FACILITY 4572
Table of Contents

1 FACILITY CONDITION ASSESSMENT 1

1.1 Facility Function and Description 1
1.1.1 Architectural / Civil / Structural Systems 1
1.1.2 Mechanical / HVAC 1
1.1.3 Electrical 2
1.2 Facility 4572 Site Plan 3
1.3 Facility 4572 Floor Plans 5
1.4 Facilities Condition Assessment (FCA) Procedure 11
1.4.1 Scope and Purpose 11
1.5 Overall Building Condition Ranking 12
1.6 Architectural Facility Condition Assessment Findings 12
1.6.1 Interior 12
1.6.2 Exterior 13
1.6.3 Roofs 14
1.6.4 Civil 15
1.6.5 Structural 15
1.7 Mechanical Findings 16
1.7.1 Sump Pumps 16
1.7.2 Potable Water System 16
1.7.3 Water Pumps 16
1.7.4 Bridge Crane 16
1.7.5 Sprinkler System 16
1.7.6 Hot Water Booster Pump 16
1.7.7 Safety Shower/Eyewashes 17
1.7.8 Hydraulic Elevator 17
1.8 HVAC Findings 18
1.8.1 Packaged DXAC Units 18
1.8.2 Computer Room Units 18
1.8.3 Electric Unit Heaters 18
1.8.4 Split-System DXAC Units 18
1.8.5 Heat Vent Units 18
1.8.6 Exhaust Fans 18
1.9 Electrical FCA Findings 18
1.9.1 Unit Power Centers 19
1.9.2 Panel Boards 19
1.9.3 Battery Bank 19
1.9.4 Motor Control Center 19
1.9.5 Fire Alarm System 19
1.9.6 Emergency Lighting and Aviation Warning Lights 19
1.9.7 Transformers 20
1.10 Synopsis of FCA Actions and Recommendations 20
1.11 Safety Impact from Failure of Equipment in Poor/Replace Condition 21
1.12 Energy Recommendations 21
1.13 Estimated Costs 21
1.14 FCA Detail Summary 28

2 RELIABILITY CENTERED MAINTENANCE (RCM) ANALYSIS 30

2.1 Objectives/Team Members 30

2.2 Background 30
2.3 Electrical Systems 32
2.3.1 Unit Power Center 32
2.3.2 Panel Boards 32
2.3.3 Battery Bank 32
2.3.4 Motor Control Center 33
2.3.5 Fire Alarm System 33
2.3.6 Emergency Lighting 33
2.3.7 Transformers 33
2.4 MECHANICAL / HVAC SYSTEMS 34
2.4.1 Split System DXAC Units 34
2.4.2 Heat Vent Units 34
2.4.3 Computer Room Units 34
2.4.4 Packaged DXAC Units 35
2.4.5 Sump Pumps 35
2.4.6 Hot Water Booster Pump 35
2.4.7 Exhaust Air Fans 35
2.4.8 Electric Unit Heaters 35
2.5 MISCELLANEOUS SYSTEMS 36
2.5.1 Sprinkler System 36
2.5.2 Bridge Crane 36
2.5.3 Potable Water System 36
2.5.4 Safety Shower/Eyewashes 36
2.5.5 Roof 37

3 APPENDIX ..... Error! Bookmark not defined.

FACILITY 4572
CONTINUOUS FACILITIES ASSESSMENT
October 2007

1 FACILITY CONDITION ASSESSMENT

1.1 Facility Function and Description

The condition of this building was previously assessed and evaluated in August, 2003. Building 4572 is described as a **Propulsion and Structural Test Facility**. This facility has been deemed a national historic landmark. The test stand portion is mothballed but the second floor offices are occupied by EM personnel. The high bay area is used for hazardous cryogenic structural testing. This building is being considered for future testing as part of the CLV Program.

The original seven (7) story structure was constructed in 1957. It has a gross area of 11,916 square feet and a net usable area of 6,344 square feet. There are approximately three (3) building occupants. Building 4572 is assigned to the Environmental Effects Branch (EM50) for utilization.

