Chilled Water Piping Replacement and TS Change

Surry Power Station

December 6, 2006

Introduction

Matt Adams
Director - Surry Station Safety and Licensing

Introductions and Meeting Agenda

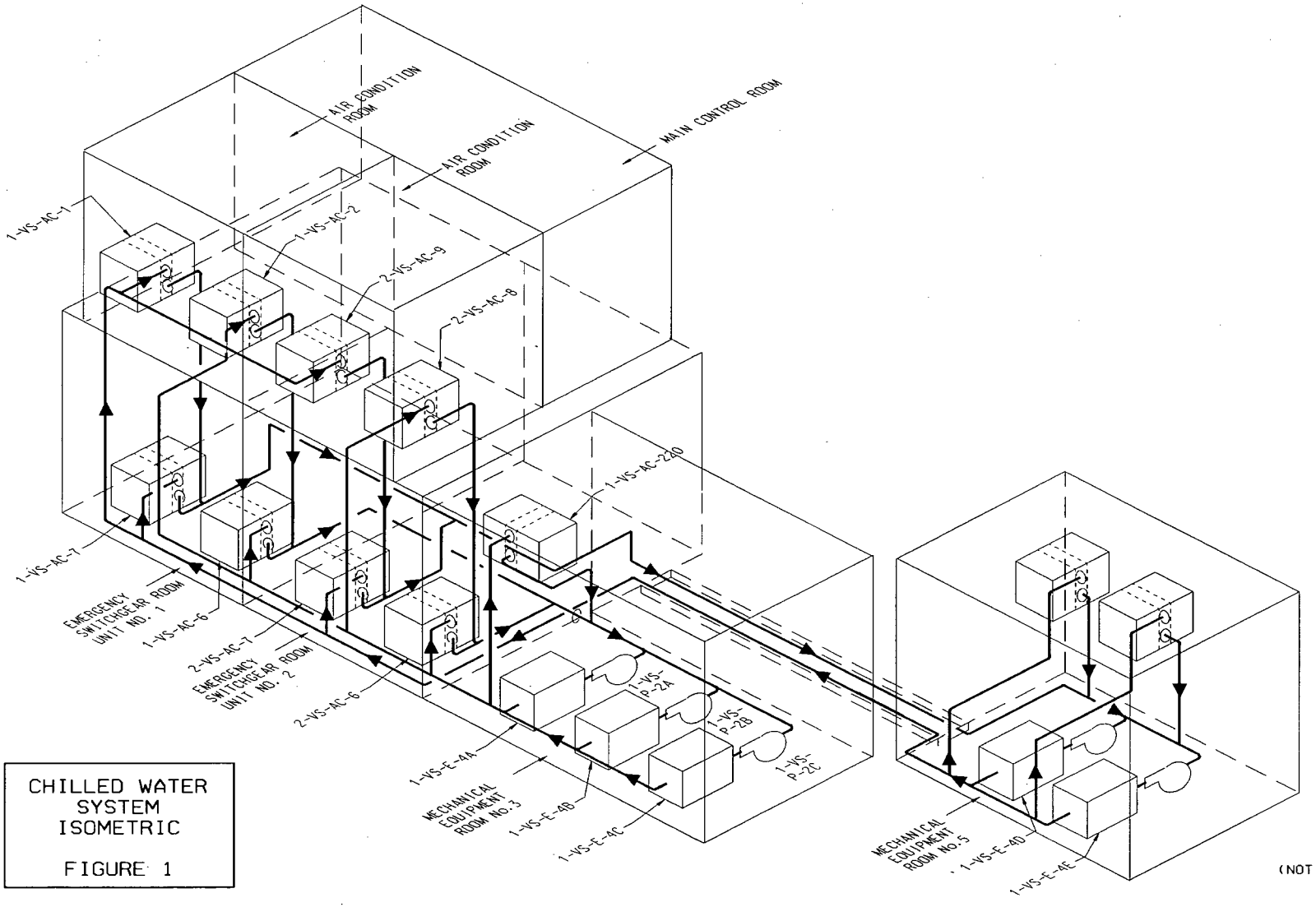
- Purpose of Meeting
- Attendee Introductions
- Meeting Agenda
  - Chilled Water System Description
  - Chilled Water Piping Replacement Plan
  - Current Technical Specification Requirements and Proposed License Amendment Request
  - Supporting Risk Analysis
  - Concluding Remarks

Chilled Water System Description

Bernard Sloan
Supervisor - System Engineering

Chilled Water System Description

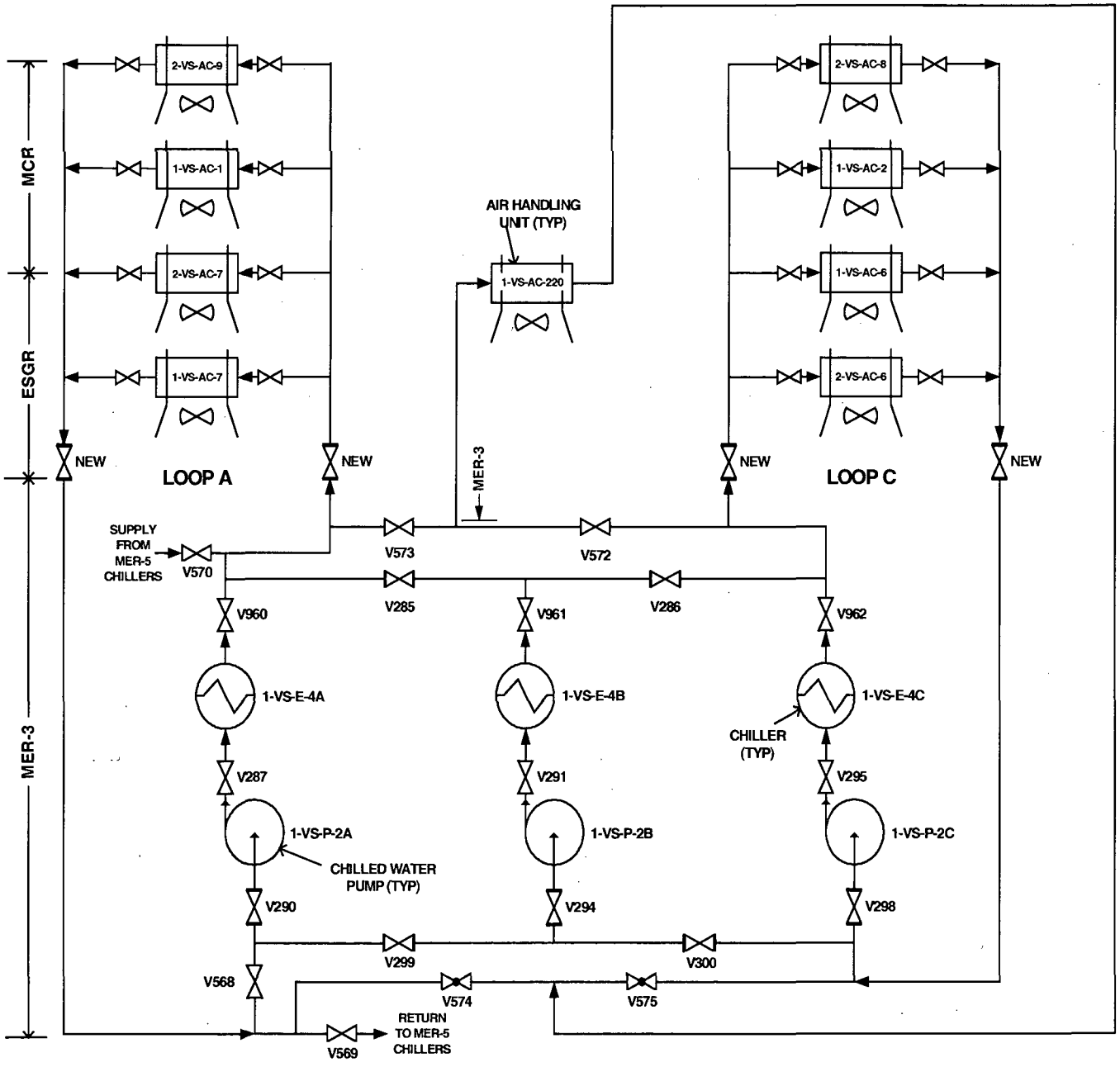
- System Design and Operation
- Chilled Water Piping Configuration
- Need for Chilled Water Piping Replacement



