UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

November 28, 1984

Docket No. STN 50-470

MEMORANDUM FOR: Cecil O. Thomas, Chief
Standardization & Special Projects Branch
Division of Licensing

FROM: Pierre R. Moriette
Standardization & Special Projects Branch
Division of Licensing

SUBJECT: SUMMARY OF NOVEMBER 9, 1984 MEETING WITH COMBUSTION ENGINEERING (CE) TO DISCUSS OPERABILITY OF SHUTDOWN COOLING SYSTEM RELIEF VALVES OF SYSTEM 80 DESIGN

A meeting was held on November 9, 1984, between NRC representatives and representatives of CE to obtain additional information on the operability of the shutdown cooling system relief valves employed in the System 80 Design. Representatives of the valve suppliers for Palo Verde and WPPSS (System 80 designers) were also attending.

Previous presentations by CE of available test data (September 18 meeting) had not demonstrated to the staff's satisfaction the operability of the safety relief valves employed in the System 80 Design, and specifically the operability of the CROSBY 6R10 J0-55 relief valves installed in Palo Verde 1-3 Units.

CE's presentation at this meeting was aimed at demonstrating that all tests conducted by the manufacturer were indeed representative of the operating conditions of the relief valves, and in some cases, even more severe than the actual operating conditions.

The staff's additional questions were answered by the CROSBY representative.

At the conclusion of the meeting, after a caucus, the NRC staff stated the following:

- the information provided at this meeting gives reasonable assurance that the design of the System 80 safety relief valve is acceptable;

- the specifics of valve operation are not part of the CESSAR scope; the operability of the valves selected for a given System 80 plant will have to be verified on a case-by-case basis;

- the information provided for the CROSBY valves installed on Palo Verde 1-3 gives reasonable assurance that they will perform as intended; this information must be supplied formally in the Palo Verde Docket, and will include the steam tests performed on Palo Verde CROSBY 6R10 J0-55 valves.

Enclosed is a copy of the set of transparencies presented at the meeting, and a list of participants.

Pierre R. Moriette
Standardization & Special Projects Branch
Division of Licensing

Enclosures:
As stated

List of Attendees

NRC

F. Cherny
G. Hammer
M. Licitra
P. Moriette
C. Thomas
T. Marsh
C. Liang
K. Eccleston
G. Knighton

CE

G. Davis
F. Ferraraccio
M. Wolpert
P. Hepner
D. Quinn
T. Collier

BECHTEL

S. Shepherd

APS

T. Quan

WPPSS

D. Coleman

LP&L

B. Murillo

CROSBY

J. R. Zahorsky

DRESSER

P. Bolger

SHUTDOWN COOLING SYSTEM RELIEF VALVES

(LOW TEMPERATURE OVERPRESSURE PROTECTION)