1.1.1 Architectural / Civil / Structural Systems

The facility is constructed of heavy structural steel and is on a reinforced concrete foundation. The floor is reinforced concrete-on-grade, as well as steel grating. The roof system consists of concrete with coating, transite panels, and an EPDM fully adhered membrane. Exterior walls are corrugated metal siding, concrete block, and reinforced concrete. Doors are steel, some with glass inserts. The interior finish includes painted gypsum board walls, floor tile flooring, and painted reinforced concrete ceilings. Exterior parking and material staging areas are paved concrete.

1.1.2 Mechanical / HVAC

The Mechanical / HVAC systems for 4572 Propulsion & Structural Test facility include equipment to provide climate control for the facility, as well as various other functions. Two (2) computer room units cool the computer rooms and keep the sensitive computer components from overheating. Three (3) split-system DXAC units provide climate control for the facility. Seven (7) electric unit heaters provide heat to the facility. Two (2) packaged DXAC units also provide climate control for the facility. Two (2) heat vent units provide addition warmth in other areas of the facility. Two (2) exhaust fan blowers remove fumes out the battery and electrical rooms. Two (2) safety shower/eyewash units provide water in case of direct chemical contact; one of the shower/eyewash units is out of service. One (1) safety eyewash provides water in case of emergency. One (1) domestic hot water heater heats potable water for the facility's restroom sinks. Two (2) sump pumps regulate the water level in the facility's pit areas. Two (2) water pumps previously served high pressure water lines used for various facility processes. They are both out of service. One (1) hot water booster pump provides extra pressure to circulate potable hot water to the facility's restrooms. One (1) 10-ton bridge crane provides for the lifting of large equipment and material payloads in the SRB High Bay. One (1) hydraulic passenger elevator has stops at the first floor, mezzanine, second floor, and elevator penthouse levels.

1.1.3 Electrical

The main power system serving building 4752 is a 4160-volt feed coming from a pad-mounted substation on the east side of Building 4570. The Substation feeds 4160-volts to two (2) 1200-amp unit power centers located in room 104A, E-01 at Building 4572. These unit power centers transform the voltage to 480 volts and feed the facility through a series consisting of a motor control center, high voltage distribution panel boards located throughout the facility, and dry-type step down transformers for low voltage (208/120V). The high voltage panels (480/277V) supply power for operation of lighting, pumps, air compressors, HVAC, and user specific equipment. The low voltage panels provide 120/208V for lighting, receptacles, office equipment and miscellaneous power loads. Building 4572 contains emergency lights to illuminate exit routes when power outages occur.

1.2 Facility 4572 Site Plan

1.3 Facility 4572 Floor Plans

FLOOR 1

FLOOR 2

FLOOR 3

FLOOR 4

FLOOR 5

1.4 Facilities Condition Assessment (FCA) Procedure

1.4.1 Scope and Purpose

The purpose of this procedure is to provide a periodic scheduled visual and functional examination of Facilities. Facility condition is evaluated and documented in order to provide a basis for rational funding and scheduling of necessary repairs, and to maintain the facility in a condition consistent with it's assigned mission. Surveys will encompass the different components of the Facilities, such as, but not limited to HVAC, roofs, interior finishes, electrical devices and pumps. Also, included are roads, grounds, sidewalks, storage tanks, drainage structures and utility systems. The Assessments will ensure 80% accuracy of the Backlog of Maintenance and Repairs (BMAR) at all times and will include a cost estimate for corrections of any deficiencies or replacement of equipment.
The COSS Contractor's Systems Engineers utilize the following reference material:

- UBC
- ACI
- IEEE
- NFPA
- ANSI
- ASME
- OSHA
- ASTM
- NECA
- ASHRAE

The COSS contractor's System Engineering Manager has overall responsibility for the FCA Report. The Systems Engineering Branch provides Systems Engineers to perform and document Facility Condition inspections and initiate the required corrective action. The COSS Contractor's Systems Maintenance Engineering Department develops and manages the annual Facility Condition Assessment schedule.

Conclusions are documented after the visual inspections are complete. The FCA team members complete the Engineering discrepancies and recommendations sheets describing the discrepant items, evaluating the problems and determining the proper method to achieve the necessary corrective maintenance.

1.5 Overall Building Condition Ranking

Building 4572 is in overall **fair/poor** condition. The ratings and conditions for the building's individual systems are described in sections **1.6** through **1.9**.

1.6 Architectural Facility Condition Assessment Findings

1.6.1 Interior

Overall, the interior is in **fair/poor** condition. In the office area (first and second floors), the floor tile needs to be replaced. Some touch-up painting on the walls is also required. Bathrooms need to be renovated.