CHILLED WATER SYSTEM ISOMETRIC

FIGURE 1

(NOT TO SCALE)



MCR / ESGR CHILLED WATER SYSTEM

FIGURE 2

System Design and Operation

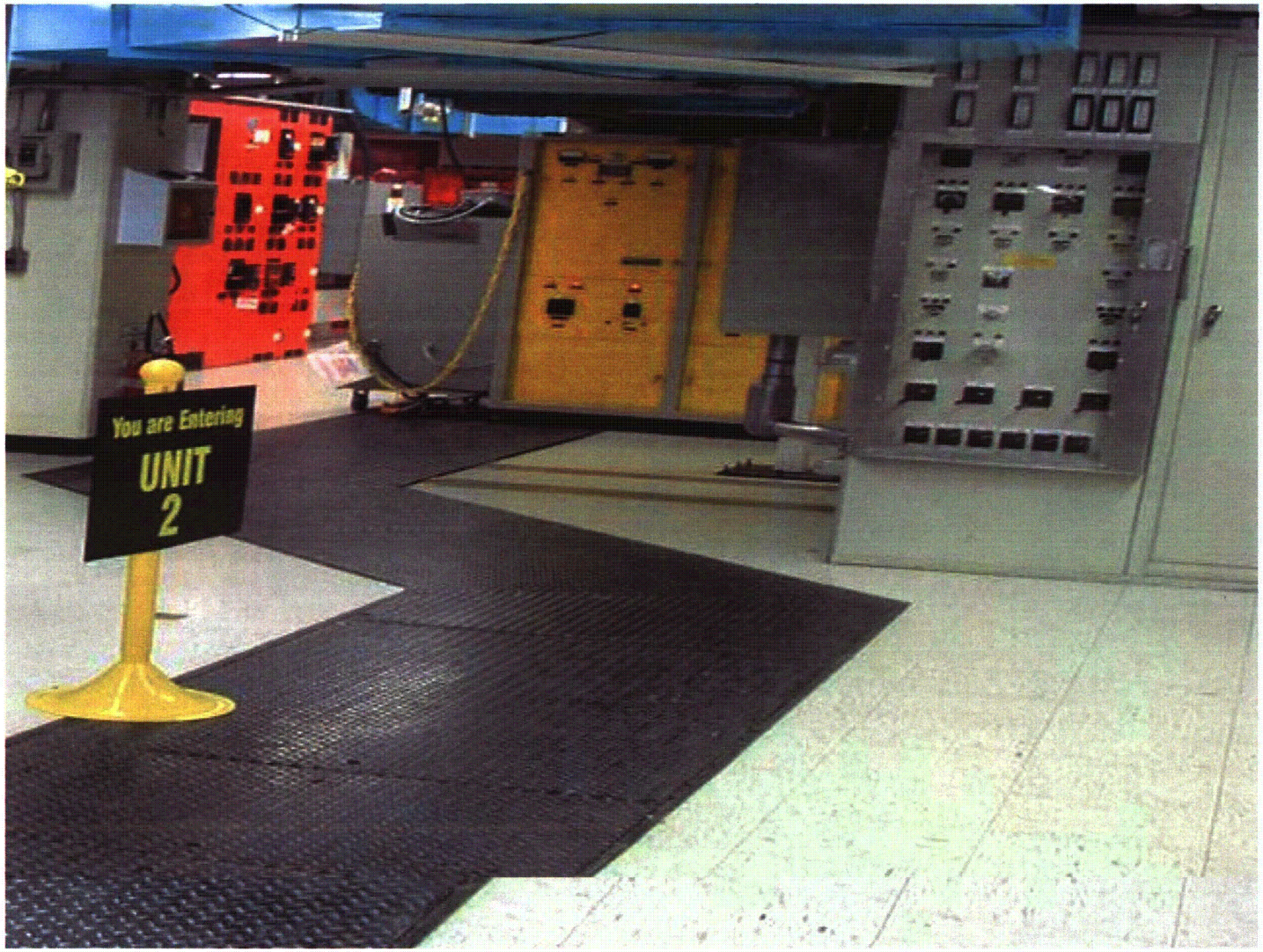
- Safety related, chemically treated, closed loop system
- Low pressure and temperature
  - Design: 150# and 40°F (low)/ 100°F (high)
  - Operating: 125# and 40°F - 55°F
- Safety Class 3 designed to USAS B31.1
- Schedule 40 (STD) and Schedule 80 (XS) carbon steel piping
- Common Chilled Water System serves both units
- Five mechanical chillers supply chilled water to eight air handling units (AHUs), arranged in two chilled water loops

