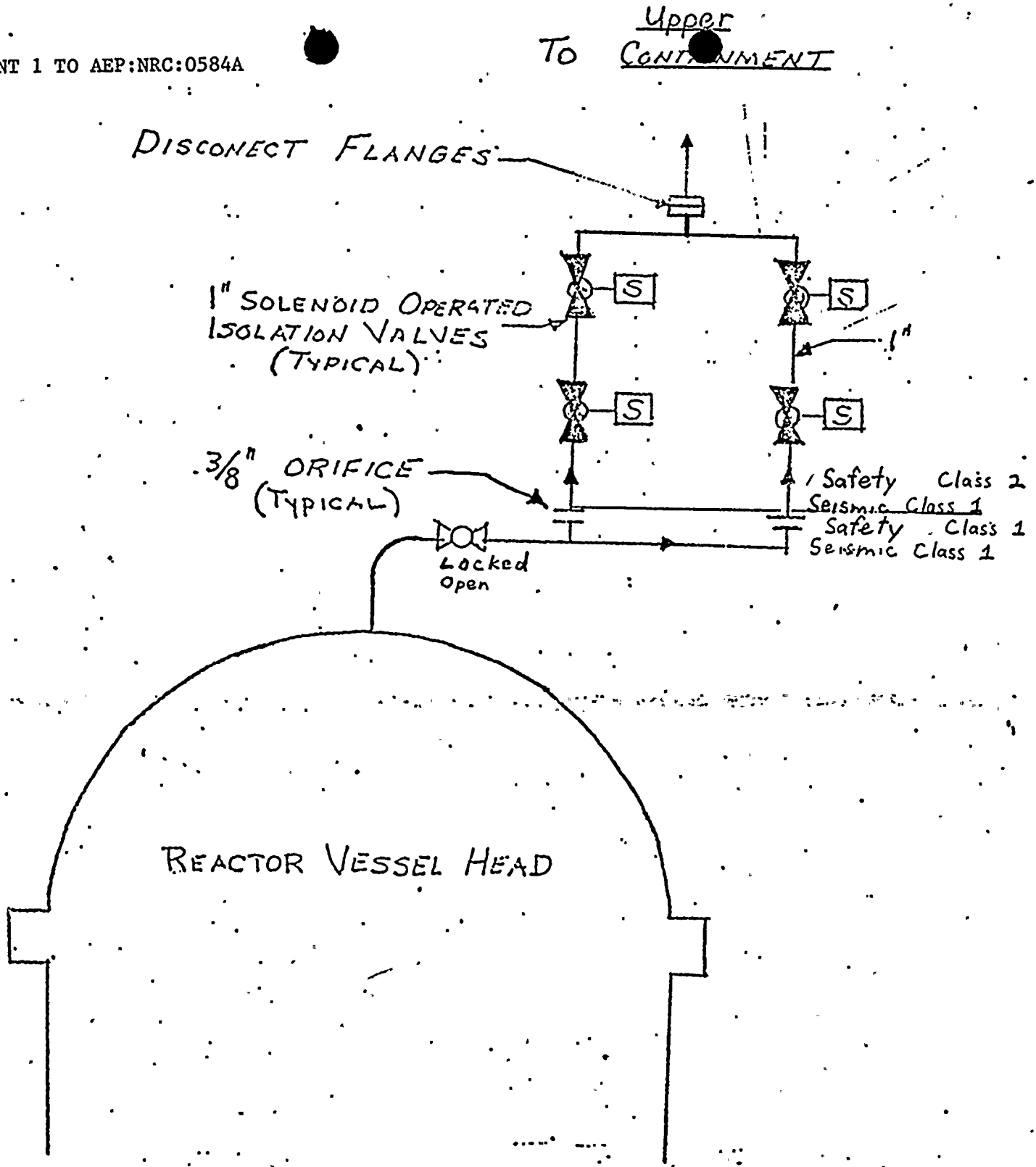
These isolation valves are located inside the missile barrier in the containment. The isolation valves on the reactor head vent are located on top of the reactor head with the valve stems pointed upward. During normal plant operation, missile blocks are provided over the reactor head. If a valve stem did become a missile it would hit the missile blocks and deflect. Since the valve stems are small in size and most of the energy would dissipate when they hit the missile blocks, the valve stems would not cause damage to any components required for a safe shutdown.