Floor Tile to be Removed - Typical

1.6.2 Exterior

The exterior of this building is in **poor** condition. Most of the structural steel, stairs, and handrails are exhibiting signs of severe rusting. Paint on the reinforced concrete and concrete block walls is fading. Recommend painting the entire exterior area of 4572.

Note Faded Paint on Block Wall

Note Rusting Steel

Note Condition of Steel on Elevator Shaft

Note Rusting Steel

1.6.3 Roofs

Building 4572's roofs and gutters are in **fair** condition. After performing the FCA investigation and reviewing the craft inspections, it is recommended to apply a coating to the concrete roof surfaces.

1.6.4 Civil

The roads and grounds around the facility are in overall **good** condition. No deficiencies were noted during the FCA inspection.

1.6.5 Structural

Structurally, Building 4572 is in **good/fair** condition. Other than painting the structural steel (mentioned under exterior comments), no major deficiencies were noted during the FCA inspection.

1.7 Mechanical Findings

The mechanical components in this assessment are:

- Sump Pumps (2)
- Potable Water System (1)
- Water Pumps (2)
- Bridge Crane (1)
- Sprinkler System (1)
- Hot Water Booster Pump (1)
- Safety Shower/Eyewashes (3)
- Hydraulic Elevator (1)

1.7.1 Sump Pumps

4572's sump pumps (4572-SPMP001A and 4572-SPMP001B) are both rated in **poor** condition based on their exceeded life expectancy and deteriorated condition.

1.7.2 Potable Water System

4572's potable water system is rated in **replace** condition based on its age and deteriorated condition. The potable water system is 50 years old.

1.7.3 Water Pumps

4572's water pumps, 4572-PMP0002 and 4572-PMP0003, are both rated in **poor** condition based on their advanced age and deteriorated condition. These two water pumps are no longer in service, so no replacements are needed at this time.

1.7.4 Bridge Crane

4572's 10 ton crane is rated in **fair** condition based on appearance, performance, and age. This unit has been decommissioned.

1.7.5 Sprinkler System

4572's sprinkler system provides emergency water to the building's mezzanine level in the event of a fire. 4572-SPR0001 is rated in **fair** condition based on appearance, performance, and age.

1.7.6 Hot Water Booster Pump

4572's hot water pump is rated in **fair** condition based on its age and physical appearance.

1.7.7 Safety Shower/Eyewashes

Safety shower/eyewash 4572-SHEW0001 is rated in **new** condition based on its young age (installed in 2007), and physical appearance. 4572-SHEW0002, which is decommissioned equipment, is rated in **poor** condition based on old age and poor physical condition. A replacement for this unit is not necessary at this time. 4572's safety eyewash is rated in **fair** condition based on its age, physical appearance, and performance history.

1.7.8 Hydraulic Elevator

4572's hydraulic elevator is rated in **poor** condition based on its age, physical appearance and poor performance history.

1.8 HVAC Findings

The HVAC components covered in this assessment are:

- Packaged DXAC Units (2)
- Computer Room Units (2)
- Electric Unit Heaters (7)
- Split-System DXAC Units (3)
- Heat Vent Units (2)
- Exhaust Fans (2)

1.8.1 Packaged DXAC Units

4572 contains two packaged DXAC units. 4572-DXAC0007 is rated in **poor** condition based on age, appearance, and remaining life expectancy. 4572-DXAC0006 is rated in **good** condition based on its young age, physical appearance, and performance.

1.8.2 Computer Room Units

4572's computer room units, 4572-CRU0002 and 4572-CRU0004, are both rated in **fair** condition based on physical appearance, performance, age.

1.8.3 Electric Unit Heaters

Six (6) of 4572's seven (7) electric unit heaters (4572-UH0001 to 4572-UH0006) are rated **fair** condition based on age, appearance, and performance. 4572-UH0007 is rated in **poor** condition based on physical appearance and age.

1.8.4 Split-System DXAC Units

4572 contains three (3) split-system DXAC Units. Both halves of 4572-DXAC0001 and 4572-DXAC0003 are rated in **fair** condition based on age, physical appearance, and performance. 4572-DXAC0005's air handler section is rated in **fair** condition based on age, physical appearance, and performance. The condenser portion of 4572-DXAC0005 (installed in 2005) is rated in **new** condition based on its young age, physical appearance, and performance.