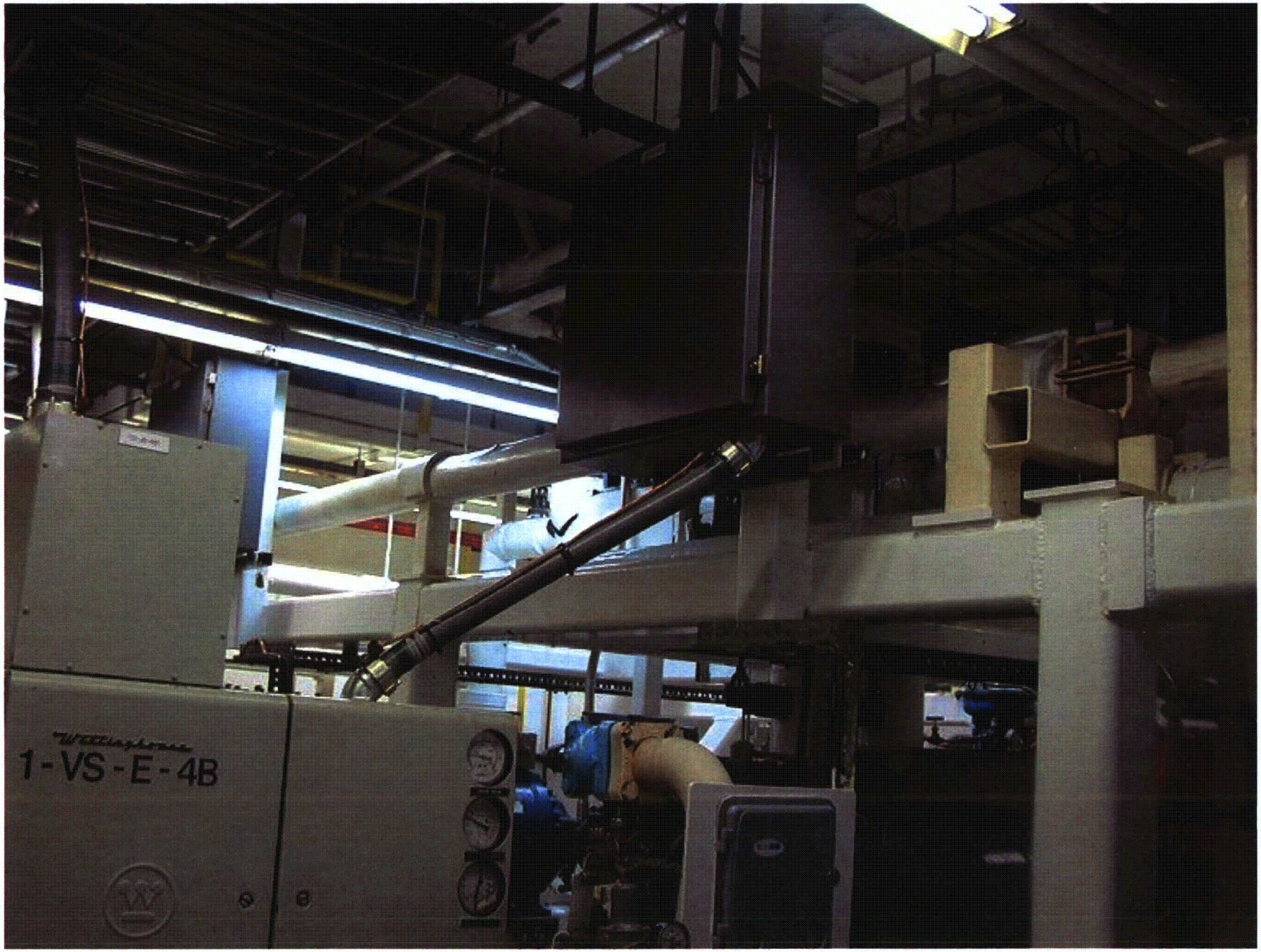
System Design and Operation

- Each chilled water loop contains four AHUs (one for each MCR and ESGR of each unit)
- Each AHU has 100% capacity for heat load for its space (MCR or ESGR)
- Each chilled water loop provides sufficient cooling for heat load on both units
- Currently individual AHU can be isolated with 7-day TS clock entry (TS 3.23.2.a.1 or TS 3.23.2.b.1)
- Currently chilled water loop cannot be isolated without two-unit 6-hour TS clock entry (TS 3.0.1)

Chilled Water Piping Configuration

- Uninsulated supply and return lines from chillers to AHUs located in pipe trench that traverses ESGRs and MER-3
- Four parallel pipe runs in pipe trench with limited space between the piping and trench walls and floor
- Insulated chilled water piping above trench runs to and in MCR, as well as in MER-3


You are Entering
UNIT
2


1-VS-E-4B

Need for Chilled Water Piping Replacement

- Exterior surface of chilled water piping is exhibiting general corrosion
- Continuous flow of 40°F - 55°F water inside pipe causes condensation resulting in general corrosion of exterior surface

Need for Chilled Water Piping Replacement

- General surface corrosion attributes
  - General surface corrosion is visible as exfoliation of corrosion products from pipe exterior
  - Deterioration is uniform versus localized attack
  - Corrosion product is predominately hydrated iron oxide (rust) in thick exterior scale
  - Rust scale does not typically represent significant pipe wall loss
  - Typically volume of rust deposit is 4 - 7 times volume of iron from which it forms