The isolation valves on the pressurizer vent are located inside the pressurizer enclosure near the top of the pressurizer. The valve stems are pointed towards the top of the pressurizer enclosure. The valve stems are small in size in relation to other equipment at the top of the pressurizer enclosure and would not prevent the safe shutdown of the plant in the unlikely event that a valve stem becomes a missile.

(c) All the piping used in the RCS Vent System is one inch nominal size or less, and thus dynamic effects associated with the postulated rupture of RCS vent pipe is not applicable.

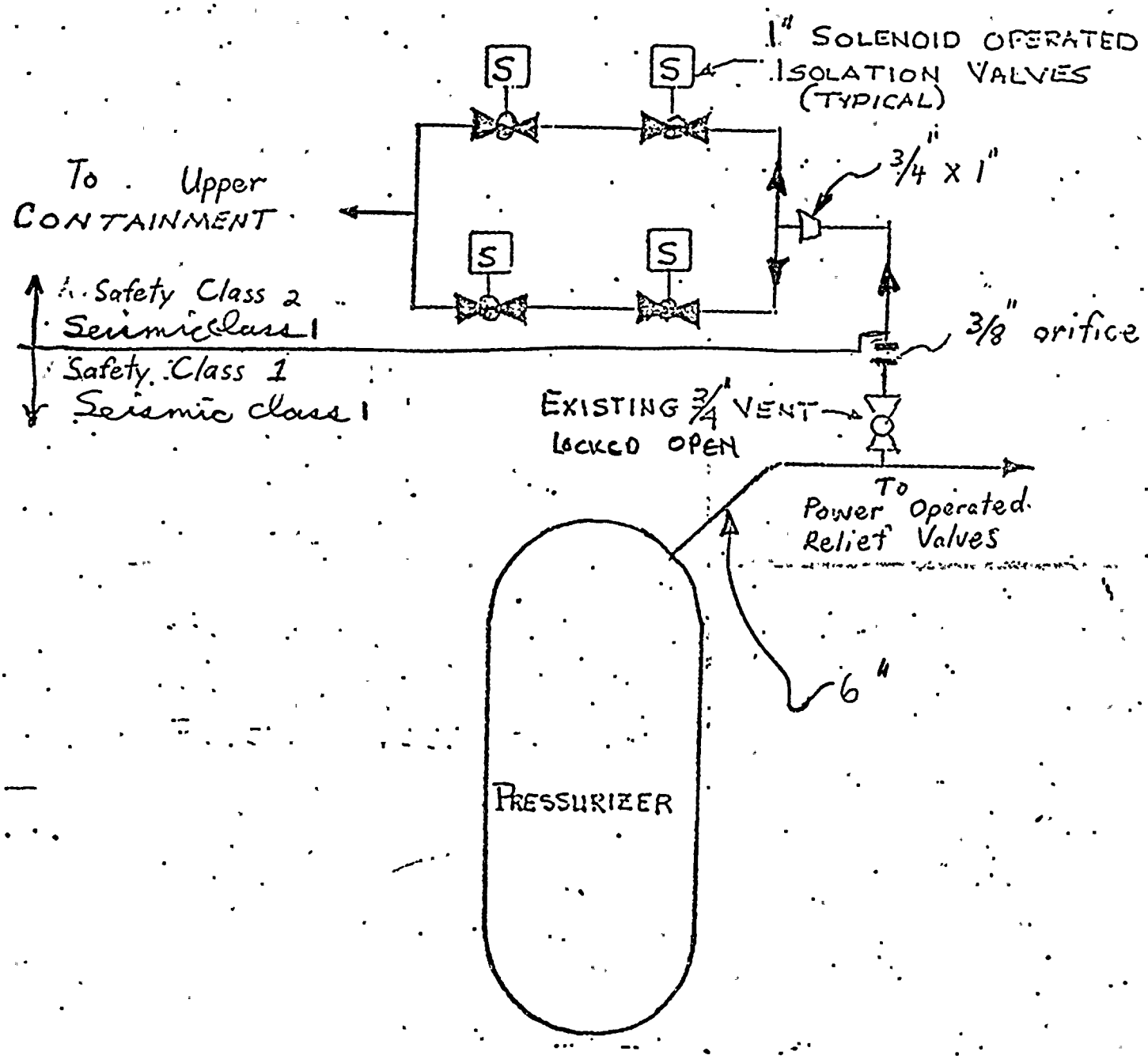
(d) The RCS vent system piping is one inch nominal size or less. Piping one inch or less is excluded in our high energy line studies. However, the possibility of damaging a CRDM due to a jet from the vent has been reviewed. In the event of a jet from a vent pipe that damages a CRDM, causing the most reactive control rod assembly to eject from the reactor vessel, the reactor could still shut down safely. Furthermore, all accident analyses which call for a reactor scram assume that the most reactive control rod assembly remains stuck completely out of the core.