1.8.5 Heat Vent Units

4572 has two (2) heat vent units. 4572-HV0001 is rated in **poor** condition based on its old age and poor physical appearance. 4572-HV0002 is rated in **replace** condition based on exceeded life expectancy and deteriorated physical appearance.

1.8.6 Exhaust Fans

4572's exhaust air fans are both rated **poor** condition based on their exceeded life expectancy and physical appearance.

1.9 Electrical FCA Findings

The electrical components covered in this assessment are:

- Unit Power Centers
- Panel Boards
- Battery Bank
- Motor Control Centers
- Fire Alarm System
- Emergency Lighting and Aviation Warning Lights
- Transformers

1.9.1 Unit Power Centers

There are two (2) unit power centers located in building 4572. They are located in room 101. They consist of a primary section, transformer section and a secondary section. Their primary function is to step down the line voltage from 4160V to 480/277V, and distribute power to distribution panels and specific equipment. Both unit power centers are rated in **replace** condition, due to their advanced ages and antiquated appearance.

1.9.2 Panel Boards

There are twenty two (22) panel boards located throughout building 4572. These panel boards distribute power to building lights, office equipment and other power requirements. Four (4) panel boards are rated in **good** condition; three (3) panel boards are rated in **fair** condition; and fifteen (15) panel boards are rated in **replace** condition, due to their respective ages and physical conditions.

1.9.3 Battery Bank

There is one (1) battery bank in building 4572. Battery bank BATB0001 is located in room 101. It supplies backup power for computerized equipment. The battery bank is rated in **good** condition, due to its age and battery condition.

1.9.4 Motor Control Center

There is one (1) motor control center (MCC) located in Building 4572. The motor control supplies power for HVAC equipment, pumps, and certain specialized user equipment. 4572-MCC0001 is located in room 101, and is currently not being used. This MCC is rated in **replace** condition, due to its old age and condition.

1.9.5 Fire Alarm System

The Simplex 4020 fire alarm system (4572-FAS0001) is located in the front entrance foyer by the elevator. It notifies the fire department and building occupants when a fire occurs. It is rated in **good** condition due to its current age.

1.9.6 Emergency Lighting and Aviation Warning Lights

There are seven (7) flashing aircraft warning lights located on the roof of building 4572. They are rated in **good** condition. In addition, there are seventeen (17)

emergency lights located throughout the facility which are on the PM program. These emergency lights are all rated in **good** condition.

1.9.7 Transformers

There are two (2) transformers located in building 4572. They are used to step down voltage from 480/277 volts to 208/120 volts and supply low voltage control power. One (1) transformer is rated in **good** condition and one (1) transformer is rated in **replace** condition, due to their respective ages and conditions.

1.10 Synopsis of FCA Actions and Recommendations

4572's hot water booster pump is not currently on any preventive maintenance plan. It is recommended that 4572-HWP0001 be placed on the appropriate PM plan.

If returned to operation, It is recommended that an annual thermographic inspection be conducted on 4572's motor control center (4572-MCC0001) to identify any high resistance connections or contacts. Additionally, the unit should be manually cleaned every two to five years.

Transformers that provide power for the emergency warning systems and fire alarm system should be tested annually for correct voltage and current levels. An annual infrared thermographic inspection and a vibration analysis should be performed if the transformer is critical. This determination should be made for 4572's two (2) transformers, and they should be added to the appropriate PM/PT&I programs as necessary. A power outage will be necessary in order to fully access the electrical system and determine the specific equipment the transformers feed.

1.11 Safety Impact from Failure of Equipment in Poor/Replace Condition

4572-EAF0001 is rated in **poor** condition, and should be considered for immediate replacement. It serves a battery bank room on the first floor. A failure by the fan could result in the accumulation of flammable hydrogen gas within the room, which could lead to an explosion.

Hydraulic elevator 4572-ELEV0001, which is rated in **replace** condition, has suffered multiple failures in recent years. Future failures may result in passengers being trapped in the elevator if the doors and controls become inoperable. It is recommended that the elevator be considered for immediate replacement.

1.12 Energy Recommendations

Replacing electric unit heater 4572-UH0007 and heat vent units 4572-HV0001 and 0002 (all rated in **replace** condition) with more modern, energy efficient units will reduce the energy costs associated with providing climate control for the facility.