SYSTEM CONFIGURATION

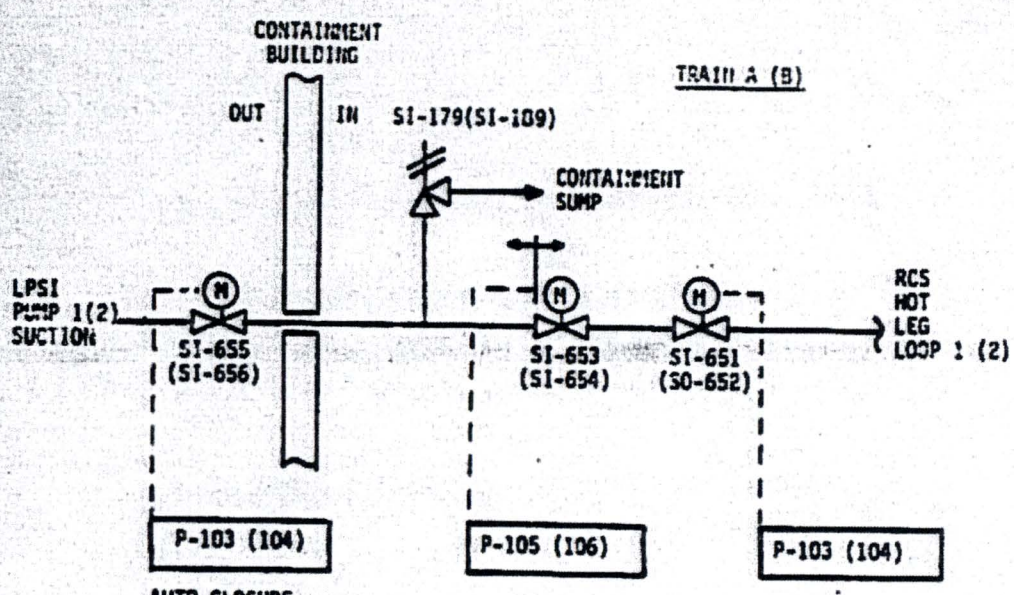
DESIGN BASIS

SIZING CRITERIA

SYSTEM CONFIGURATION

SHUTDOWN COOLING SYSTEM

SUCTION LINE RELIEF AND ISOLATION VALVES



AUTO CLOSURE
SETPOINT: 500 PSIA

OPEN PERMISSIVE
SETPOINT: 410 PSIA

SETPOINT: 700 PSIA

SETPOINT: 410 PSIA

LTOP ALARMS:

RCS PRESS > 410 PSIA
VALVE NOT CLOSED

RCS TEMP < 260°F
VALVE CLOSED

SETPOINT: 700 PSIA

SETPOINT: 410 PSIA

LTOP ALARMS:

RCS PRESS > 410 PSIA
VALVE NOT CLOSED

RCS TEMP < 250°F
VALVE CLOSED

DESIGN BASIS

DESIGN REQUIREMENTS OF RESIDUAL HEAT REMOVAL SYSTEM:

BRANCH TECHNICAL POSITION, RSB 5-1
(ASME B&PVC SEC III, NC-7000)

OVERPRESSURE PROTECTION OF PWR WHILE OPERATING AT LOW TEMPERATURE:

BRANCH TECHNICAL POSITION, RSB 5-2

SIZING CRITERIA

ORIGINAL FUNCTION: SDC OVERPRESSURE PROTECTION

CESSAR SECTION 5.4.7.2.2.(4.A2)

- EACH VALVE; RELIEF OF COINCIDENT OCCURENCE OF:

  2 HPSI PUMPS (RUNOUT)
  3 CHARGING PUMPS
  ENERGIZATION OF PRESSURIZER HEATERS

ADDITIONAL FUNCTION: LTOP

CESSAR SECTION 5.2.2.10.2.1

- EVALUATED WITH AS PURCHASED EQUIPMENT
- LIMITING EVALUATIONS:

  MASS ADDITION: INADVERTANT SAFETY INJECTION ACTUATION

  ENERGY ADDITION: RCP START WITH POSITIVE S.G. TO RCS ΔT.

SYSTEM 80 SCS RELIEF VALVES

PURCHASED TO 1974 ASME SECTION III, SUBSECTION NC

- o ASME CODE REQUIREMENTS
  - CAPACITY CERTIFICATION BY CALCULATIONS OR FLOW TEST
  - FULL SCALE TESTING WAS NOT REQUIRED
  - HYDROSTATIC TESTS
- o C-E SPECIFICATION REQUIREMENTS
  - SEISMIC OPERABILITY TO BE DEMONSTRATED BY TEST AND/OR ANALYSIS
  - LOADS TO BE CONSIDERED IN THE VALVE DESIGN
    - SEISMIC LOADS
    - SYSTEM PRESSURE
    - LOADS DUE TO VALVE OPERATION
  - STANDARD PRODUCTION TESTS
    - VERIFY SET PRESSURE
    - SEAT LEAKAGE TEST AT 90% OF SET PRESSURE

SYSTEM 80 SCS RELIEF VALVES

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    - SYSTEM PRESSURE
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  - STANDARD PRODUCTION TESTS
    - VERIFY SET PRESSURE
    - SEAT LEAKAGE TEST AT 90% OF SET PRESSURE

Outline for Palo Verde SCS RV Presentation

Purpose of Presentation: To document the bases for operability of the Crosby 6R10 J0-55 relief valve.

Basic Data:

1. Prorated water test data for Crosby 4P6 J0-45 relief valve at 65 psig set pressure (test report no. 4053, Rev. 01).

2. Production test data for Crosby J0 series steam valves. Saturated steam tests at pressures up to 250 PSIG (saturation temperatures up to 400°F).