Need for Chilled Water Piping Replacement

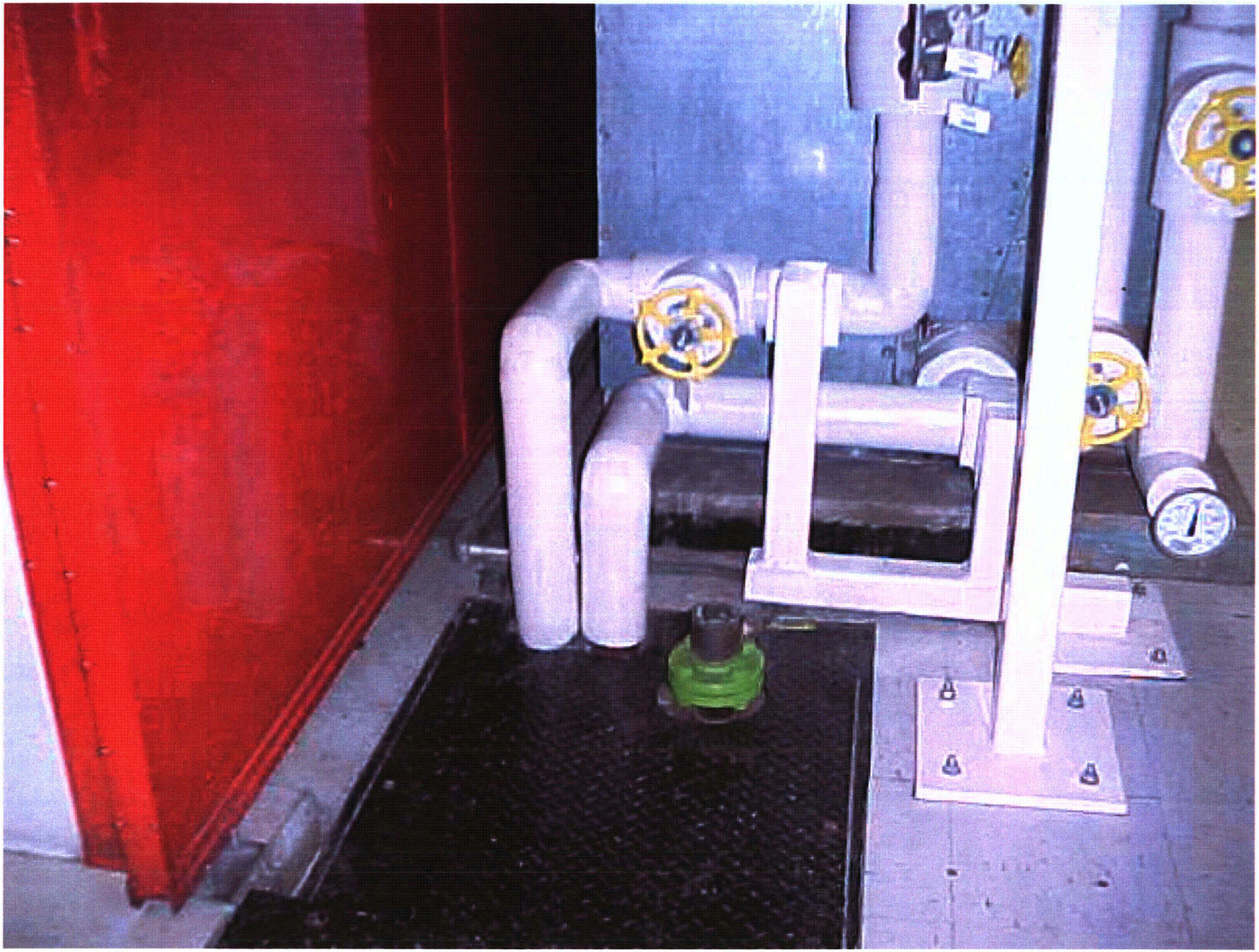
- VT-2 visual inspection of chilled water piping conducted every 18 months (required by risk-informed ISI program)
- No through wall leaks on chilled water piping
- Chilled Water Piping System Contingency Plan addressing chilled water piping leak in place

Need for Chilled Water Piping Replacement

- Elements of existing Contingency Plan
  - Provision to install a non-structural clamp to contain leaks
  - NDE methodology to characterize flaws
  - Flaw characterization requirements
  - Flaw evaluation templates
  - Leak-rate determination
  - Operability determination process
  - Staging of repair materials
  - Mock-up testing

Need for Chilled Water Piping Replacement

- Piping to be replaced in MCR, ESGR, and MER-3 was installed as part of original Surry plant construction
- MER-5 piping was installed in 1993-1994 time frame during installation of chillers 4D and 4E; no plan to replace MER-5 piping



Chilled Water Piping Replacement Plan

Roger Riley
Supervisor - Nuclear Engineering Projects

Chilled Water Piping Replacement Plan

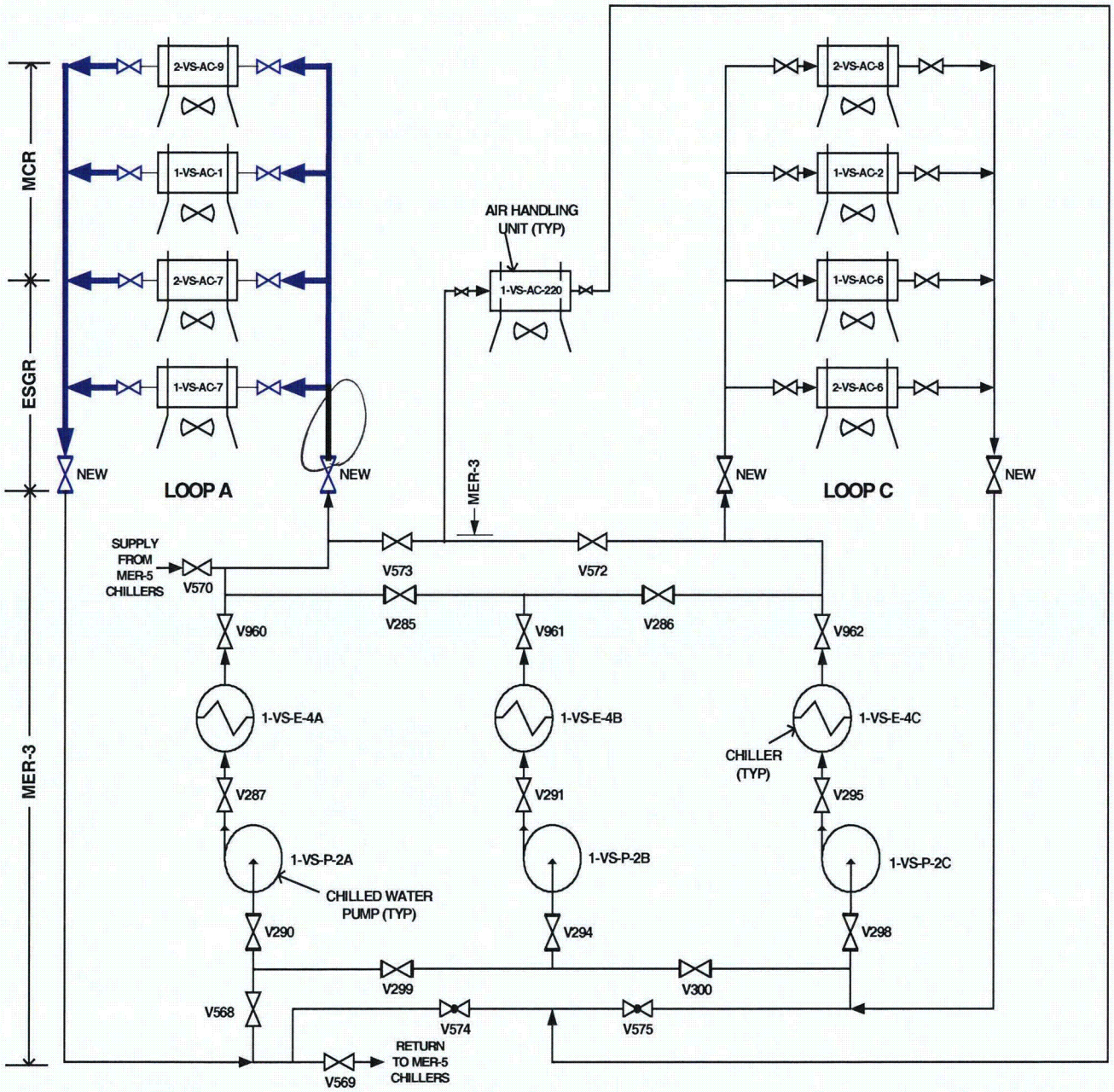
- Replacement Options Considered
- Piping Replacement Plan
- Planned Compensatory Actions

