

# “Meaningful Management” 2011

SAND2011-2045C

## BIM for FM

*Design for Maintenance strategy*



**Birgitta Foster**  
**Facilities BIM Champion**  
SSA/Sandia National Labs

April 6, 2011



Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.



# Disclaimer

“The **views expressed** in this presentation are **those of the author** and do not reflect the official policy or position of Sandia National Laboratories, Dept of Energy, or the US Government.”

# Overview

-  Introduction
-  Owners : Cost of **NOT** doing BIM
-  BIM for Operational Savings
  - “Design for Maintenance” Strategy
-  Tying it all together
-  Resource Recommendations

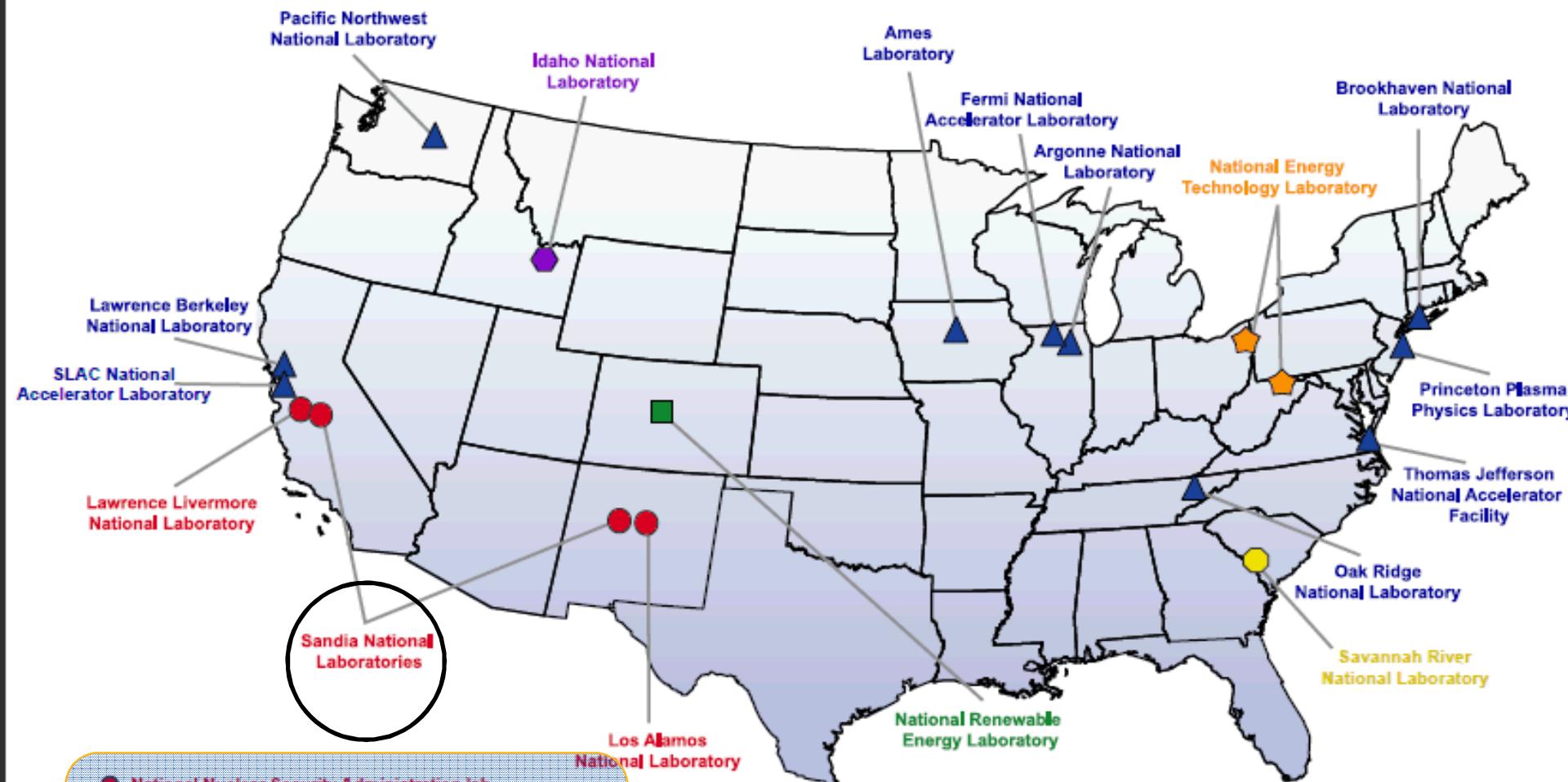
# Birgitta Foster, BSME, MBA

## Career Path

- **Manufacturer** : Ingersoll Rand
- **Engineering & Construction** : John Brown E&C
- **Fabrication** : Caterpillar
- **General Contractor**: for Intel
- **Specialty Contractor** : for Intel/Sandia National Labs
- **Mechanical Contractor** : for Sandia National Labs
- **Owner** : Sandia National Labs



# DEPARTMENT OF ENERGY NATIONAL LABORATORIES



-  **National Nuclear Security Administration lab**
-  **Office of Energy Efficiency and Renewable Energy lab**
-  **Office of Environmental Management lab**
-  **Office of Fossil Energy lab**
-  **Office of Nuclear Energy, Science and Technology lab**
-  **Office of Science lab**

# DOE : GO/CO\* structure



\*Gov't Owned/Contractor Operated



**Sandia  
National  
Laboratories**

# National Missions

## SANDIA'S NATIONAL SECURITY MISSIONS



### Nuclear Weapons

Ensure a safe, secure, & reliable nuclear deterrent.



### Energy & Infrastructure Assurance

Ensure clean, abundant, & affordable energy and water.



### Nonproliferation

Reduce proliferation of weapons of mass destruction & threat of accidents.



### Defense Systems & Assessments

Help maintain U.S. military weapon-systems superiority.



### Homeland Security

Help protect our nation against terrorism through advanced technology.



### Science, Technology, & Engineering

Conduct R&D programs to support all national security missions.



Sandia  
National  
Laboratories

# Mission: Tech Transfer



## Magic Cube

The Sandia-developed "Magic Cube" can blow a fragment-free hole in 1/4-inch steel. It can be used to **safely look at a terrorist bomb inside a vehicle** or create an **opening to see accident victims** and send them supplies.



Sandia  
National  
Laboratories

www.sandia.gov

Sandia National Laboratories - Windows Internet Explorer  
http://www.sandia.gov/index.html

Favorites Sandia National Laboratories

Sandia National Laboratories Employee Locator | Index | Site Map  
Search

About | Mission Areas | Newsroom | Careers | Doing Business | Education | Contact Us

SECURING A PEACEFUL AND FREE WORLD THROUGH TECHNOLOGY

**Gene sequencing for biofuels**  
Researchers to study microbial genes in arid grasslands » [Full Story](#)

All News Releases

News ▶ Gene sequencing for biofuels ▶ Magnetic mixing creates a stir ▶ Perspectives on energy policy

**60th Anniversary**  
60 ways Sandia Labs has impacted the nation

Sandia 2008  
The Labs' annual report (with video)

Lab Accomplishments  
Key milestones for 2009

**SANDIA'S NATIONAL SECURITY MISSIONS**

**Nuclear Weapons**  
Ensure a safe, secure, & reliable nuclear deterrent.

**Energy & Infrastructure Assurance**  
Ensure clean, abundant, & affordable energy and water.

**Nonproliferation**  
Reduce proliferation of weapons of mass destruction & threat of accidents.

**Defense Systems & Assessments**  
Help maintain U.S. military weapon-systems superiority.

**Homeland Security**  
Help protect our nation against terrorism through advanced technology.

**Science, Technology, & Engineering**  
Conduct R&D programs to support all national security missions

**RESOURCES FOR...**

Community

Employees & Retirees

News Media

Partners & Collaborators

Students

Suppliers

Visitors

**FOLLOW US**

9



# Sandia Overview

## Four sites ( ~ 1100 bldg, 7M GSF)

- NM (Albuquerque )
- CA (Livermore)
- NV (Tonopah)
- HI (Kauai)

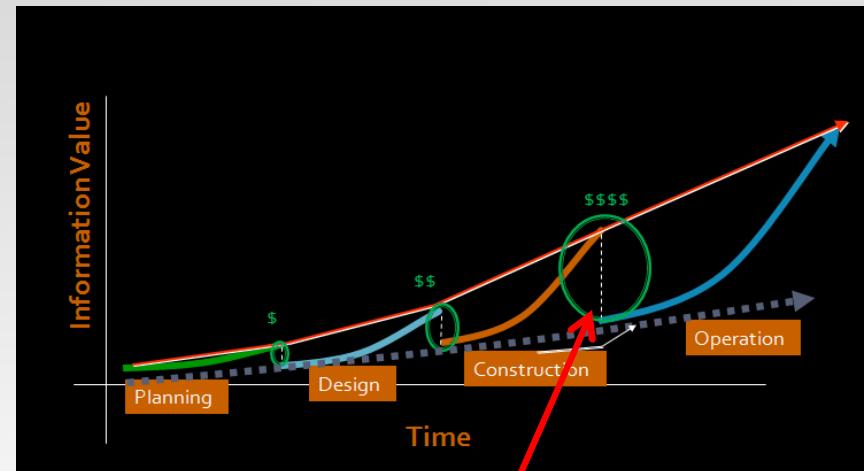
### Sandia - NM site

- 891 Bldgs
- 6M GSF
- 8700 acres



# Owners: Cost of NOT doing BIM

## NIST Survey (2004)



Industry Inefficiency Costs : \$15B/yr

- 66% borne by Owners
- Increased O&M costs = \$9.9B/yr
- \$0.23/ existing SF/yr

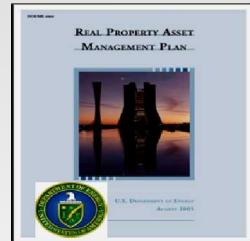
# Putting in to Context...@0.23/SF



Sandia

- 6M GSF

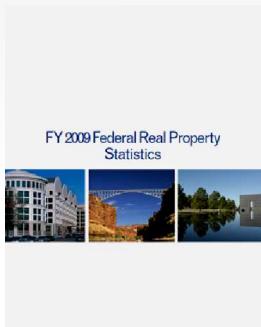
**Costing : \$1.38 M/yr**



DOE

- 127M GSF

**Costing : \$29 M/yr**



All Federal Agencies

- 3.38B GSF

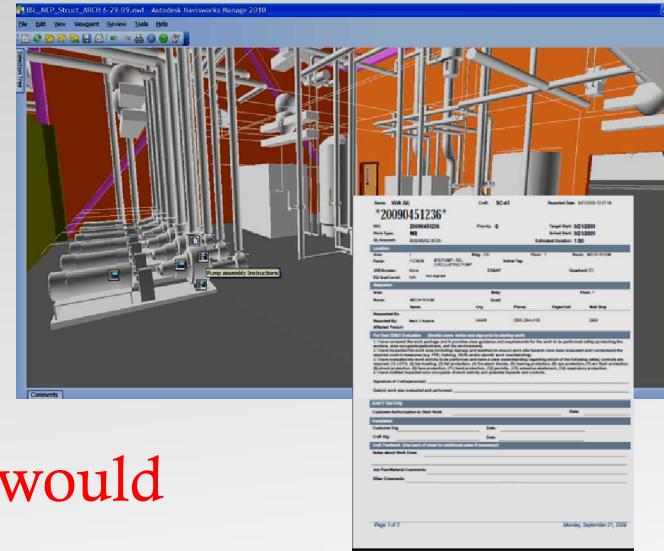
**Costing : \$0.77 B/yr**

# NIST Study Validation

NIST Study =  $\sim \$1.4M$

## Sandia “straw man” survey

Using BIM, if you could get all needed information in 5 minutes, how much time would that save?