1.13 Estimated Costs

4572 TOTAL FCA ESTIMATED COST

ARCHITECTURAL ESTIMATE	$545,304
MECHANICAL ESTIMATE	$122,556
HVAC ESTIMATE	$26,050
ELECTRICAL ESTIMATE	$618,549
4572 Total	**$1,312,459**

4572 ARCHITECTURAL ESTIMATE

INTERIOR

Paint Wall(s)	$	436
Repair/Replace Bathroom Fixtures	$	3,896
Replace Flooring, Carpeting, etc.	$	39,100
SUBTOTAL	**$**	**43,432**

EXTERIOR

Paint Door	$	500
Paint Structural Members	$	489,960
Paint Wall	$	8,500
SUBTOTAL	**$**	**498,960**

4572 ARCHITECTURAL ESTIMATE (Cont.)

ROOF

Seal-Coat Roof	$2,912
SUBTOTAL	**$2,912**

STRUCTURAL

Not Applicable	$0
SUBTOTAL	**$0**

CIVIL

Not Applicable	$0
SUBTOTAL	**$0**

4524 ARCHITECTURAL SUMMARY

INTERIOR	$43,432
EXTERIOR	$498,960
ROOF	$2,912
CIVIL	$0
STRUCTURAL	$0
4524 ARCH. TOTAL	**$545,304**

4572 MECHANICAL ESTIMATE

EQUIPMENT

	POOR	REPLACE
Elevator	$113,260	
Pump	$7,200	
Safety Shower/Eyewash	$924	
Sump Pump	$1,172	
SUBTOTAL	**$122,556**	**$0**

OTHER

(none)	
	$0
SUBTOTAL	**$0**

Note: Only Equipment Rated As "Poor" or "Replace" Is Estimated, With "Replace" Being The More Urgent.

MECH. SUMMARY

EQUIPMENT (P)	**$122,556**
EQUIPMENT (R)	**$0**
OTHER	**$0**
MECH. TOTAL	**$122,556**

4572 HVAC ESTIMATE

EQUIPMENT

	POOR	REPLACE
Direct Expansion AC Unit	$7,000	$0
Exhaust Air Fan	$250	$0
Heating Ventilation Unit	$0	$17,700
Unit Heater	$1,100	$0
SUBTOTAL	**$8,350**	**$17,700**

OTHER

(none)	
SUBTOTAL	**$0**

Note: Only Equipment Rated As "Poor" or "Replace" Is Estimated, With "Replace" Being The More Urgent.

HVAC SUMMARY

EQUIPMENT (Poor)	**$8,350**
EQUIPMENT (Replace)	**$17,700**
OTHER	**$0**
HVAC TOTAL	**$26,050**

4572 ELECTRICAL ESTIMATE

EQUIPMENT

	POOR	REPLACE
Circuit Breaker Panel		$5,718
Contactor		$5,928
Motor Control Center		$54,967
Panel Board		$139,045
Safety Switch	$33,636	$2,960
Starter		$5,964
Starter Safety Switch		$3,996
Transformer		$6,585
Unit Power Center		$359,750
SUBTOTAL	**$33,636**	**$584,913**

EQUIPMENT

	POOR	REPLACE
SUBTOTAL	**$0**	**$0**

Note: Only Equipment Rated As "Poor" or "Replace" Is Estimated, With "Replace" Being The More Urgent.

ELECTRICAL SUMMARY

EQUIPMENT (Poor)	**$33,636**
EQUIPMENT (Replace)	**$584,913**
OTHER	**$0**
ELECTRICAL TOTAL	**$618,549**

1.14 FCA Detail Summary

An itemized list of all facility equipment (including conditions, estimates, and comments) and architectural line-item comments is available from the COSS Contractor's Facility Engineering Department upon request.

2 RELIABILITY CENTERED MAINTENANCE (RCM) ANALYSIS

2.1 Objectives/Team Members

This Reliability Centered Maintenance (RCM) Analysis of this Marshall Space Flight Center Building was performed during 2005 on NASA Center Operations Support Services Contract NAS8-03078. The COSS Contractor's Facilities Engineering Department performed the analysis using a team of engineers and craft specialists. The objective of the team was to examine the facilities and collateral equipment at the building using the RCM analysis process, and to develop a proposed maintenance approach.