We do not have to consider fluid sprays from normally unpressurized portions of the RCS Vent System because we do have leak detection instrumentation downstream of the isolation valves.



REACTOR VESSEL HEAD VENT

Figure 1



PRESSURIZER HEAD VENT

Figure 2

DONALD C. COOK NUCLEAR PLANT UNIT NOS. 1 AND 2

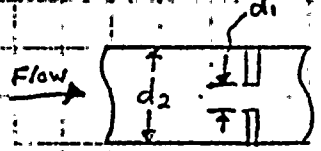
ATTACHMENT 2

TO

AEP:NRC:0584A

Flow Thru 3/8" RCS Vent System Orifices

* $Q = 236 d_1^2 C \sqrt{\frac{\Delta P}{\rho}}$



$\Delta P = 2235$ psi

$d_1 = 3/8" = .375"$

$d_2 = .815"$ (1" sch. 160 pipe)

Assume $C = .61$

$\rho = 42.301$ #/ft^3

$Q = 236 (.375^2)(.61)\sqrt{\frac{2235}{42.301}}$

$Q = 147.15$ gpm

Calculate Reynolds Number Based on d_2

$\mu = .085$

$Re = \frac{Q(\rho)}{d_2(\mu)} = \frac{147.15 (42.301)}{.815 (.085)} = 89,853$

$B = \frac{.375}{.815} = .46$

From pg. A-20 in Crane's Flow of Fluids

$C = .61$ is correct for the calculated Re.

Therefore $Q = 147.15$ gpm is correct.

Q = flow rate in gpm

d_1 = dia of orifice in inches

d_2 = I.D of upstream pipe

C = Flow Coefficient for Sq.-Edge Orifice

ΔP = Pressure Drop Across Orifice

ρ = Density of Water @ 600°F

* Obtained from Crane Flow of Fluids - Technical Paper # 410

$B = \frac{d_1}{d_2}$

Re = Renolds Number

μ = viscosity of water @ 600°F

Check Method used

4.3.4 of MED

Procedure # 8

Flow thru 3/8" orifices = Q = 147.15 gpm

@ 600°F $147.15 \text{ gpm} = \frac{147.15 \times 60 \text{ min/HR}}{\text{specific vol @ } 600°F} = \frac{147.15 \times 60}{.1768 \text{ gal/ft}}$

$= 49{,}938 \text{ \#/HR}$

130°F One Centrifugal Charging must make up:

$$\frac{49{,}938 \text{ \#/HR} \times \text{specific vol. @ } 130°F}{60 \text{ min/Hr}} =$$

$$\frac{49{,}938 \text{ \#/HR} \times .1215 \text{ gal/\#}}{60 \text{ min/HR}} = 101 \text{ gpm}$$

This calculation is conservative in that it assumes that flashing does not occur. In reality flashing will occur reducing the above calculated flow thru a 3/8" break.

CONTRACTOR

CUSTOMER AEP

ITEM NO. AEP-1 P.O. 545-CAZ-103311-RN

TEST PERFORMANCE CURVE NO.