Bases for Operability of the Crosby 6R10 J0-55 relief valve:

1. Test data for Crosby 4P6 J0-45 relief valve are applicable To Crosby 6R10 J0-55 relief valve.
2. Water test data from 66 psig set pressure test are applicable to 467 psig set pressure operation at the same temperature.
3. Steam test data for Crosby J0 series relief valves provide a basis for operability of the Crosby 6R10 J0-55 relief valve for higher temperature service (up to 400°F).

Detailed Discussion of Bases:

1. Comparison of 4P6 and 6R10 valves
   - Physical Geometry
   - Materials
   - Functional Characteristics
   - Summary of Applicability of 4P6 to 6R10

2. Applicability of Prorated Test Results to Full Pressure Operability
   - Mechanical Valve Operation
   - Valve/Fluid Interaction
   - Summary of Applicability of Low Pressure Tests to Full Pressure Operation

3. Justification of Operability at Design Temperature
   - Mechanical Valve Operation
   - Valve/Fluid Interaction
   - Summary of Operability at Design Temperature

Summary

PURPOSE OF PRESENTATION

TO DOCUMENT THE BASES FOR OPERABILITY OF THE

CROSBY 6R10 JO-55 RELIEF VALVE.

BASIC DATA

1. PRORATED WATER TEST DATA FOR CROSBY 4P6 J0-45

   RELIEF VALVE AT 66 PSIG SET PRESSURE (TEST REPORT

   NO. 4053, REV. 01).

2. PRODUCTION TEST DATA FOR CROSBY J0 SERIES STEAM VALVES.

   SATURATED STEAM TESTS AT PRESSURES UP TO 250 PSIG

   (SATURATION TEMPERATURE UP TO 400°F).

BASES FOR OPERABILITY OF THE CROSBY 6R10 JO-55 RELIEF VALVE

1. TEST DATA FOR CROSBY 4H6 JO-45 RELIEF VALVE ARE APPLICABLE TO CROSBY 6R10 JO-55 RELIEF VALVE.

2. WATER TEST DATA FROM 66 PSIG SET PRESSURE TEST ARE APPLICALBE TO 467 PSIG SET PRESSURE OPERATION AT THE SAME TEMPERATURE.

3. STEAM TEST DATA FOR CROSBY JO SERIES RELIEF VALVES PROVIDE A BASIS FOR OPERABILITY OF THE CROSBY 6R10 JO-55 RELIEF VALVE FOR HIGHER TEMPERATURE SERVICE (UP TO 400°F).

COMPARISON OF 4P6 AND 6R10 VALVES

PHYSICAL GEOMETRY

SIMILARITIES -
- OVERALL DIMENSIONS ARE SCALED
- NOZZLE GEOMETRY
- 2-RING CONTROL
- CLEARANCES ARE COMPARABLE AND APPROPRIATE FOR SERVICE

DIFFERENCES	4P6	6R10	SIGNIFICANCE
DISC DESIGN	SINGLE PIECE DISC	DISC INSERT	NEGLIGIBLE OVERALL DIMENSIONS WOULD SCALE - DISC INSERT ENHANCES SEAT TIGHTNESS
GUIDING SURFACES	TWO LANDS ON DISC	"LABYRINTH" GEOMETRY	NEGLIGIBLE "LABYRINTH" GEOMETRY DESIRABLE FOR GUIDING LARGER VALVES