Replacement Options Considered

- Replacement of piping in current configuration
- Rerouting of piping via different pathways
  - Permanent routing
  - Temporary routing (e.g., use of a temporary jumper)
- Feasibility study concluded permanent rerouting and use of temporary jumper not viable and ruled out due to:
  - Complexities involved with rerouting
  - Potential impact on existing SSCs
  - Potential for additional construction-related issues

Piping Replacement Plan

- Replacement in four segments
  - Chilled water loop A in ESGR and MCR
  - Chilled water loop C in ESGR and MCR
  - Chilled water piping in MER-3 associated with chillers 1-VS-E-4A and 1-VS-E-4B
  - Chilled water piping in MER-3 associated with chiller 1-VS-E-4C
- Replacement piping will be carbon steel with exterior coating

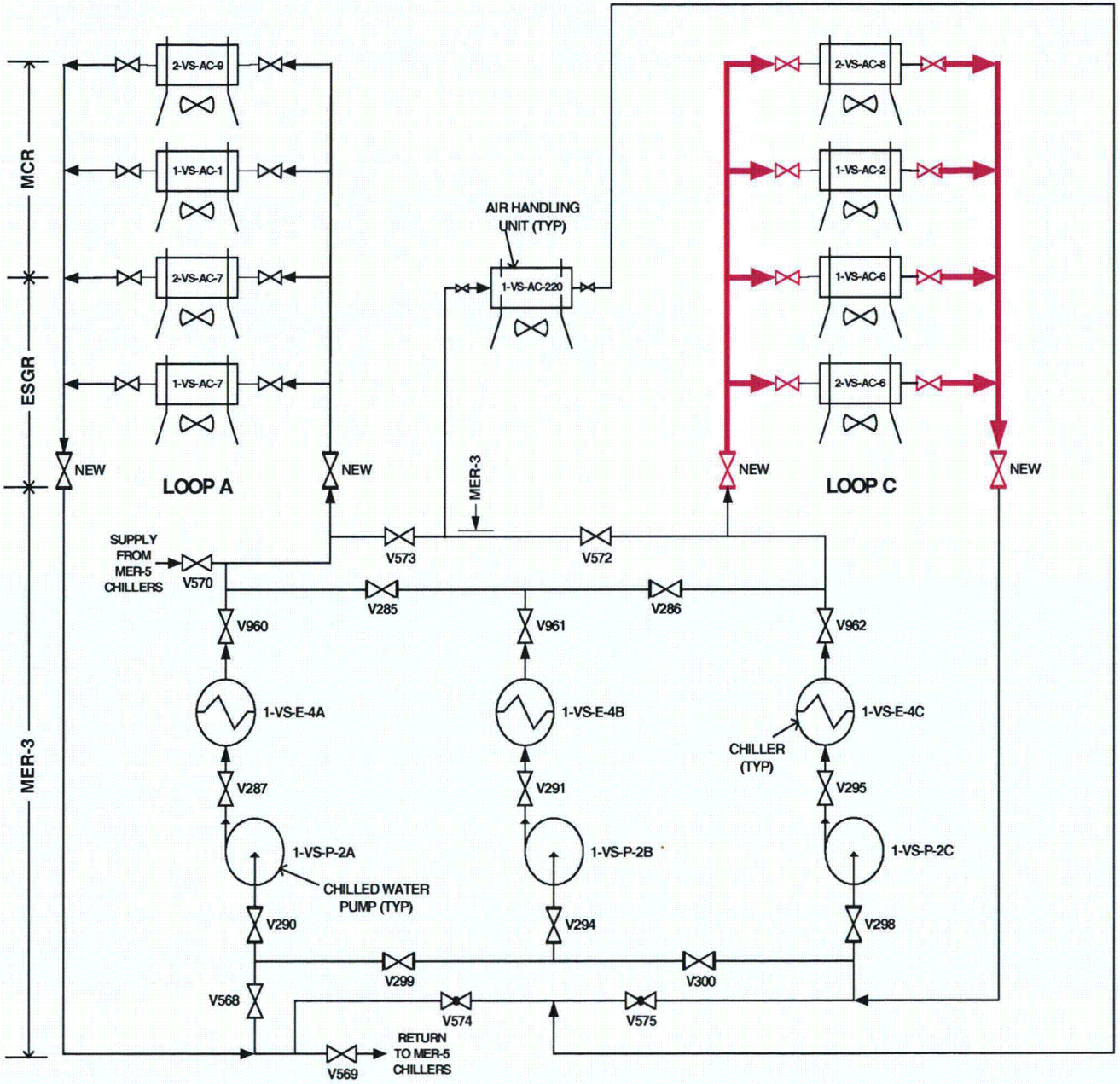


LOOP A 45-DAY AOT PIPING REPLACEMENT SCOPE IN BOLD

250' OF 3" DIA.
100' OF 2-½" DIA.
110' OF 2" DIA.