Response: up to 2 hours per work order (WO)

$$2 \text{ hrs/WO} \times \$50/\text{hr} = \$100/\text{WO}$$
$$\text{WO/yr} = \sim 24,000$$

Potential savings:  **$\$2.4 \text{ M/year}$**

# BIM for FM : Evidence of savings

2004



NIST Industry Study  
*Cost Analysis of Inadequate Interoperability*

2009



NIST Validation  
*"Straw man" Survey*

2010



BIM for FM Survey :  
*"View of the future for FM"*



## UNM BIM for FM Survey :

*"View of the Future for Facilities Management"*

**Francisco Forns-Samso**  
Graduate student  
Construction Program  
Civil Engineering Department



THE UNIVERSITY *of*  
NEW MEXICO

# Survey on BIM for FM





- 77% Owners
- Majority manage campus-type facilities
- over 50% over 1M GSF
  - 22% 1-5M GSF
  - 35% over 5M GSF
- Respondents were a good cross-section with Education, Office, Gov't, Laboratory
- Majority had over 30,000 WO per year
- There is a perceived time savings up to 40% per WO

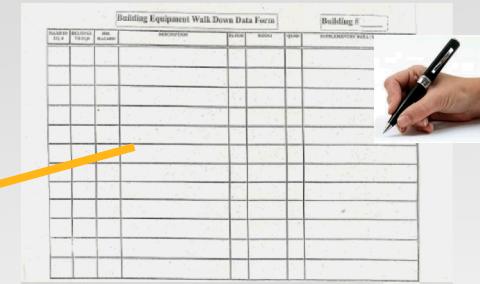
# FM Data Collection dilemma

- Current condition : **Inefficient**

- Manual / Reentry

- Not Trusted

- Hard to locate



- Future vision : **Efficient**

- Automated

- Manufacture supplied

- Entered Once, then Shared



# What do we infer?

Assets

Find Select Action

Asset 1006361 891:CIRCULATING CHILLED WATER PUMP # Site SNMFAC  
Status OPERATING Classification PUMP  
Yellow Tag # L00515

Details

Maintain Hierarchy? Parent [ ]  
Location 891 [ ] Energy Technology Office and Lab Building [ ]  
Bin [ ]  
Rotating Item [ ]  
Meter Group [ ]

Priority 2 [ ]  
Serial # 740113-2 [ ]  
Failure Class [ ]  
Item Type [ ]  
Asset/Property REAL [ ]  
SNL Site ALBUQUERQU [ ]

JSHE/Access P [ ]  
Qual Level N/A [ ]  
Supp Data VERIFIED [ ]  
Room BASEMENT EQUIP ROOM [ ]  
Floor BASEMENT [ ]  
Quad NE [ ]  
Model # 5L-3 [ ]  
Catalog # [ ]  
Condition [ ]

Purchase Information Costs

Vendor WEINMAN [ ]  
Manufacturer WEINMAN, AMW INDUSTRIES [ ]  
Installation Date [ ]  
Warranty Expiration Date [ ]  
Purchase Price 0.00 [ ]  
Replacement Cost 0.00 [ ]  
PO [ ]

Total Cost 75.17 [ ]  
YTD Cost 0.00 [ ]  
Budgeted 0.00 [ ]  
Inventory 0.00 [ ]  
GL Account 0000362/02.051 [ ]

Downtime Modified

Asset Up?   
Last Changed Date [ ]  
Total Downtime 0.00 [ ]

Changed By KNMEHLH  
Changed Date 3/29/00 8:04 AM

# How to collect data?

1	AE to complete this section								CONTRACTOR to complete this section					
2	Asset number	EQUIPMENT Classification	New Replace Remove	AREA	Location (Bldg#)	RM	FLR	Quadrant	Manufacturer	Model #	Catalog #	Serial Number	Installation date	Warranty Expiration date
3	100567	PUMP	Replace	I	880	26	BSMT	NE	Goulds					
4		PUMP	New	I	880	26	BSMT	NE						
5	100570	MOTOR	Replace	I	880	26	BSMT	NE	Baldor					
6		MOTOR	New	I	880	26	BSMT	NE						
7		CHILLER	New	I	880	26	BSMT	NE						
8	101845	CHILLER	Remove	I	880	26	BSMT	NE	Trane					
9	101846	CHILLER	Replace	I	880	26	BSMT	NE	Trane					
10		BOILER	New	I	880	26	BSMT	NE						
11														

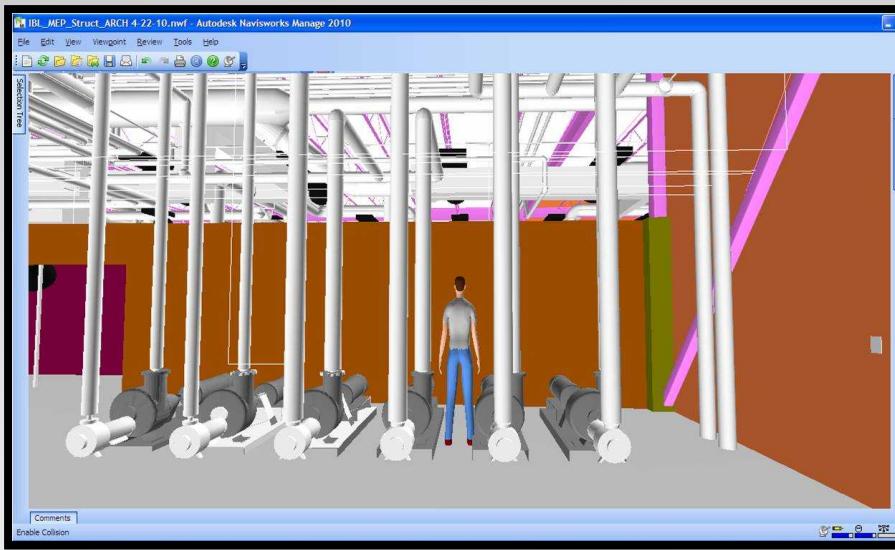
MASTER EQUIPMENT LIST - Asset Changes																
AE to complete this section								CONTRACTOR to complete this section								
Asset Number	EQUIPMENT Classification	New	Replace	Remove	AREA	Location (Bld)	Room	Floor	Quadrant	Manufacturer	Model	Catalog #	Serial#	Installation Da	Warranty Exp	JSHE/Access
111	PUMP	NEW			I	720	212	1st	NW	BELL & G	1510 5A					
112	PUMP	NEW			I	720	212	1st	NW	BELL & G	1510 5A					
113	PUMP	NEW			I	720	212	1st	NW	BELL & G	1510 4BC					
114	PUMP	NEW			I	720	212	1st	NW	BELL & G	1510 4BC					
115	PUMP	NEW			I	720	212	1st	NW	BELL & G	1510 2BC					
116	PUMP	NEW			I	720	212	1st	NW	BELL & G	1510 2BC					
121	BOILER	NEW			I	720	212	1st	NW	LOCHINV	PBN-1002-					
122	BOILER	NEW			I	720	212	1st	NW	LOCHINV	PBN-1002-					
245	AIRHDLR	NEW			I	720		ROOF	NE							
247	CHILLER	NEW			I	720		1st	NW							
256	MOTOR	NEW			I	720	212	1st	NW							

# Operational Savings with BIM

- Know there is a need
- Know there are perceived savings
- Cost Reduction Strategies
  - Energy
  - ?? Operations and Maintenance

***“Design for Maintenance” Strategy***

# *“Design for Maintenance”* strategy



*“Maintenance Friendly”*

*NOT “Maintenance Friendly”*



# Federal Agency Overview

## Overview

FY 2009 Federal Real Property Statistics



### Agency Profile: FY 2009 Total Number of Buildings and Structures and Total Building Square Footage

Agency Name	Total Number of Buildings and Structures	Total Building Square Footage
Army	65	170,000
Interior	32	5,170,000
Air Force	11	294,000
Navy	8	1,414,000
Transport	5	320,000
Agriculture	4	59,000
Homeland Security	2	81,000
Energy	1	1,500,000
State		
Corps of Engineers		
Veterans Affairs		
General Services Administration		
National Science Foundation		
Space Agency		
Justice		
Labor		
Health and Human Services		
United States Postal Service		
Information		
Commerce		
Smithsonian Institution		
National Endowment for the Humanities		
Peace Corps		
John F. Kennedy Center for the Performing Arts		
<b>Totals</b>	<b>912,780</b>	<b>3,388,992,000</b>

<sup>1</sup>Agencies listed in blue font (those same agencies subject to the CFO Act) are required to submit data under EO 13327 and sections 901 (b)(1) and (b)(2) of title 31, United States Code.

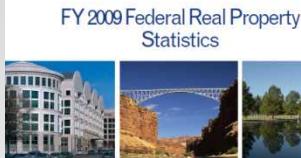
Total GSF

# Federal Agency Overview



## Key Statistics: FY 2009 CFO Act Agencies

The chart on this page represents data from the 24 agencies required to submit data (those same agencies subject to the CFO Act). All data in this report starting on this page through the end of the report includes data from only those agencies.