MATERIALS

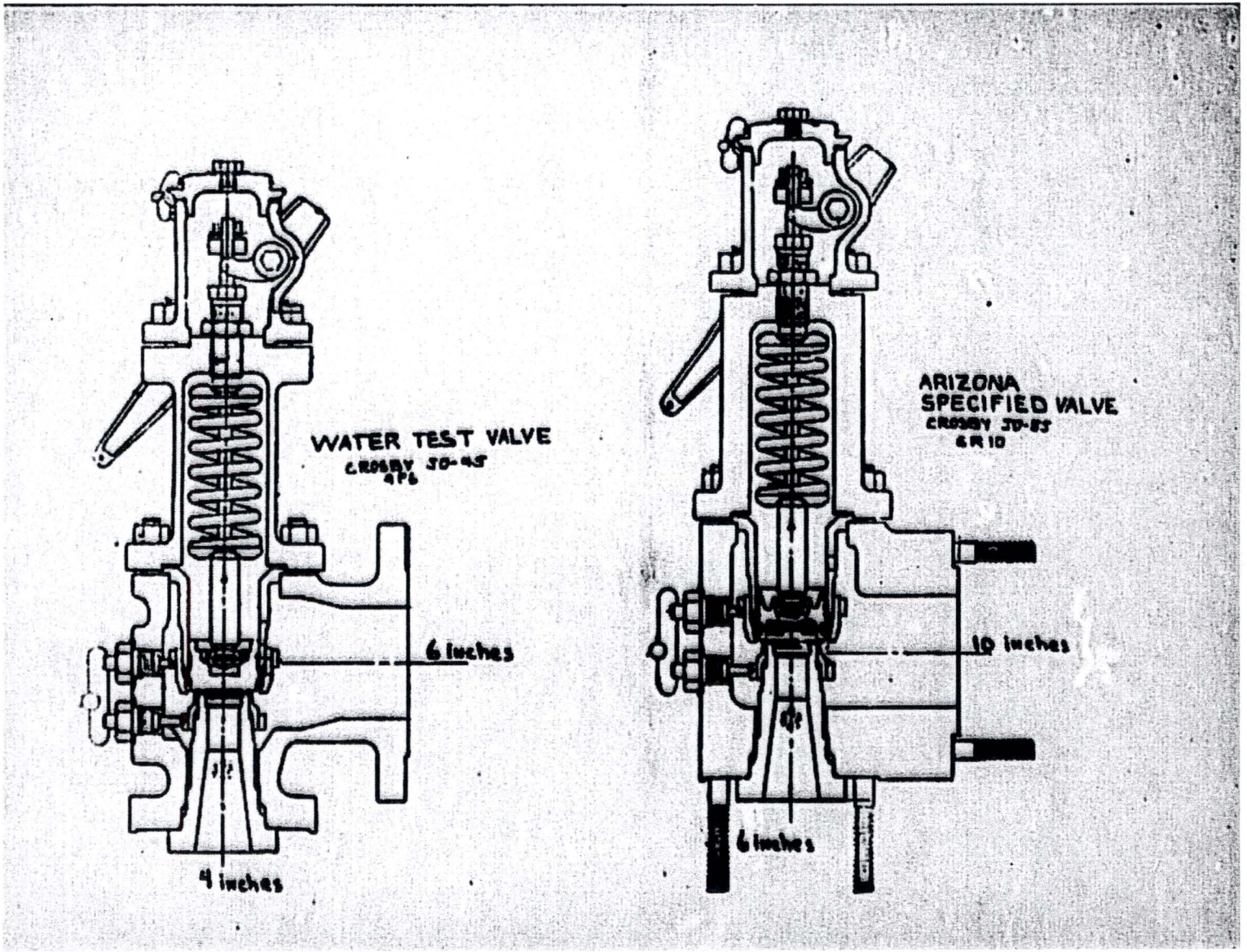
- SELECTED TO AVOID GALLING
- TESTED BY CROSBY FOR WATER SERVICE
- SEATING MATERIALS ARE THE SAME
- DISC MATERIALS ARE THE SAME (316 STAINLESS STEEL)
- 6R10 GUIDE ASTM A743 BETTER GALLING RESISTANCE
- 4P6 GUIDE 316 STAINLESS STEEL

FUNCTIONAL CHARACTERISTICS

- THE SAME DESIGN PHILOSOPHY WAS USED IN BOTH 4P6 AND 6R10 VALVES.
- RING SETTINGS HAVE THE SAME BASIS.

SUMMARY OF APPLICABILITY OF 4P6 TO 6R10

- OVERALL DIMENSIONS ARE SCALED
- THE GEOMETRICAL AND MATERIAL DIFFERENCES BETWEEN THE 4P6 VALVE AND THE 6R10 VALVE ARE FOR ENHANCING THE 6R10 VALVE AND ARE NOT CONSIDERED SIGNIFICANT
- THE SAME DESIGN PHILOSPHY WAS USED FOR EACH
- RING SETTINGS HAVE THE SAME BASIS
- THEREFORE, TEST OF 4P6 VALVE IS BELIEVED APPLICABLE TO 6R10 VALVE


WATER TEST VALVE
CROSBY JO-4S
4P6
6 inches
4 inches
ARIZONA
SPECIFIED VALVE
CROSBY JO-8S
6 R 10
10 inches
6 inches