MCR / ESGR CHILLED WATER SYSTEM

FIGURE 3

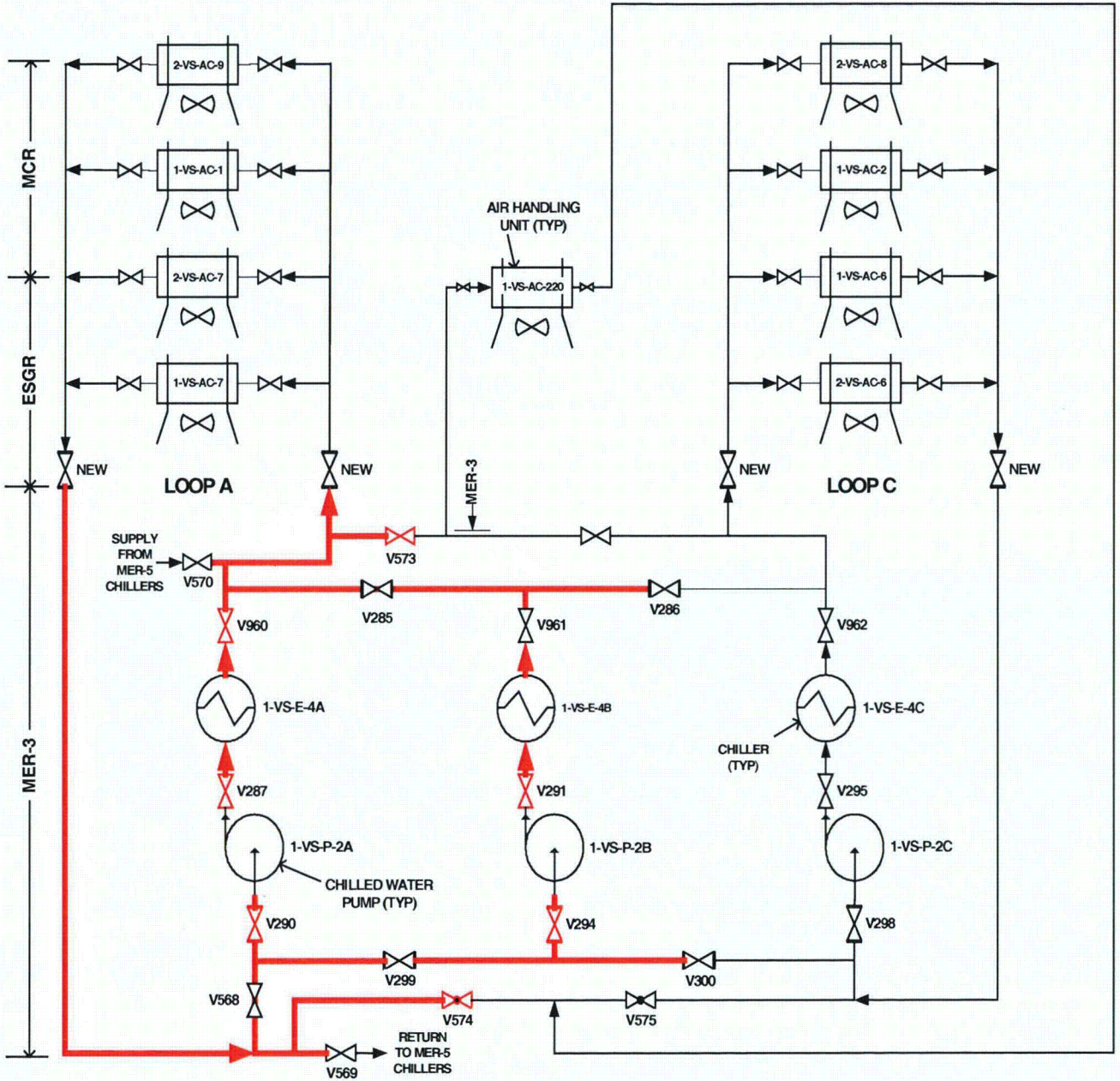


LOOP C 45-DAY AOT PIPING REPLACEMENT SCOPE IN **BOLD**

250' OF 3" DIA.
100' OF 2-½" DIA.
110' OF 2" DIA.