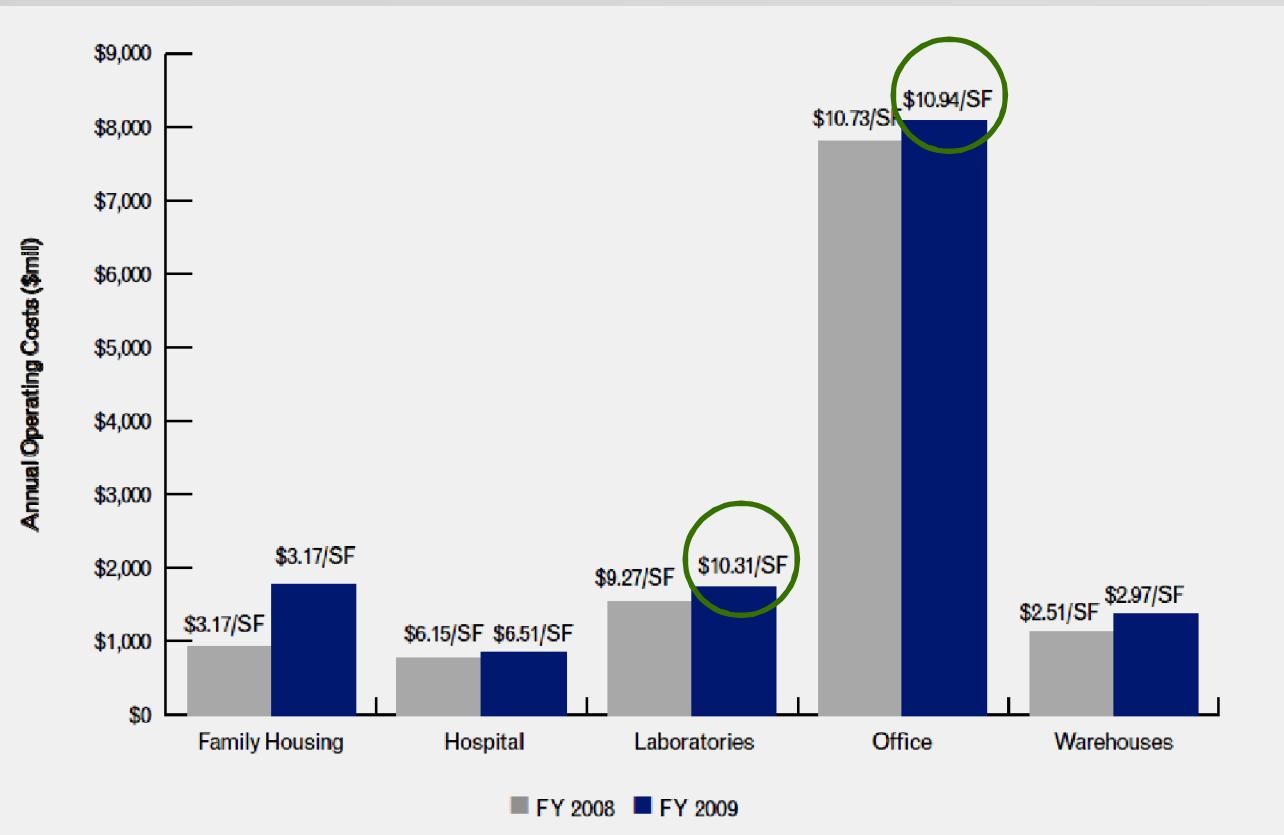
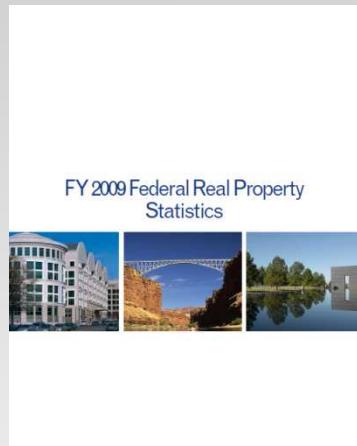
	FY 2008	FY 2009	Variance
Total Federal Building Assets <sup>2</sup>	406,000	429,000	23,000
Total Area of Building Assets <sup>3</sup>	3.26 billion square feet	3.34 billion square feet	71.0 million square feet
Total Federal Structures	489,000	482,000	-7,000
Total Federal Land Acreage	40,905,000	39,790,000.00	-1,115,000
<b>Total Federal Buildings and Structures</b>	<b>895,000</b>	<b>911,000</b>	<b>16,000</b>

<sup>2</sup> May include multiple leases in one building.

<sup>3</sup> All square feet data is represented in gross square feet.

# Federal Buildings: Annual Operating Costs

## by Building Predominant Use and Square Footage



# Federal Annual Operating Costs

## ■ **Custodial**

- Pest control/refuse collection
- Recycling costs

Owned Buildings			
	Annual Operating Costs	Total Square Feet (SF)	Annual Operating Costs/SF
FY 2008	\$12,036,779,000	2,588,928,000	\$4.65
FY 2009	\$13,212,448,000	2,576,552,000	\$5.13

[http://www.gsa.gov/graphics/ogp/FY2009\\_FRPR\\_Statistics.pdf](http://www.gsa.gov/graphics/ogp/FY2009_FRPR_Statistics.pdf)

## ■ **Roads/Grounds**

- Landscaping/snow-ice removal

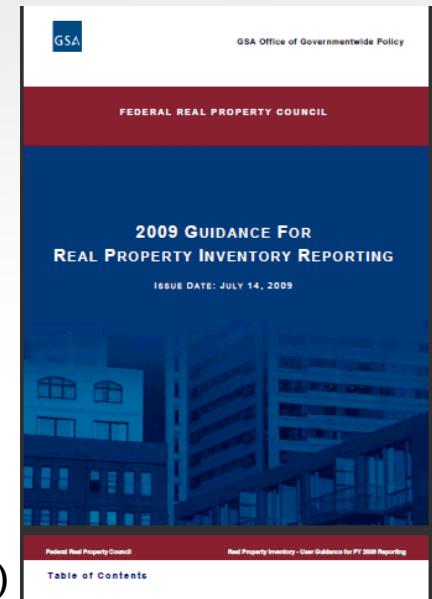
## ■ **Utilities**

- Plant operations and energy

## ■ **Reoccurring Maintenance and Repair**

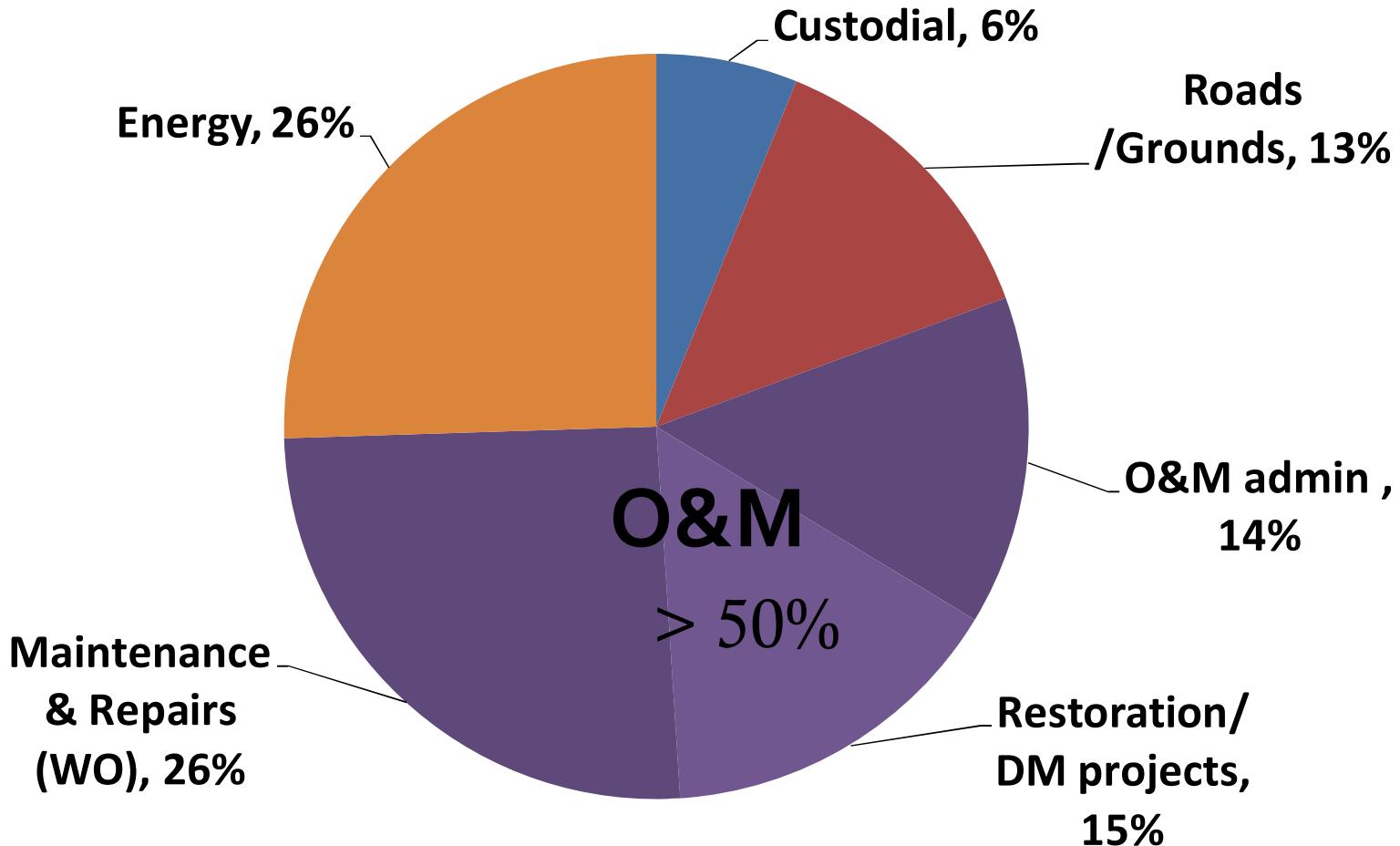
- Work orders

(source : FRPC Real Property Inventory – Users Guidance FY09)