APPLICABILITY OF PRORATED TEST RESULTS TO FULL PRESSURE OPERABILITY

MECHANICAL VALVE OPERATION

- MECHANICAL VALVE OPERATION EXPECTED TO BE IDENTICAL
- SAME RING SETTINGS WOULD BE USED AT LOW AND HIGH PRESSURES

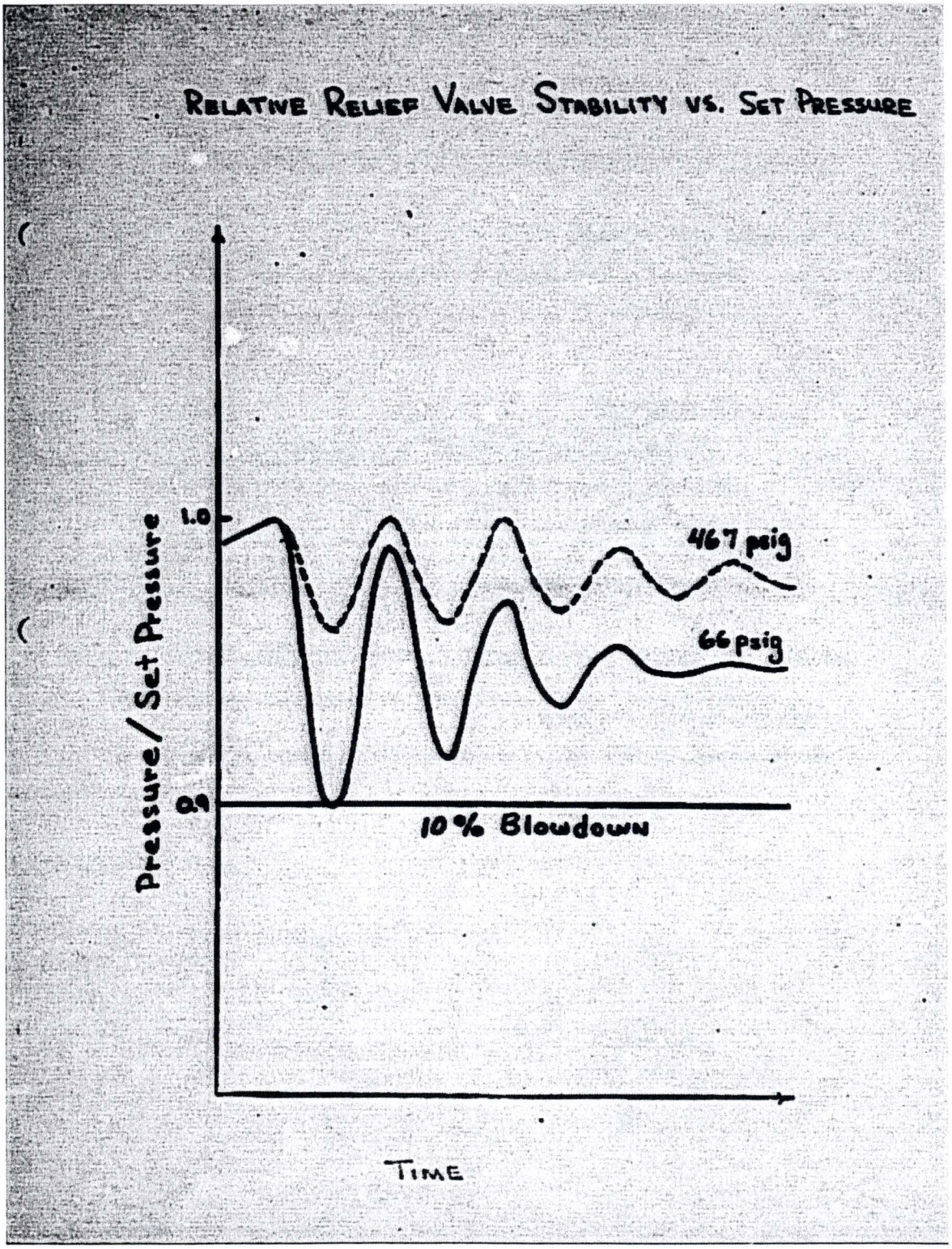
VALVE/FLUID INTERACTION

- VALVE/FLUID INTERACTION EXPECTED TO BE THE SAME
- RELIEF VALVE OPERATING CHARACTERISTICS EXPECTED TO BE THE SAME
- PERCENT BLOWDOWN SHOULD BE COMPARABLE
- MARGIN TO STABILITY INCREASES WITH INCREASING SET PRESSURE FOR CONSTANT PERCENT BLOWDOWN

SUMMARY OF APPLICABILITY OF LOW PRESSURE TEST TO FULL PRESSURE OPERATION

LOW PRESSURE (PRORATED SPRING) TEST RESULTS ARE CONSIDERED REPRESENTATIVE OF OPERATION AT FULL PRESSURE.