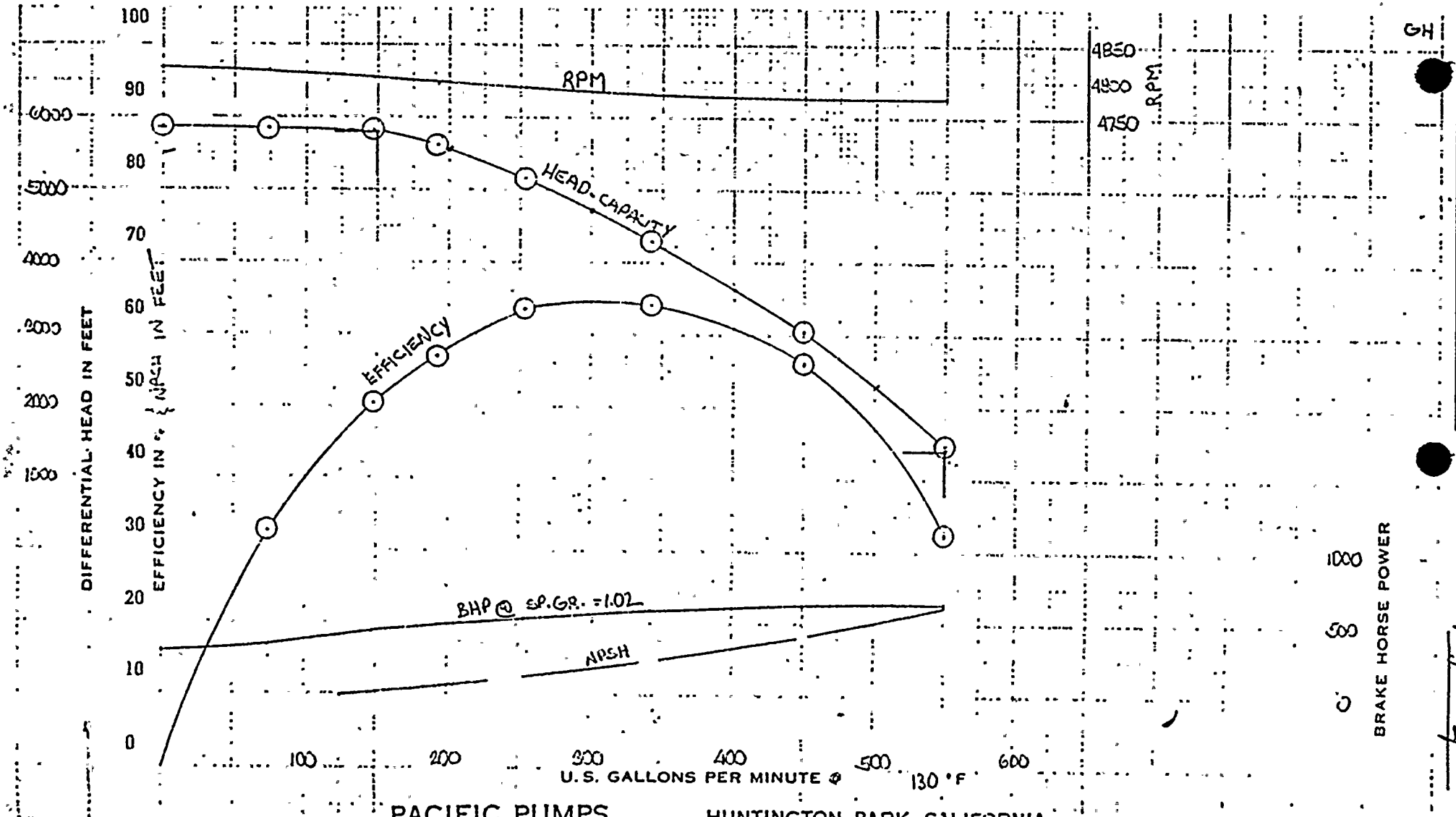
SIZE 2½" RL TYPE IJ STAGES 11

R.P.M. AS SHOWN DATE 16 OCT 1970

PUMP NUMBER 45605

PERFORMANCE ALSO APPLIES TO PUMP NUMBER

IMPELLER PATTERN	M-7278	M-6534
MAXIMUM DIAMETER	8 1/4	8 1/4
RATED DIAMETER	8 1/4	STAGE 2,3 8 1/4 — 1-11 8 1/8
MINIMUM DIAMETER	7 1/4	7 1/4



PACIFIC PUMPS HUNTINGTON PARK CALIFORNIA

GH

ATTACHMENT 2 TO AEP:NRC:0584A

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