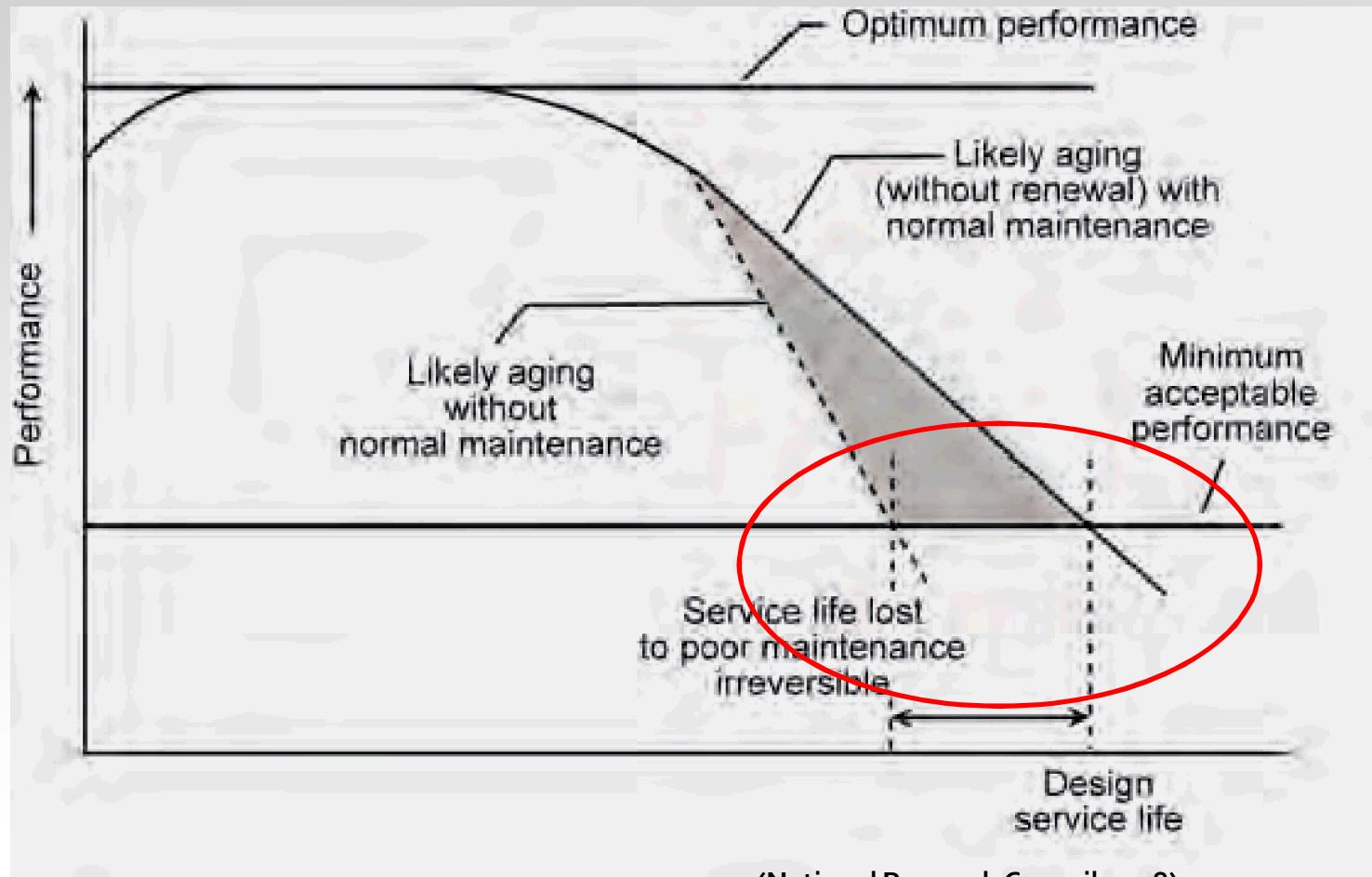


# Covering Operating Costs :

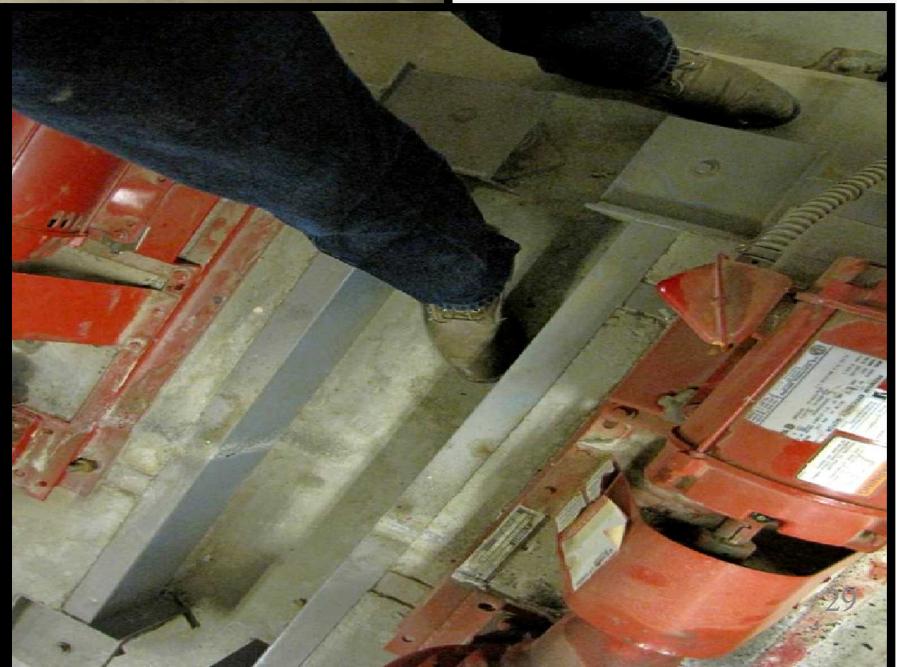
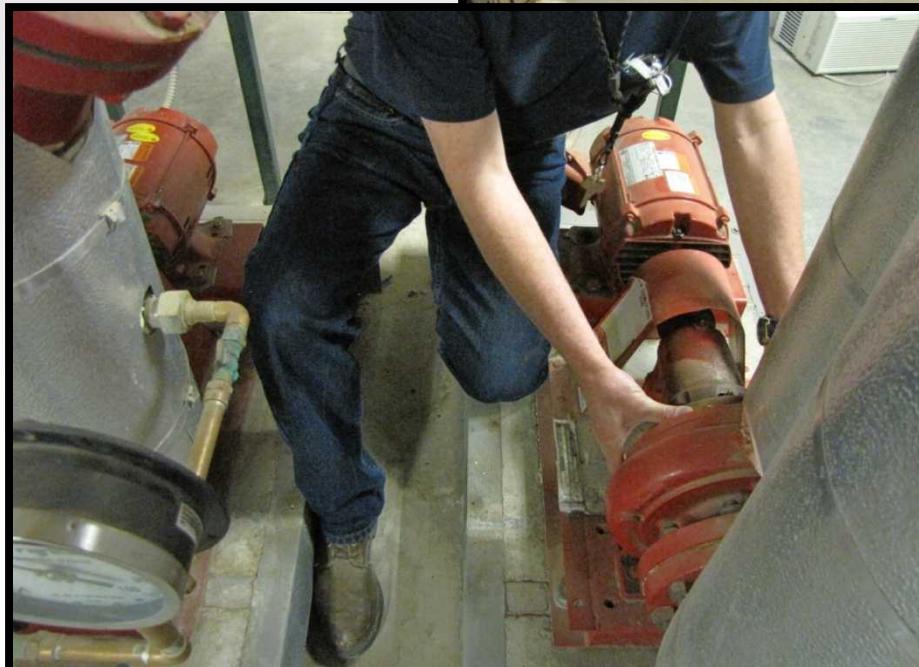
## Space Charge Back