2.2 Background

Analysis was limited to facilities and collateral equipment in Building 4572 that is the responsibility of the COSS facility maintenance contractor. Excluded were those systems that are maintained by the Army and include electric power supply to the building and some steam system equipment. Included were all facilities and collateral equipment within the building (up to 5 feet of the outer wall) associated cooling towers, emergency generators and switch gear.

To support the analysis, all systems were assigned a Failure Criticality Code and a Probability of Failure Code. Appendix A lists the systems and the codes assigned by the team. The codes, based upon similar codes used in the automotive industry[1], are identified in Tables 2-1 and 2-2. Table 2-1 builds upon the four risk categories presented in the COSS Preventive Maintenance Plan and provided additional options for the analysis team. High Risk (Category A) items are ranked 8-10. Moderate Risk (Category B) items are ranked 4-7. Low Risk (Category C) items are ranked 2-3. Negligible Risk (Category D) is ranked as 1.

[1] Reliability, Maintainability, and Supportability Guidebook, Third Edition, Society of Automotive Engineers, Inc., Warrendale, PA, 1995.

Table 2-1: Failure Criticality Codes

Ranking	Effect	Comment
1	None	No reason to expect failure to have any effect on Safety, Health, Environment or Mission.
2	Very Low	Minor disruption to facility function. Repair of failure can be accomplished during trouble call.
3	Low	Minor disruption to facility function. Repair of failure May be longer than trouble call but does not delay Mission.
4	Low to Moderate	Moderate disruption to facility function. Some portion of Mission May need to be reworked or process delayed.
5	Moderate	Moderate disruption to facility function. 100% of Mission May need to be reworked or process delayed.
6	Moderate to High	Moderate disruption to facility function. Some portion of Mission is lost. Moderate delay in restoring function.
7	High	High disruption to facility function. Some portion of Mission is lost. Significant delay in restoring function.
8	Very High	High disruption to facility function. All of Mission is lost. Significant delay in restoring function.
9	Hazard	Potential Safety, Health, or Environment issue. Failure will occur with warning.
10	Hazard	Potential Safety, Health, or Environment issue. Failure will occur without warning.

Table 2-2: Probability of Failure Codes

Ranking	Statistical	Comment
1	1/10,000	Remote probability of occurrence; unreasonable to expect failure to occur.
2	1/5,000	Low failure rate. Similar to past design that has, in the past, had low failure rates for given volume.
3	1/2,000	Low failure rate. Similar to past design that has, in the past, had low failure rates for given volume.
4	1/1,000	Occasional failure rate. Similar to past design that has, in the past, had similar failure rates for given volume.
5	1/500	Moderate failure rate. Similar to past design that has, in the past, had moderate failure rates for given volume.
6	1/200	Moderate to high failure rate. Similar to past design that has, in the past, had moderate failure rates for given volume.
7	1/100	High failure rate. Similar to past design that has, in the past, had high failure rates that have caused problems.
8	1/50	High failure rate. Similar to past design that has, in the past, had high failure rates that have caused problems.
9	1/20	Very High failure rate. Almost certain to cause problems.
10	1/10+	Very High failure rate. Almost certain to cause problems.

2.3 Electrical Systems

Electrical systems include all circuits from the substation to the load. Systems analyzed are listed in Table 2-3.

Table 2-3: Building 4572 Electrical Systems

Component Name	Criticality Code	Probability of Failure Code	Number of Items
Unit Power Center	6	6	2
Panel Boards	4	4 - 6	22
Battery Bank	4	4	1
Motor Control Centers	6	6	1
Fire Alarm System	9	2	1
Emergency Lighting	9	2	17
Aviation Warning Lights	9	2	7
Transformers	4	2 - 6	2
Total Number of Components			**53**

2.3.1 Unit Power Center

The two (2) unit power centers currently in use in 4572 are considered highly reliable units. Failures are generally associated with insulation failure and connection failure. The unit power centers provide power to building systems, equipment, offices and fire alarm system. These units should be checked annually for correct voltage and current levels. Infrared thermographic inspection and vibration analysis should be performed annually. The failure rate for these units is considered high due to their age and condition.