MCR / ESGR CHILLED WATER SYSTEM

FIGURE 4

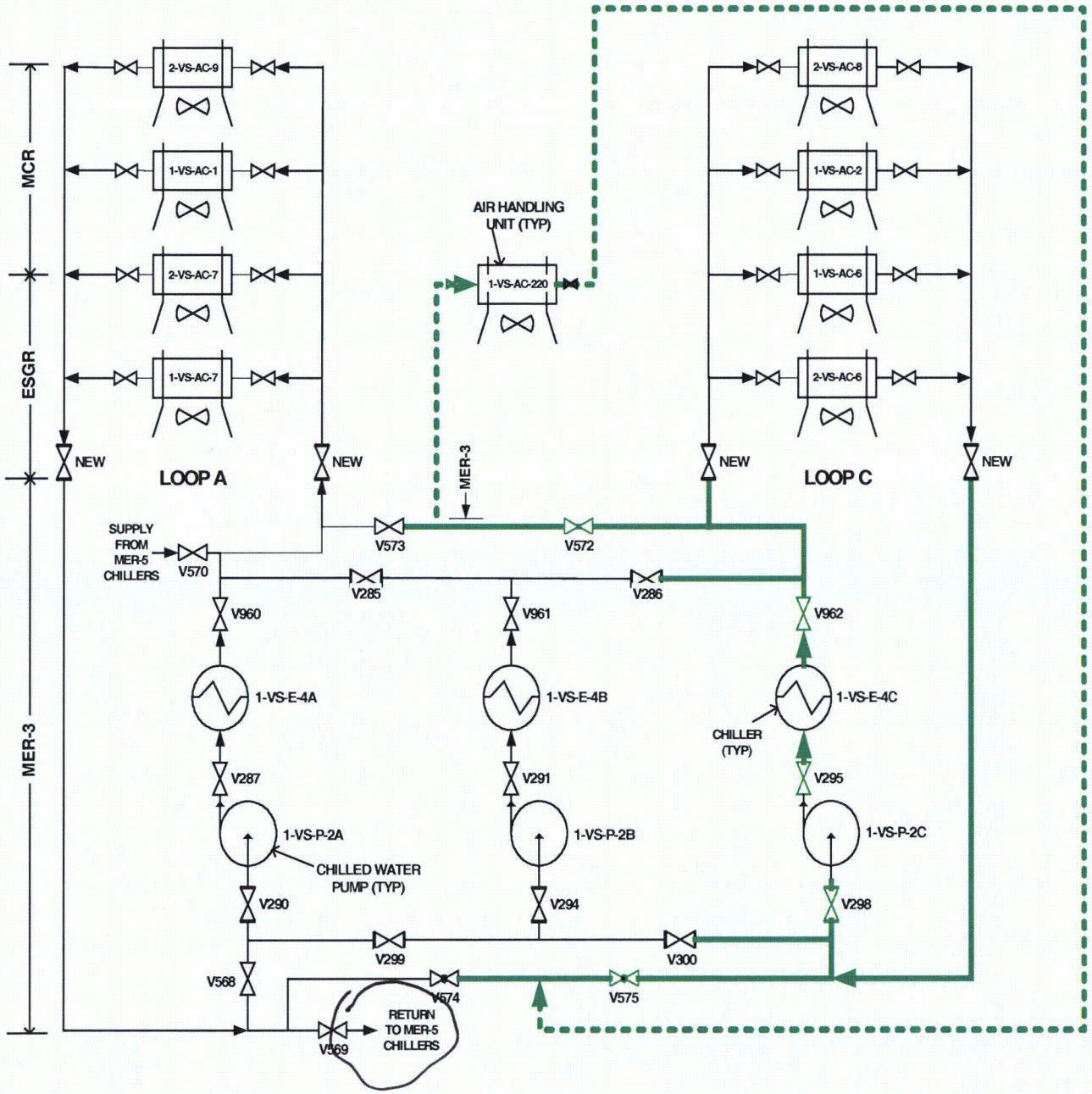


THIRD 45-DAY AOT
MER-3 PIPING REPLACEMENT
SCOPE IN **BOLD**

160' OF 3" DIA.
65' OF 2" DIA.

MCR / ESGR CHILLED WATER SYSTEM

FIGURE 5



FOURTH 45-DAY AOT
MER-3 PIPING REPLACEMENT
SCOPE IN **BOLD**

80' OF 3" DIA.
35' OF 2" DIA.

40' OF 1" DIA. PIPING SHOWN IN DASHED LINE TO BE REPLACED WITH MER-3 PIPING REPLACEMENT ACTIVITIES. THIS IS NOT A TECHNICAL SPECIFICATION ITEM.

MCR / ESGR CHILLED WATER SYSTEM

FIGURE 6

Planned Compensatory Actions

- Four AHUs (two AHUs per unit) on operating loop will be identified as protected equipment by Operations
- Due to close proximity to loop piping being replaced, operating loop piping will be physically protected from impact, grinding, chipping, arc strike, etc. by sheet metal, fire retardant plywood, rubber, welding/grinding/chipping shields, as appropriate
- Existing procedures and practices regarding combustibles, ignition sources, and housekeeping will be used

Planned Compensatory Actions

- Walkways in work area will be kept free of obstructions and by temporary trench covers, as required
- There will be no outstanding AHU maintenance that could affect reliability
- Availability of AHU spare parts (safety stock items) will be verified
- Existing procedures are in place to initiate contingency action to maintain temperature if loss of MCR and ESGR ACS cooling occurs

Planned Compensatory Actions

- Existing Chilled Water Piping System Contingency Plan addressing chilled water piping leak will remain in place until replacement complete
- No flood-related compensatory action needed because postulated rupture of in-service chilled water loop not an ESGR flooding concern
  - Emergency busses are most risk-significant components in ESGR
  - Volume of water in in-service chilled water loop piping significantly less than volume of water required to impact emergency busses

Current Technical Specification Requirements and Proposed License Amendment Request

Barry Garber
Supervisor - Surry Licensing

Current Technical Specification Requirements and Proposed License Amendment Request

- Current TS 3.23.C
- Proposed TS Change to Permit Piping Replacement
- Proposed Schedule

Current TS 3.23.C

- 7-day AOT with one AHU inoperable per unit when unit is above cold shutdown (TS 3.23.2.a.1 or TS 3.23.2.b.1)
- With a chilled water loop out of service, two AHUs per unit inoperable
- With two or more AHUs per unit inoperable, the affected unit shall be placed in hot shutdown within 6 hours (TS 3.0.1)

Proposed TS Change to Permit Piping Replacement

- Risk-informed temporary 45-day AOT revision to be submitted includes:
  - OL condition for each unit regarding use of temporary 45-day AOT to permit piping replacement
  - Footnote providing 45-day AOT and permitting four entries in 24-month time span with maximum of two entries per year
  - TS 3.23 Basis revision to reflect TS 3.23 revisions for temporary 45-day AOT

Proposed Schedule

- Proposed risk-informed TS submittal following today's meeting (December 2006)
- Request 6-month review by NRC (June 2007)
- Four 45-day AOT entries over 24-month period
  - First in Late Summer / Fall 2007
  - Second and third in 2008
  - Fourth in Spring 2009

Supporting Risk Analysis

Tom Hook
Supervisor - Nuclear Analysis &
Fuel/Probablistic Risk Analysis

Supporting Risk Analysis

- Supporting Risk Analysis Overview
- RG 1.174 Analysis Results
- RG 1.177 Tier 1 Analysis Results
- RG 1.177 Tier 2 Analysis Results
- RG 1.177 Tier 3 Analysis Results
- Summary of PRA Quality

Supporting Risk Analysis Overview

- RGs 1.174 and 1.177 evaluation of temporary 45-day AOT performed
- Acceptably small increase in risk
- PRA model includes internal events (including internal flooding), internal fire, and seismic events
- Other IPEEE external events determined to have no impact on this application

RG 1.174 Analysis Results

- Expected annual AOT risk for 24-month period (two 45-day AOTs per year)
  - CDF = 4.6E-5/year and LERF = 9.1E-7/year
  - ΔCDF = 1.3E-6/year and ΔLERF = 2.2E-8/year
- RG 1.174 classification
  - CDF: Small and LERF: Very small

RG 1.177 Tier 1 Analysis Results

- Risk impact of single AOT - loop A out of service 45 days
  - ICCDP = 1.8E-7 and ICLERP = 9.0E-9
- Risk impact of single AOT - loop C out of service 45 days
  - ICCDP = 3.1E-7 and ICLERP = 1.2E-8
- RG 1.177 classification
  - ICCDP: Small and ICLERP: Small

T&E' Risk of single entry for 45 days

RG 1.177 Tier 2 Analysis Results

- Tier 2 evaluation based on RG 1.177 ICCDP and ICLERP
- Tier 2 evaluation resulted in list of equipment with operational restrictions
- Unavailability of each of these components due to scheduled maintenance and surveillance testing will be limited during chilled water loop AOTs so that ICCDP and ICLERP do not exceed RG 1.177 Tier 1 limits