# *“Design For Maintenance” Strategy:* Main Premise



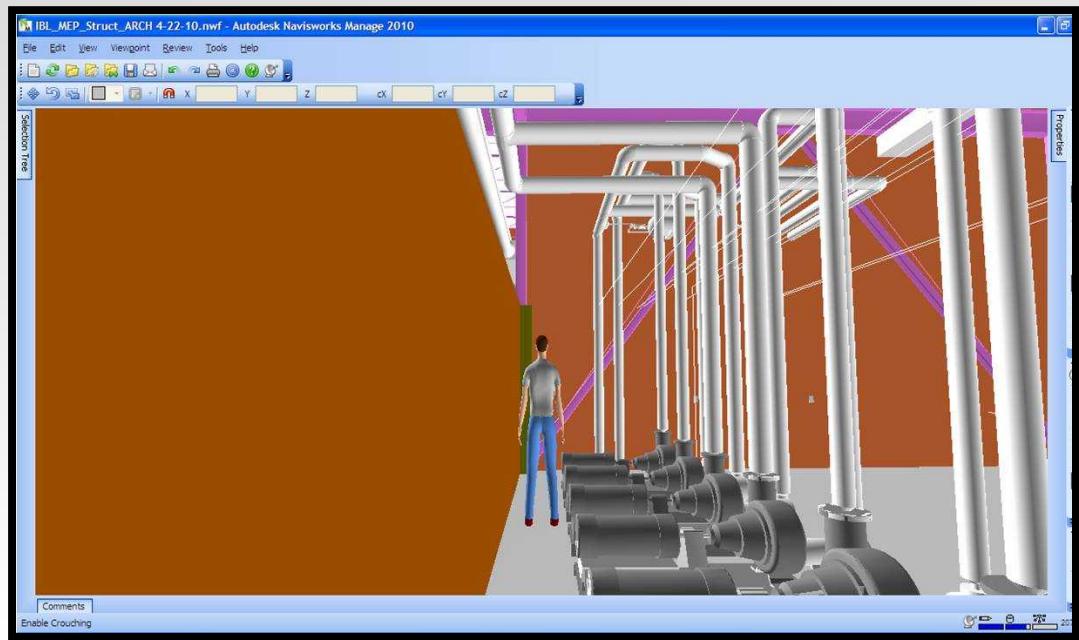
# *“Maintenance Friendly”*



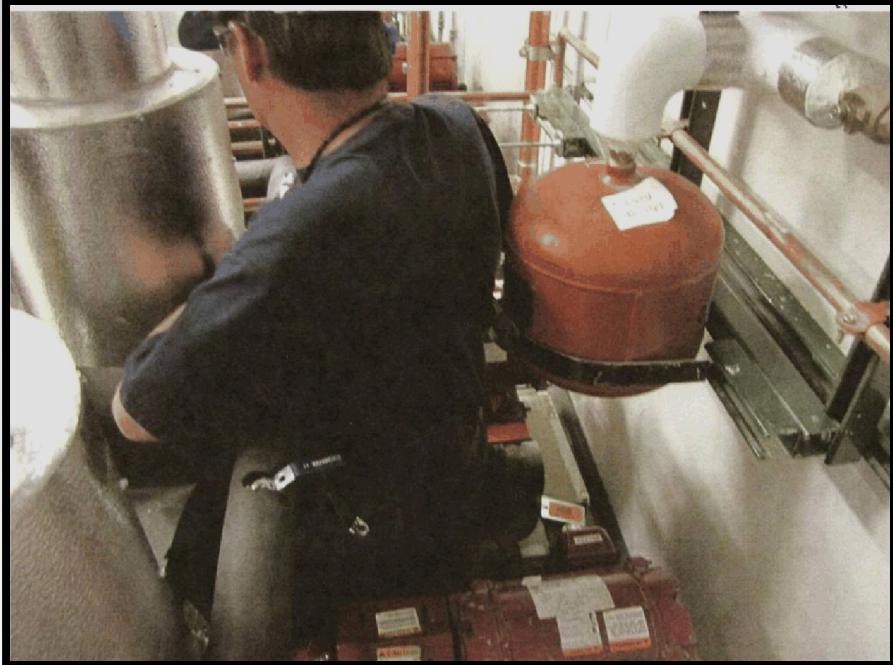
# *NOT “Maintenance Friendly”*



# *“Maintenance Friendly”*

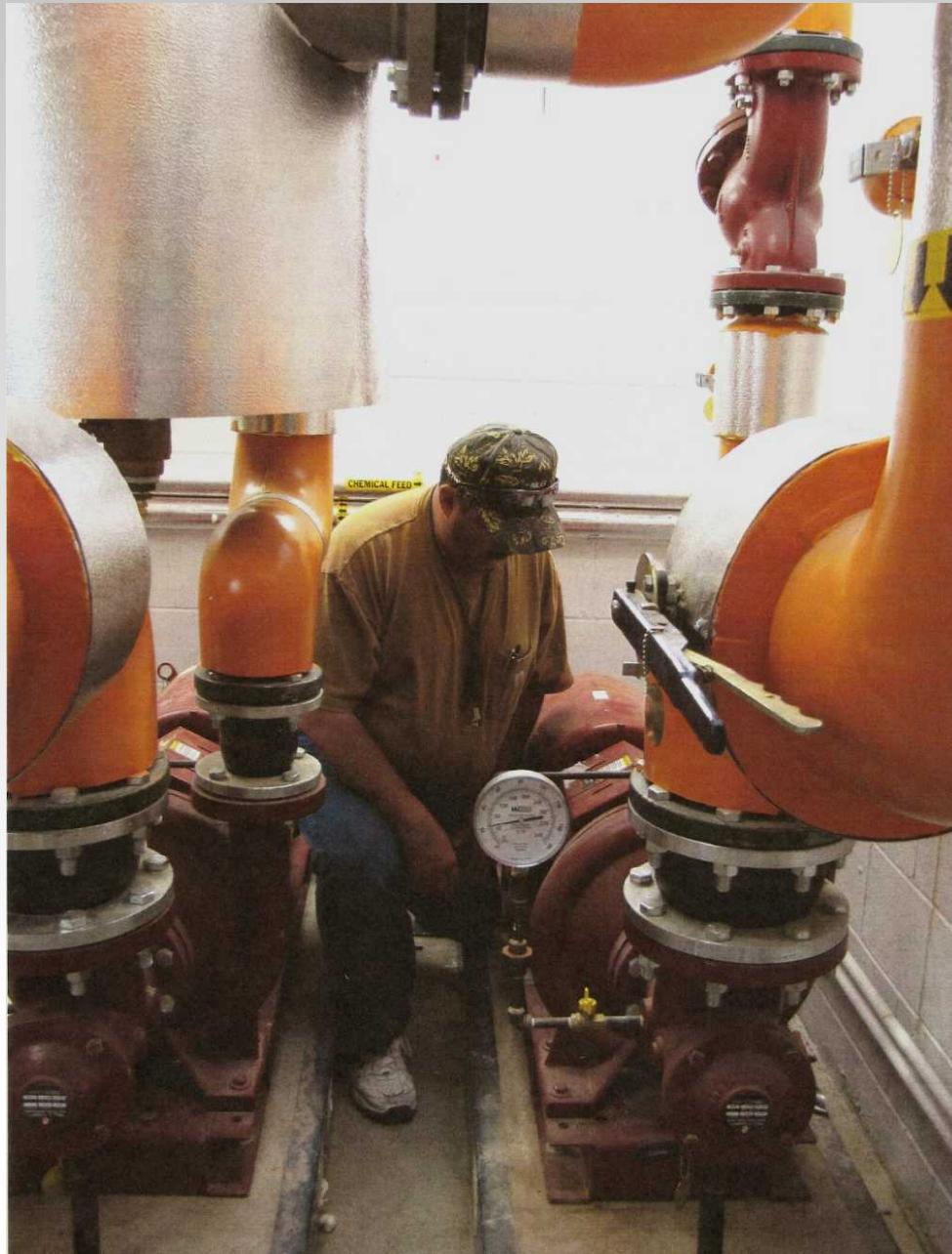


# *NOT “Maintenance Friendly”*



**O&M Impact :**  
**2x PM time**  
**4x CM time**

..... **Over 25 years**



# Maintenance : Equipment Check Lists

## 9.9.11 Pumps Checklist

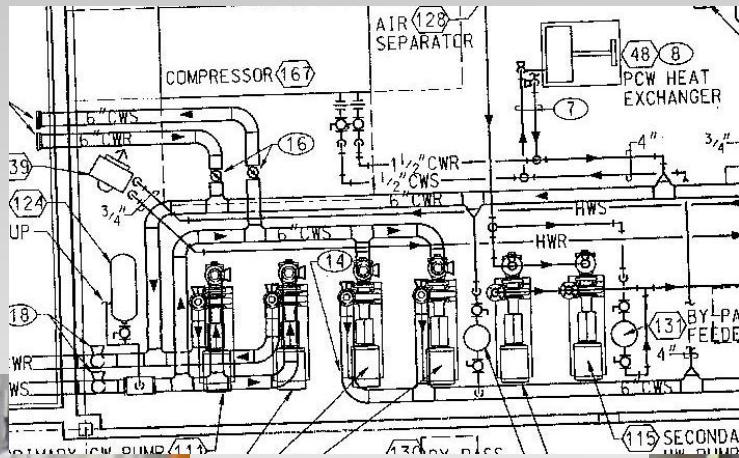
Description	Comments	Maintenance Frequency			
		Daily	Weekly	Monthly	Annually
Pump use/sequencing	Turn off/sequence unnecessary pumps	X			
Overall visual inspection	Complete overall visual inspection to be sure all equipment is operating and safety systems are in place	X			
Check lubrication	Assure that all bearings are lubricated per the manufacturer's recommendation			X	
Check packing	Check packing for wear and repack as necessary. Consider replacing packing with mechanical seals.			X	
Motor/pump alignment	Aligning the pump/motor coupling allows for efficient torque transfer to the pump			X	
Check mountings	Check and secure all pump mountings			X	
Check bearings	Inspect bearings and drive belts for wear. Adjust, repair, or replace as necessary.				X
Motor condition	Checking the condition of the motor through temperature or vibration analysis assures long life				X

(FEMP: O&M Best Practice 3.0)

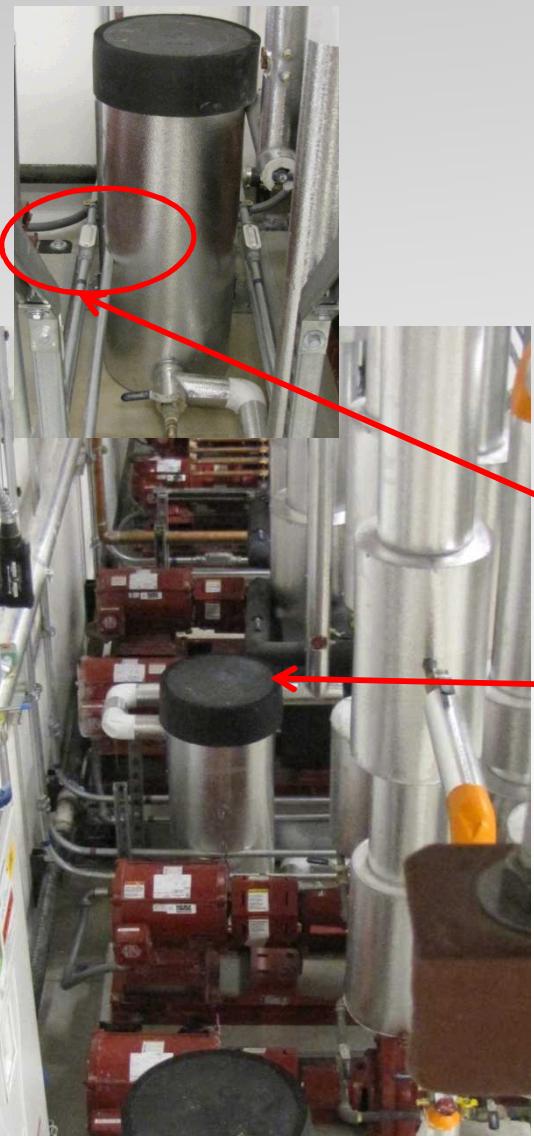
## 9.10.10 Electric Motors Checklist

Description	Comments	Maintenance Frequency			
		Daily	Weekly	Monthly	Annually
Motor use/sequencing	Turn off/sequence unnecessary motors	X			
Overall visual inspection	Complete overall visual inspection to be sure all equipment is operating and safety systems are in place	X			
Motor condition	Check the condition of the motor through temperature or vibration analysis and compare to baseline values			X	
Check lubrication	Assure that all bearings are lubricated per the manufacturer's recommendation				X
Check packing	Check packing for wear and repack as necessary. Consider replacing packing with mechanical seals.				X
Motor alignment	Aligning the motor coupling allows for efficient torque transfer to the pump				X
Check mountings	Check and secure all motor mountings				X
Check terminal tightness	Tighten connection terminals as necessary				X
Cleaning	Remove dust and dirt from motor to facilitate cooling				X
Check bearings	Inspect bearings and drive belts for wear. Adjust, repair, or replace as necessary.				X
Motor condition	Checking the condition of the motor through temperature or vibration analysis assures long life				X
Check for balanced three-phase power	Unbalanced power can shorten the motor life through excessive heat build up				X
Check for over-voltage or under-voltage conditions	Over- or under-voltage situations can shorten the motor life through excessive heat build up				X