2.3.2 Panel Boards

The panel boards provide electrical power distribution through low amperage circuit breakers. Typical loads include lighting, office machines and receptacles. Failure modes include development of high resistance connections within the electrical circuits and failure of the overload protection devices. The failure rate for all of 4572's panels is considered extremely high, due to the older age of fifteen (15) panel boards. These panel boards are part of the 1095-day breaker exercising PM Program.

2.3.3 Battery Bank

The battery bank in building 4572 is on a 30-day PM program. Every 30 days the battery bank's connections are checked, terminals are cleaned and lubricated, and the batteries are cleaned if necessary. There are no changes recommended to the current PM program.

2.3.4 Motor Control Center

4572's motor control center provides electric power distribution and equipment control including starting/stopping and overload protection. Currently this MCC is not operating, however it could control loads on air handlers, pumps, fans, etc. Failure modes include development of high resistance connections within the electrical circuits, failure of the overload protection device, and mechanical binding of the starter mechanism. The probability of failure was evaluated and is considered to be high, due to this MCC's old age. If returned to operation, it is recommended that an annual thermographic inspection be conducted on the motor control center to identify any high resistance connections or contacts. Additionally, the unit should be manually cleaned every two to five years.

2.3.5 Fire Alarm System

A Simplex 4020 control panel serves the facility through general alarm bells, pull stations, and automatic detectors. It is recommended that the 30-day and 180-day PM plans for fire alarm systems should be followed to maintain proper functionality of this unit. The panel and the smoke detectors are inspected for damage and obstructions every 30 days. Every 180 days, the operation of all pull stations and bells are verified, the smoke detectors are cleaned, tested, and calibrated, and a visual inspection of the panel and smoke detectors is performed.

2.3.6 Emergency Lighting

The seventeen (17) emergency lights and aircraft warning lights at building 4572 are on the emergency light PM schedule. The emergency lights are maintained on 30-day, 180-day, and a 365-day PM program. Every 30 days, the following actions are performed: the exteriors of each light and lamp head are cleaned, the status of the battery is checked, and a 30-second operational test is conducted. Any deficiencies are noted on the PM record. In addition, every 180 days the interior of the light housing is cleaned and the battery terminals are checked. Every 365 days the light is subjected to a 1.5-hour operational test. No changes to the PM program are recommended.

2.3.7 Transformers

The two (2) dry type transformers provide voltage step-down functions. These transformers are considered a highly reliable type of equipment. Unit failures are typically associated with insulation failure and connection failure. Transformers that provide power for the emergency warning systems and fire alarm system should be tested annually for correct voltage and current levels. An annual infrared thermographic inspection and a vibration analysis should be performed if the transformer is critical. This determination should be made for these transformers, and they should be added to the appropriate PM/PT&I programs as necessary.

2.4 MECHANICAL / HVAC SYSTEMS

Mechanical systems include components associated with heating, ventilation, and air conditioning, and other pumping systems. Systems analyzed are listed in Table 2-4.

Table 2-4: Building 4572 Mechanical/ HVAC Systems

Component Name	Criticality Code	Probability of Failure Code	Number of Items
Split-System DXAC Units	3	2	3
Heat Vent Units	3	5	2
Computer Room Units	6	3	2
Packaged DXAC Units	3	3	2
Sump Pumps	4	4	2
Hot Water Booster Pump	2	3	1
Exhaust Air Fans	3	3	2
Electric Unit Heaters	3	4	7
Total Number of Items			**21**

2.4.1 Split System DXAC Units

4572's split-system DXAC units receive preventive maintenance on a 90, 180, and 365-day frequency. Every 90 days the unit's filters are checked and changed as necessary, and the units' operation and controls are checked. At 180 days, the units' operation and controls are checked again. The 365-day job plan adds further steps to check safety interlocks, and clean condenser and evaporator coils. No changes are recommended to the preventive maintenance of these units.

2.4.2 Heat Vent Units

4572's heat vent units receive preventive maintenance on 180-day frequency. Steps for the maintenance are to check filter and change if necessary, check controls and unit for proper operation, lubricate shaft and motor bearings as necessary, check belts for wear, proper tension, and alignment; adjust as necessary. No changes are recommended to this PM approach.