VALVE IS MORE LIKELY TO CHATTER AT LOW PRESSURE IF PERCENT BLOWDOWN IS THE SAME.


RELATIVE RELIEF VALVE STABILITY VS. SET PRESSURE
PRESSURE / SET PRESSURE
1.0
0.9
467 psig
66 psig
10% Blowdown
TIME

JUSTIFICATION OF OPERABILITY AT DESIGN TEMPERATURE

MECHANICAL VALVE OPERATION

PRODUCTION TEST DATA FOR CROSBY J0 SERIES STEAM VALVES DEMONSTRATE PROPER MECHANICAL VALVE OPERATION FOR TEMPERATURES UP TO 400°F (DESIGN TEMPERATURE).

J0 SERIES STEAM VALVES ARE OF THE SAME BASIC DESIGN AS J0 SERIES WATER VALVES.

VALVES TESTED INCLUDE J0-46, 6R10 VALVE WHICH IS THE SAME SIZE AS THE PALO VERDE J0-55, 6R10 VALVE.

VALVE/FLUID INTERACTION

EPRI TESTS DEMONSTRATED THAT SPRING-LOADED SAFETY VALVES WERE MORE PRONE TO CHATTER AS THE DEGREE OF SUBCOOLING INCREASED.
THEREFORE, PRORATED TESTS WITH COLD WATER ARE CONSERVATIVE DUE TO LARGE AMOUNT OF SUBCOOLING.

AS TEMPERATURE INCREASES, SUBCOOLING DECREASES. IN THE LIMIT OF ZERO SUBCOOLING, STEAM CONDITIONS OCCUR. CROSBY PRODUCTION STEAM TESTS ON J0 SERIES VALVES DEMONSTRATE OPERABILITY WITH ZERO SUBCOOLING.

SUMMARY OF OPERABILITY AT DESIGN TEMPERATURE

ACCEPTABLE MECHANICAL VALVE OPERATION AT DESIGN TEMPERATURE IS DEMONSTRATED BY CROSBY J0 SERIES STEAM TESTS.
VALVE/FLUID INTERACTIONS OVER THE RANGE OF OPERATING TEMPERATURES ARE BOUNDED BY PRORATED TEST OF 4P6 VALVE AT COLD CONDITIONS AND J0 SERIES STEAM TESTS AT DESIGN TEMPERATURE.

SUMMARY

- SATISFACTORY LOW PRESSURE TEST OF 4P6 RELIEF VALVE IS BELIEVED APPLICABLE TO 6R10 VALVE.
- LOW PRESSURE TEST RESULTS ARE CONSIDERED REPRESENTATIVE OF OPERATION AT FULL PRESSURE.
- RELIEF VALVE IS MORE LIKELY TO CHATTER AT LOW PRESSURE IF PERCENT BLOWDOWN IS THE SAME
- ACCEPTABLE MECHANICAL VALVE OPERATION AT DESIGN TEMPERATURE IS DEMONSTRATED BY CROSBY JO SERIES STEAM TESTS
- VALVE/FLUID INTERACTIONS OVER THE RANGE OF OPERATING TEMPRATURES ARE BOUNDED BY 4P6 RELIEF VALVE TEST AND CROSBY JO SERIES STEAM TESTS

THEREFORE, BASED ON RELEVANT TEST DATA AND ENGINEERING JUDGEMENT, ACCEPTABLE OPERABILITY IS EXPECTED FOR THE CROSBY 6R10 RELIEF VALVE.

the information provided for the CROSBY valves installed on Palo Verde 1-3 gives reasonable assurance that they will perform as intended; this information must be supplied formally in the Palo Verde Docket, and will include the steam tests performed on Palo Verde CROSBY 6R10 JO-55 valves.

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