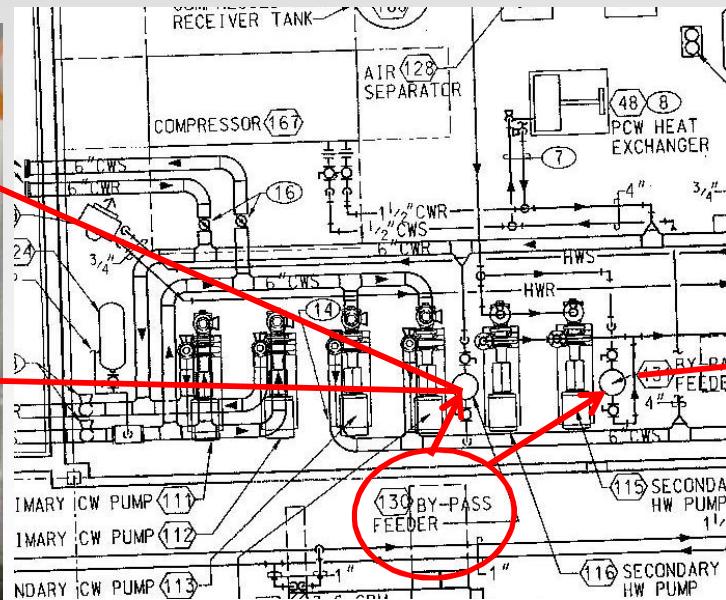
# *NOT “Maintenance Friendly”*



# By-Pass Feeders locations....



## *NOT “Maintenance Friendly”*



# By-Pass Feeder location....

*“Maintenance Friendly”*



# Steam Traps....

Reporting

Page 1 of 1

IBM.

## Job Plan Details

1453: Steam Trap Bi-Annual PM

Organization: ORGMMFAC	Priority: 0	Owner:
Site: SNMFAC	Interruptible?: N	Group Owner:
Type: MAINTENANCE	Supervisor:	Labor Group:
Duration: 00:11	Crew:	

### Job Plan Tasks

Task ID	Description	Duration	Nested Job Plan	Meter Name	Owner	Completion
10	Visually check for leaks**	00:04				
20	Read cautions**	00:01				
30	Leak detection device**	00:02				
40	Ultrasonic and infrared temperature**	00:04				
50	Fill out maintenance report**	00:00				
60	For easy access 20 minutes per steam trap.	00:00				
70	For hard access 45 minutes per steam trap.	00:00				

### Labor

Task ID	Craft	Skill Level	Vendor	Contract	Labor	Qty	Hours	Rate
	M-R					1	00:11	46.47

**Total Planned Labor:**  
October 6, 2010 2:48:40 PM MDT

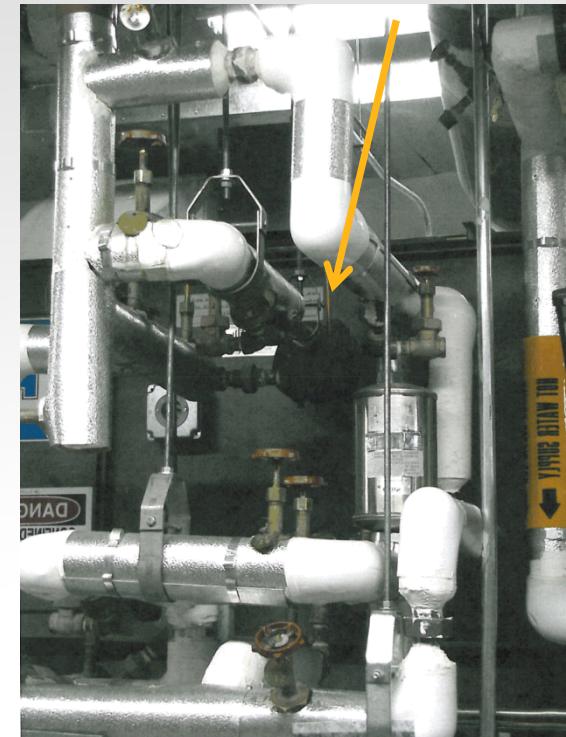
8.52

# Steam Traps....

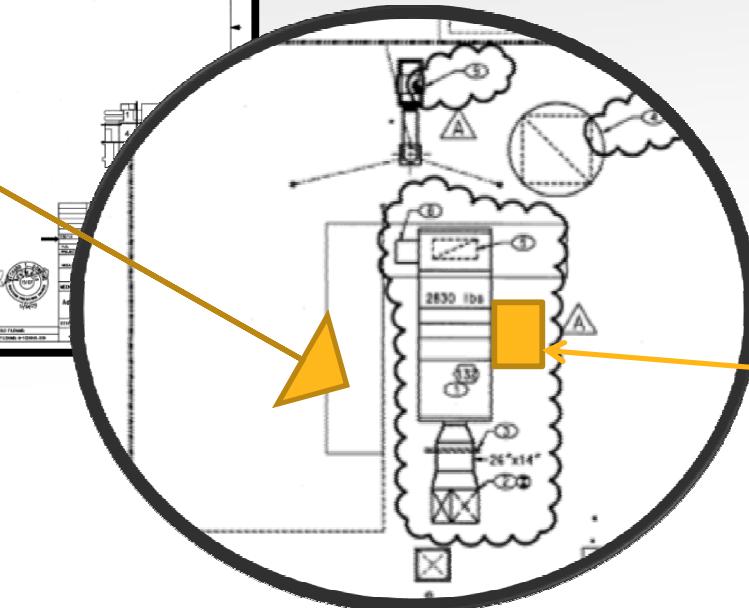
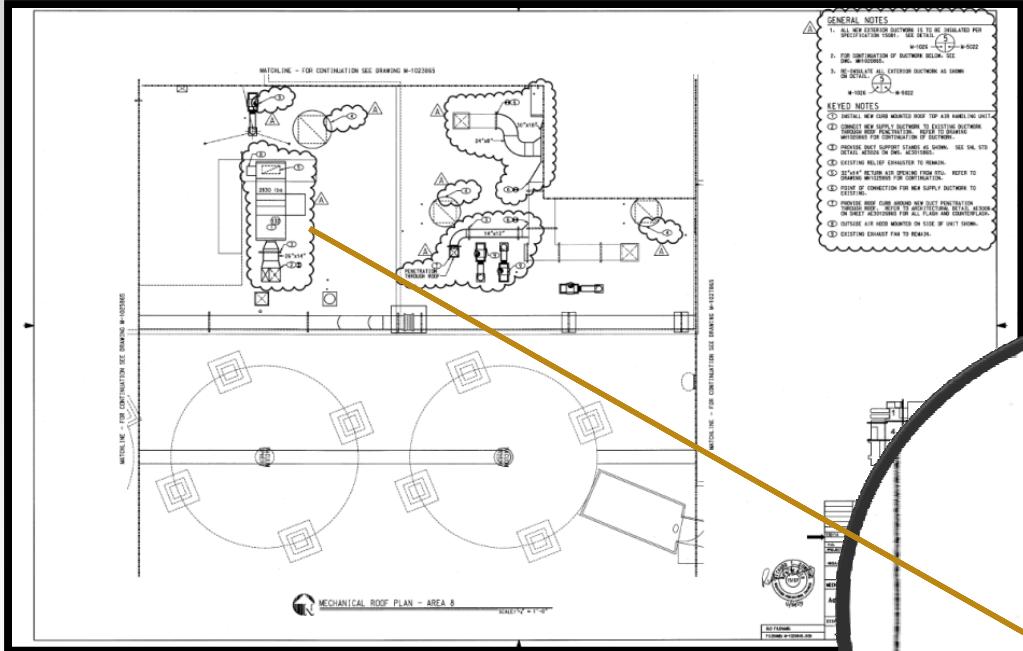