2.4.3 Computer Room Units

4572's computer room units receive preventive maintenance on a 30, 90, 180, and 365-day frequency. Steps for the maintenance on a 30-day are to check operation and controls if any problems are found issue work request; check belt, change if necessary lubricate condenser fan; and inspect drain for proper flow and clarity; check filter, if necessary. The 90-day plan adds the following steps: check safety interlocks, clean drain pans, vacuum drains, and insure drain clarity. The 180-day plan adds a step to check suction and discharge pressure. The 365-day plan adds steps to check safety interlocks and clean condenser and evaporator coils. No changes are recommended to the current preventive maintenance plan.

2.4.4 Packaged DXAC Units

4572's two (2) packaged DXAC units receive preventive maintenance on a 90, 180, and 365-day frequency. The 90-day and 180-day maintenance consists of a single step to check operation and controls, and issue a work request for any problems found. The 365-day PM adds steps to check safety interlocks and clean condenser and evaporator coils. No changes are recommended to the current PM plan.

2.4.5 Sump Pumps

4572's sump pumps receive preventive maintenance on a 30 and 180-day frequency. The steps for the 30-day plan consist of checking operation and controls and if any problems are found issue work request. The 180-day plan adds the steps of lubricating as necessary and checking coupling and drives. No changes are recommended to this approach.

2.4.6 Hot Water Booster Pump

4572's hot water booster pump is currently not on any preventive maintenance plan. The unit is being added to a 365-day job plan consisting of the following steps: check for proper operation of pump, if any problems are found issue work order request; check for leaks on suction and discharge piping, seals, packing glands and make minor repair if necessary; lubricate pump and motor as necessary; and check drive coupling.

2.4.7 Exhaust Air Fans

One of 4572's two (2) exhaust air fans receives preventive maintenance on a 180-day frequency. Steps for the maintenance are start and stop fan with local switch; check motor and fan shaft bearings for noise, vibration, overheating; lubricate as necessary, check belts for wear, tension, and alignment, if applicable adjust as required. If there are any problems are found, issue work request. The second exhaust fan located in the battery bank room is being added to the PM schedule.

2.4.8 Electric Unit Heaters

Building 4572's unit heaters are considered "run to fail" equipment and repaired on as an-needed basis. No changes are recommended to this maintenance approach.

2.5 MISCELLANEOUS SYSTEMS

Systems analyzed in this section are listed in Table 2-5.

Table 2-5: Building 4572 Miscellaneous Systems

Component Name	Criticality Code	Probability of Failure Code	Number of Items
Sprinkler System	10	3	1
Bridge Crane	10	3	1
Potable Water System	9	4	1
Safety Shower/Eyewashes	0,10	0,3	3
Roof	6	2	1
Total Number of Items			**7**

2.5.1 Sprinkler System

The fire protection of building 4572 consists of one "dry-type" sprinkler system with automatic heads. The current maintenance approach for the sprinkler system is to inspect the systems in accordance with the National Fire Protection Association (NFPA) guidelines on a 30-day frequency that incorporates extended checks and maintenance at 90 and 365-day frequency. No changes are recommended to the current maintenance, as it is in compliance with NFPA code.

2.5.2 Bridge Crane

4572's 10 ton crane is categorized as decommissioned equipment. It is recommended to be added to the appropriate PM plan if put back into use.

2.5.3 Potable Water System

4572's potable water piping is considered a "run to fail" system. Due to the piping's advanced age, it is recommended to test the piping every 3-5 years to determine the degree of deterioration of its inside surfaces.

2.5.4 Safety Shower/Eyewashes

4572 contains one eyewash unit and two safety shower/eyewash units, one of which (4572-SHEW0002) is out of service and decommissioned. 4572-SHEW0001 and 4572-EW0001 receive preventive maintenance on a 30-day frequency. The job plan consists of checking operation and controls, issuing a work order request if any problems are found, flushing system for two (2) minutes minimum; and dating and initialing inspection tag.

2.5.5 Roof

A semi-annual preventive maintenance schedule and inspection is followed for the roof at Building 4572. This inspection includes a visual search of the entire roof system for general surface condition, leaks, ponding, flashing condition, penetrations, gutter condition, membrane condition, and roof drains and scuppers condition. All conditions are noted and input into the Roof Maintenance Database, which is viewable on the roof website.

The roof system at Building 4572 consists of reinforced concrete with coating, transite panels, and an EPDM fully adhered membrane roof that is in **fair** condition. No changes or recommendations are recommended at this time for the P.M. schedule or database.