Table 4
SUMMARY OF TIER 2 OPERATIONAL RESTRICTIONS
FOR CHILLED WATER LOOP OUTAGE WHILE UNIT 1 IS AT POWER

Systems	Components	Descriptions	Acceptable Configuration Time (hours)
4KV Transfer Bus	1-EP-SW-D	Transfer Bus D 1-EP-SW-D	0
	1-EP-SW-E	Transfer Bus E 1-EP-SW-E	0
	1-EP-SW-F	Transfer Bus F 1-EP-SW-F	0
4KV Emergency Bus	1-EP-SW-1H	4160V Emergency Bus 1-EP-SW-1H	0
	1-EP-SW-1J	4160V Emergency Bus 1-EP-SW-1J	0
	2-EP-SW-2H	4160V Emergency Bus 2-EP-SW-2H	0
	2-EP-SW-2J	4160V Emergency Bus 2-EP-SW-2J	0
480 volt MCC	1-EP-MCC-1H-1	480V MCC 1-EP-MCC-1H-1	0
	1-EP-MCC-1H1-1	480V MCC 1-EP-MCC-1H1-1	0
	1-EP-MCC-1J-1	480V MCC 1-EP-BUS-1J-1	0
	1-EP-MCC-1J1-1	480V MCC 1-EP-BUS-1J1-1	0
	2-EP-MCC-2H-1	480V MCC 2-EP-MCC-2H-1	0
	2-EP-MCC-2H1-1	480V MCC 2-EP-MCC-2H1-1	0
	2-EP-MCC-2J-1	480V MCC 2-EP-BUS-2J-1	0
	2-EP-MCC-2J1-1	480V MCC 2-EP-BUS-2J1-1	0
EDG	1-EE-EG-1	EDG 1-EE-EG-1	20
	2-EE-EG-1	EDG 2-EE-EG-1	20
	3-EE-EG-1	EDG 3-EE-EG-1	20
AAC	0-AAC-DG-0M	AAC Diesel Generator 0-AAC-DG-0M	24
CC	1-CC-P-1A	CCW Pump 1-CC-P-1A	180
	1-CC-P-1B	CCW Pump 1-CC-P-1B	180
	1-CC-P-1C	CCW Pump 1-CC-P-1C	180
	1-CC-P-1D	CCW Pump 1-CC-P-1D	180
CH	1-CH-P-1A	Charging Pump 1-CH-P-1A	240 (1)
	1-CH-P-1B	Charging Pump 1-CH-P-1B	240 (1)
	1-CH-P-1C	Charging Pump 1-CH-P-1C	240 (1)
CS	1-CS-P-1A	Containment Spray Pump 1-CS-P-1A	24
	1-CS-P-1B	Containment Spray Pump 1-CS-P-1B	24
FW	1-FW-P2	Unit 1 T/D AFW Pump 1-FW-P2	20
	1-FW-P3A	Unit 1 M/D AFW Pump 1-FW-P-3A	20
	1-FW-P3B	Unit 1 M/D AFW Pump 1-FW-P-3A	20
FW	2-FW-P2	Unit 2 T/D AFW Pump 2-FW-P2	20/336/(2)
	2-FW-P3A	Unit 2 M/D AFW Pump 2-FW-P-3A	20/336/(2)
	2-FW-P3B	Unit 2 M/D AFW Pump 2-FW-P-3A	20/336/(2)
RH	1-RH-P-1A	RHR Pump 1-RH-P-1A	336
	1-RH-P-1B	RHR Pump 1-RH-P-1B	336
RS	1-RS-P-1A	Inside Containment RS Pump 1-RS-P-1A	72
	1-RS-P-1B	Inside Containment RS Pump 1-RS-P-1B	72
RS	1-RS-P-2A	Outside Containment RS Pump 1-RS-P-2A	24
	1-RS-P-2B	Outside Containment RS Pump 1-RS-P-2B	24
SI	1-SI-P-1A	LHSI Pump 1-SI-P-1A	72
	1-SI-P-1B	LHSI Pump 1-SI-P-1B	72
SW	1-SW-P-1A	Diesel Driven Emergency SW Pump 1-SW-P-1A	168
	1-SW-P-1B	Diesel Driven Emergency SW Pump 1-SW-P-1B	168
	1-SW-P-1C	Diesel Driven Emergency SW Pump 1-SW-P-1C	168
SW	1-SW-P-10A	Charging Pump SW pump 1-SW-P-10A	11
	1-SW-P-10B	Charging Pump SW pump 1-SW-P-10B	11

(1) The TS requirement for the charging pumps is 72 hours for two charging pumps out of service. There is no limitation for one charging pump out of service.
(2) When Unit 2 is at power, the feedwater pump ACT is 20 hours. When Unit 2 is shut down, the ACT is 336 hours.

RG 1.177 Tier 2 Analysis Results

- Corrective maintenance will be reviewed under Tier 3
- Planned combinations of multiple system trains unavailable concurrent with chilled water loop out of service not permitted

RG 1.177 Tier 3 Analysis Results

- 10CFR50.65 (a)(4) program governed by station procedures
- (a)(4) program assesses risk impact of equipment out of service and other plant conditions
- Risk assessment quantitatively evaluates impact on CDF and LERF using Safety Monitor
- (a)(4) program tool used by Work Planners and STAs to evaluate surveillance testing, planned and emergent maintenance, and plant conditions

Summary of PRA Quality

- Level of detail
  - Initiating events
  - Modeled systems
  - Operator actions
  - Common cause events
- Maintenance of PRA
  - Administrative control process
  - Periodic review and update

Summary of PRA Quality

- Comprehensive Critical Reviews
  - RG 1.200 self-assessment
  - WOG PRA peer review
    - Fact and observation (F&O) summary
      - No A significance F&Os on Surry model
      - 23 B significance F&Os on Surry model resolved
      - A and B significance F&Os on North Anna model applicable to Surry reviewed
      - Unresolved North Anna F&Os applicable to Surry would not change conclusions of this application

Concluding Remarks

Matt Adams

Concluding Remarks

- Chilled water piping replacement is needed
- Temporary 45-day AOT will permit orderly replacement without two-unit shutdown
- Temporary 45-day AOT TS is supported deterministically and by risk analysis
- Operational restrictions and compensatory actions will be in place during replacement
- Expeditious NRC review is needed

Questions