***“Maintenance Friendly”***

***NOT “Maintenance Friendly”***

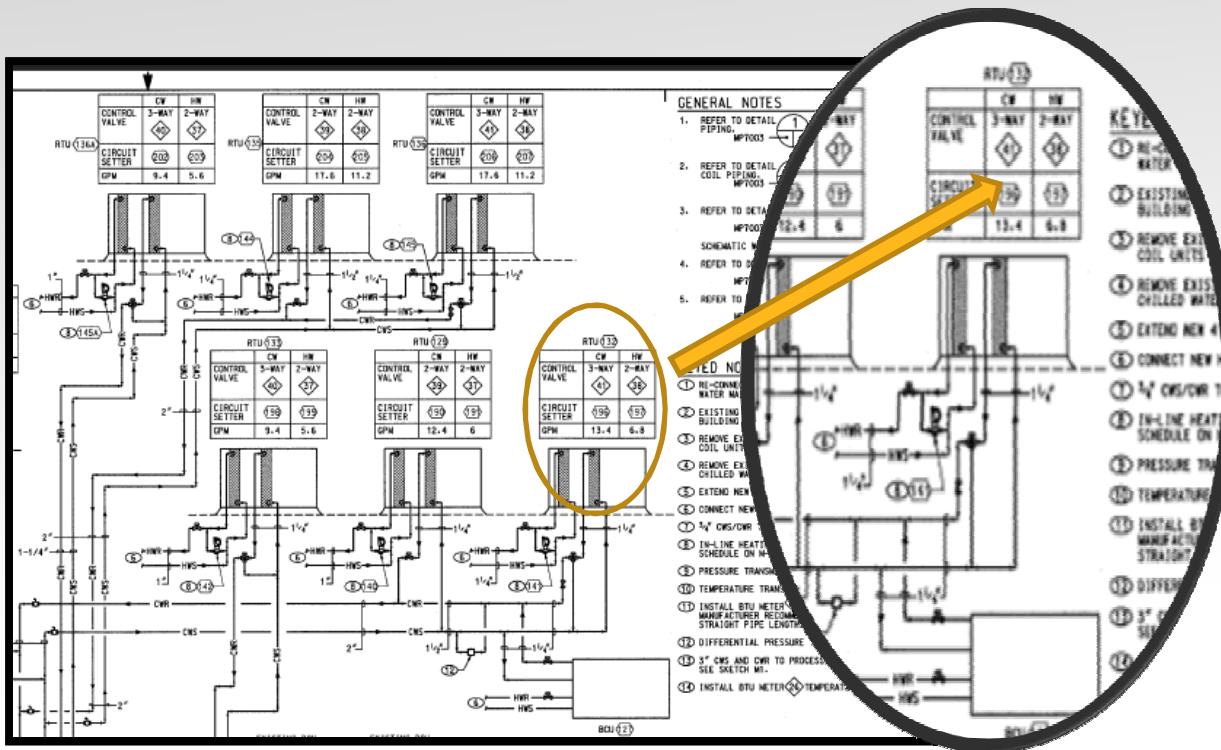


# Roof Top Unit (RTU) : piping



External box  
for  
HW/CW piping

# Roof Top Unit (RTU) : piping



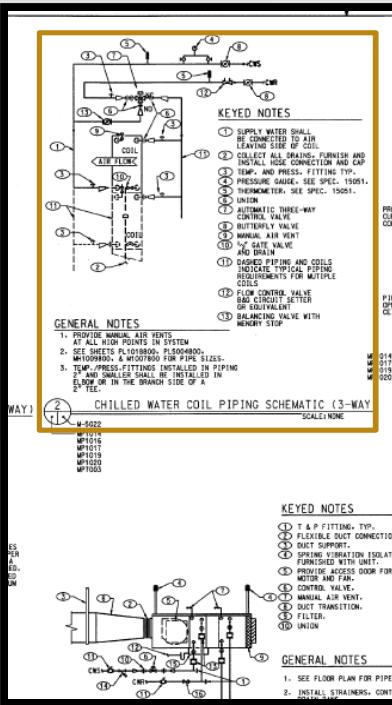
External box :

2-way HW piping  
3-way CW piping

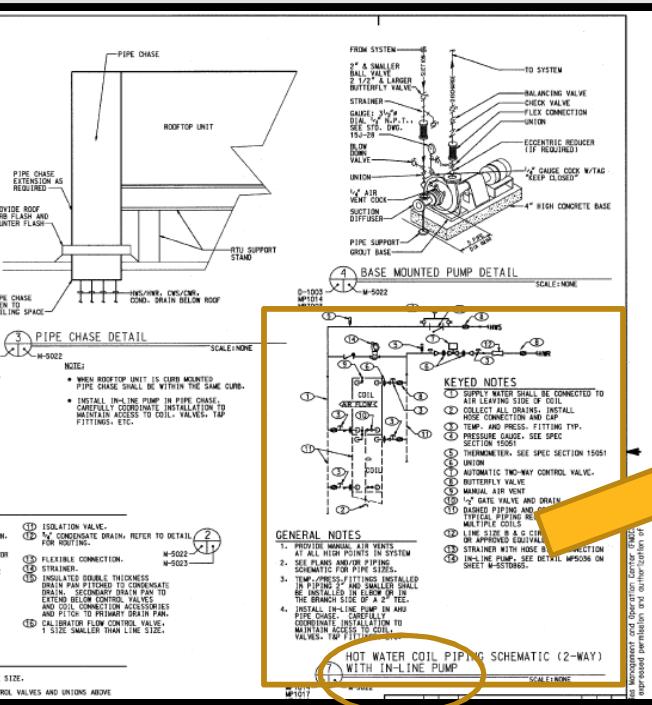
# Roof Top Unit (RTU) : piping

## Standard Detail

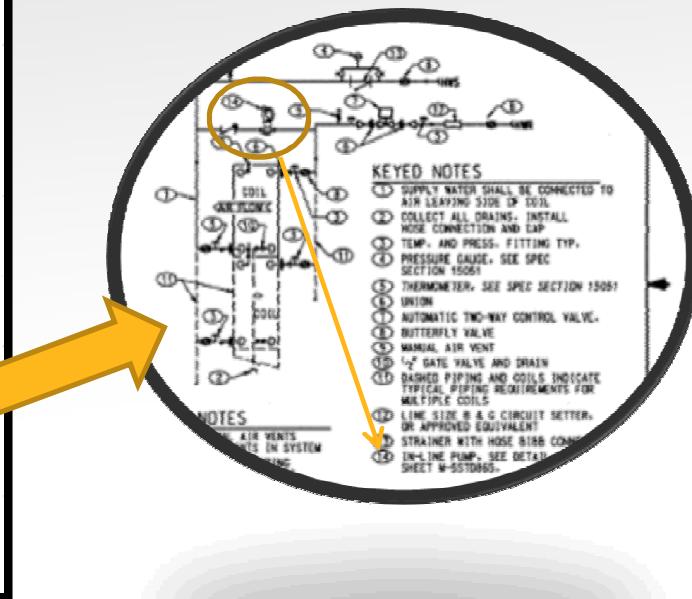
## 3-way CW piping



## 2-way HW piping



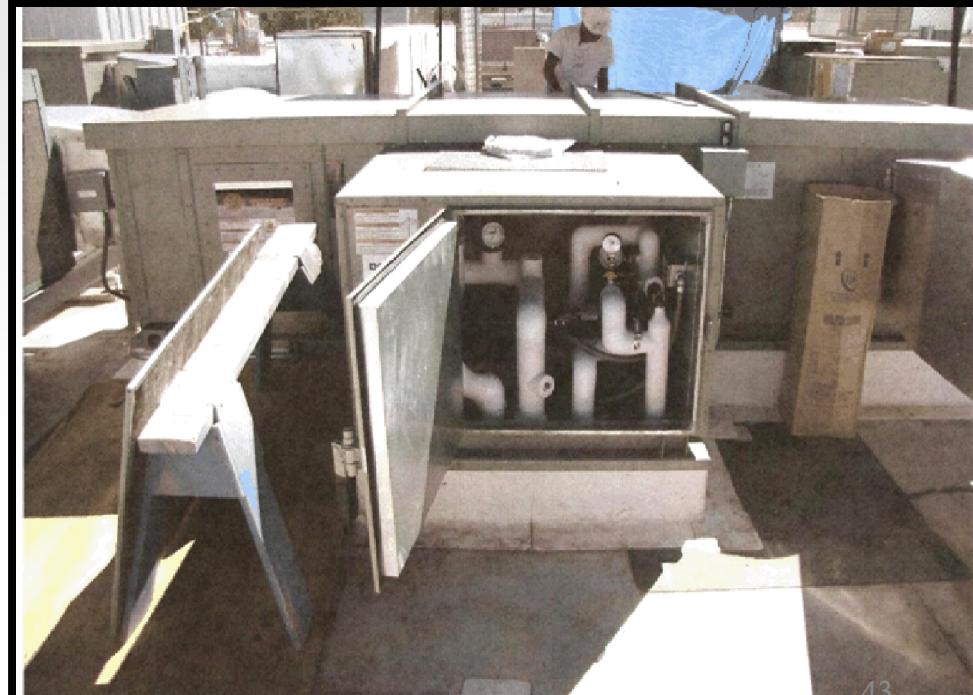
pump



# Roof Top Unit (RTU) : piping



Pump failed in 2 months :  
design issue  
or  
poor quality ??

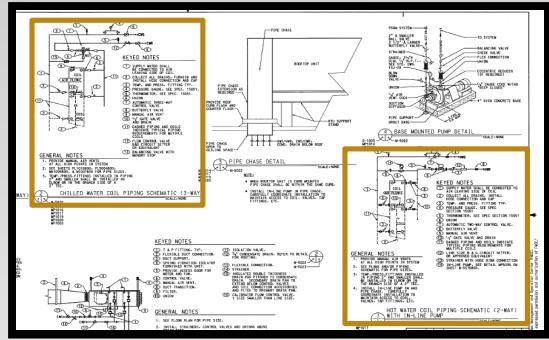


“MEANS & METHODS” ??

# RTU piping install

## Current 2D

- Design = **0** hrs
- Install = **48 hrs**  
Mech Contractors
  - Field design = 16 hrs
  - Install = **32 hrs**
- O&M = **8 hrs**



## If BIM enabled

- Design = **8 hrs**
- Install = **24 hrs**  
Mech Contractor
  - Field design = 0 hrs
  - Prefab = **8 hrs**
  - Install = **16 hrs**
- O&M = **4 hrs**



**8 Hrs of BIM design could  
reduce Install and O&M by 50%**

# Latest example... Relief Fan

**Dec 1, 2010 Forward email from a Facilities Senior Manager**

**From:** Q J  
**Sent:** Wednesday, December 01, 2010 05:03 PM  
**To:** Foster, Birgitta T  
**Subject:** FW: Building ---- | Relief Fan Access

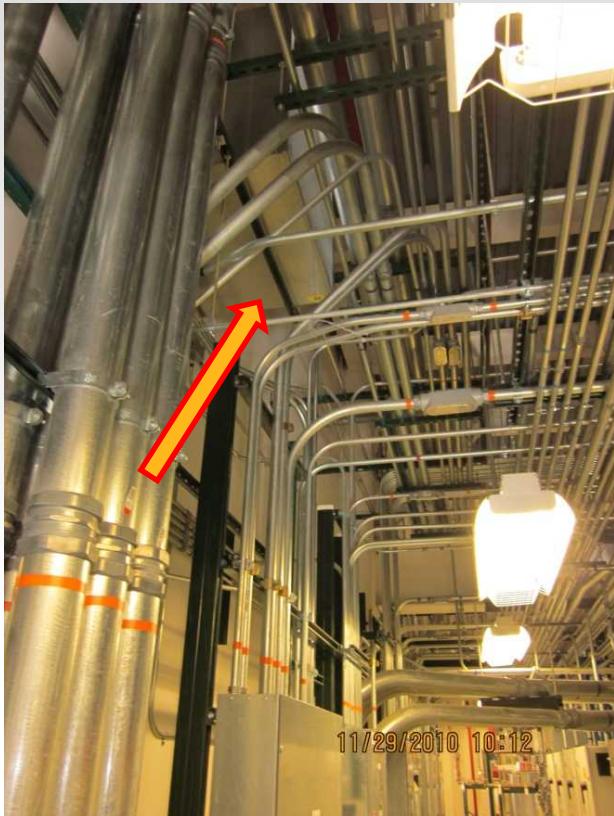
BIM anyone?

**from Service Manager team**

“Unless a team member can find an innovative access solution I will be initiating an end of any maintenance activities for Relief Fan, EF1,....I could not find a means of improving access to this fan.. thanks for bringing this to our attention the safety concerns that are associated with gaining access to this piece of equipment”

# Latest example...Relief Fan

“I have put in service request ...to find a solution to meeting the relief needs of the building, **perhaps another exhaust fan can be used....Please discontinue any Preventative Maintenance to this exhaust fan.**”



# Four Maintenance Strategies

## Reactive Maintenance (Breakdown or Run-to-Failure Maintenance)

### Basic philosophy

- Allow machinery to run to failure.
- Repair or replace damaged equipment.

Cost: \$18/hp/yr

This maintenance philosophy allows damaged equipment only when obvious. The costs of operating in this fashion are about \$18 per horsepower per year. Equipment shutdowns do not affect production.

## Preventive Maintenance (Time-Based Maintenance)

### Basic philosophy

- Schedule maintenance activities at predetermined time intervals.
- Repair or replace damaged equipment.

Cost: \$13/hp/yr

This philosophy entails the damaged equipment is repaired. Studies have shown the costs of operating in this fashion are about \$13 per horsepower per year. The approach is that it works well if personnel have the knowledge, skills, and time to perform the required activities.

## Predictive Maintenance (Condition-Based Maintenance)

### Basic philosophy

- Schedule maintenance activities when mechanical or operational conditions warrant.
- Repair or replace damaged equipment before obvious problems occur.

Cost: \$9/hp/yr

This philosophy consists of scheduling maintenance activities when mechanical or operational conditions warrant. It involves periodically monitoring for lubrication degradation, or by observing other signs of wear and damage. It gets to a predetermined unacceptable level of damage to components so as to prevent a more costly failure. Studies have shown that when it is done correctly, it costs about \$9 per horsepower per year. Advantages of this approach are that it works well if personnel have the knowledge, skills, and time to perform the required activities. It also provides some advantages in that it reduces the need for a high parts inventory. Since it is a predictive approach, it is likely to be an increase in production capacity.

## Reliability Centered Maintenance (Pro-Active or Prevention Maintenance)

### Basic philosophy

- Utilizes predictive/preventive maintenance techniques with root cause failure analysis to detect and pinpoint the precise problems, combined with advanced installation and repair techniques, including potential equipment redesign or modification to avoid or eliminate problems from occurring.

Cost: \$6/hp/yr

This philosophy utilizes all of the previously discussed predictive/preventive maintenance techniques, in concert with root cause failure analysis. This not only detects and pinpoints precise problems that occur, but ensures that advanced installation and repair techniques are performed, including potential equipment redesign or modification, thus helping to avoid problems or keep them from occurring. According to studies, when it is done correctly, operating in this fashion costs about \$6 per horsepower per year. One advantage to this approach is that it works extremely well if personnel have the knowledge, skills, and time to perform all of the required activities. As with the predictive-based program, equipment repairs can be scheduled in an orderly fashion, but additional improvement efforts also can be undertaken to reduce or eliminate potential problems from repeatedly occurring. Furthermore, it allows lead-time to purchase materials for necessary repairs, thus reducing the need for a high parts inventory. Since maintenance work is performed only when it is needed, and extra efforts are put forth to thoroughly investigate the cause of the failure and determine ways to improve machinery reliability, there can be a substantial increase in production capacity.

# “Design For Maintenance” Strategy

**SELECT.....**

## your Maintenance Strategy

**Table 5.5.1.** Reliability centered maintenance element applications

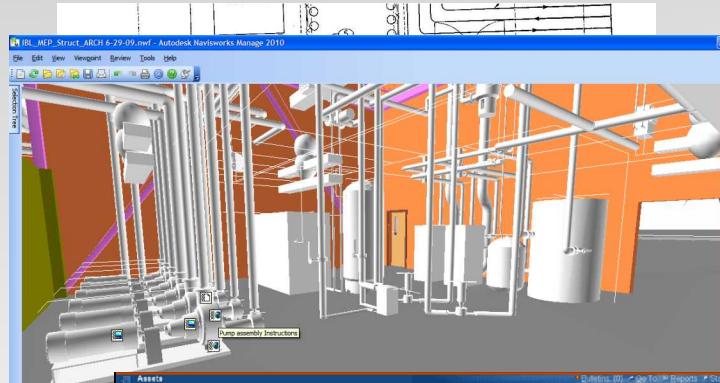
Reliability Centered Maintenance Hierarchy		
Reactive Element Applications	Preventive Element Applications	Predictive Element Applications
Small parts and equipment	Equipment subject to wear	Equipment with random failure patterns
Non-critical equipment	Consumable equipment	Critical equipment
Equipment unlikely to fail	Equipment with known failure patterns	Equipment not subject to wear
Redundant systems	Manufacturer recommendations	Systems which failure may be induced by incorrect preventive maintenance

**THEN.....**

**Share** with your Design Teams !

# OWNERS...Tying it all together

- Visual : 3D Models
- Data collection



IBL\_MEP\_Struct.ARCH 6-29-09.mwf - Autodesk Navisworks Manage 2010

File Edit View Vewpoint Review Tools Help

Assets

Asset 100061 Status OPERATING Serial # 891 CIRCULATING CHILLED WATER PUMP # 891 Classification PUMP

Details

Parent 891 Maintain Hierarchy? → Serial # 891.115.2 Location 891 Energy Technology Office and Lab Building → Priority 2 Rotating Equipment Asset Type REAL Asset & Property Site Code ALBUQUERQUE

JS/IE/Access → Supp Data VERIFIED

Supplier → Power EQUIPMENT ROOM

Supplier → Basement BASEMENT

Supplier → Quad NE NE

Supplier → Model # S3 Supplier → Condition

Purchase Information

Vendor WERMAN Manufacturer WERMAN, AMY INDUSTRIES

Costs

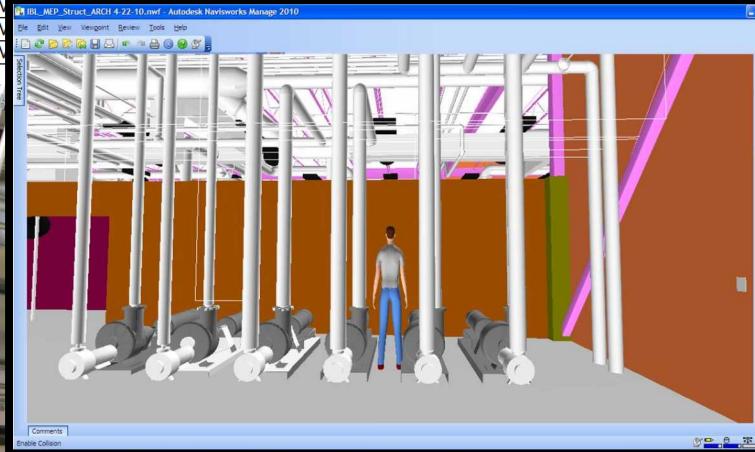
Total Cost 26.11 YTD Cost 0.00 Budgeted\* 0.00 Inventory 0.00 GL Account 00000002.00

Modified

Asset Up? Last Changed Date Total Downtime

Changed By JOMEHUH Changed Date 5/29/09 8:04 AM

AE to complete this section								CONTRACTOR to complete this section						
Asset number	EQUIPMENT Classification	New Replace	Remove	Area (Bldg#)	Location	RM	FLR	Quadrant	Manufacturer	Model #	Catalog #	Serial Number	Installation date	Warranty Expiration date
100567	PUMP	Replace		I	880	26	BSMT	NE	Goulds					
	PUMP	New		I	880	26	BSMT	NE						
100570	MOTOR	Replace		I	880	26	BSMT	NE	Baldor					
	MOTOR	New		I	880	26	BSMT	NE						
	CHILLER	New		I	880	26	BSMT	NE						
101845	CHILLER	Remove		I	880	26	BSN							
101846	CHILLER	Replace		I	880	26	BSN							
	BOILER	New		I	880	26	BSN							







buildingsmartalliance.org

**NATIONAL INSTITUTE OF BUILDING SCIENCES | COUNCIL & PROJECTS** **SEARCH**

**buildingSMART alliance®**  
a council of the National Institute of Building Sciences

**ABOUT BSA** **PROGRAMS** **PROJECTS** **JOIN/SPONSOR** **RESOURCES** **NEWS/EVENTS** **FORUMS** **CONTACT**

**A member of the buildingSMART International Ltd.** **MEMBER PORTAL LOGIN**

**SEARCH**

**ABOUT BSA**

**Developing Open BIM Standards for Communication Throughout the Facilities Industry**  
buildingSMART alliance™ has been established to coordinate the profound changes coming to the fragmented real property industry in North America. Our collective goal is open interoperability and full lifecycle implementation of building information models. The focus is to guarantee lowest overall cost, optimum sustainability, energy conservation, and environmental stewardship to protect the earth's ecosystem. Our principal product is the National BIM Standard (NBIMS), which needs support from all industry sectors. Please join the alliance and be a part of the solution.

For more information, [read our brochure](#). (PDF)

**IFC Questions?** Please post your IFC 2x3, IFC 2x4 and ISO 16739 issues on the bSa FORUM. You will

**NEWS** **VIEW ALL**

OmniClass Development Committee Announces Scheduled Cycle Jan 25 2011 [View Details](#)

OGC Discussion Paper - Indoor Navigation Jan 14 2011 [View Details](#)

Hundreds Attend Institute's Annual Meeting to Advance the Building Industry Dec 29 2010 [View Details](#)

**EVENTS** **VIEW ALL**

National BIM Standard (NBIMS): Just how "Green" will it be? Green Building Expo Online Event Series January 27, 2011 10:00 AM - 11:00 AM [View Details](#)

Winter 2011 BIM Forum February 10 - 11, 2011 San Diego, CA [View Details](#)

Mechanical Contractors Association of America (MCAA) Annual Convention 2011 [View Details](#)

**STANDARDS**

**United States National CAD Standard** **NCS** **National BIM Standard - United States** **NBIMS**

**IN ALLIANCE WITH**

**buildingSMART KOREA** **MLTM** **BIM**

**SPONSORS**

**BROADBUX & ASSOCIATES** **NEMETSCHEK Vectorworks** **FM**

**RESOURCES**

**JBM** **Journal of Building Information Modeling**  
**NEW** Fall 2010 | Download

**WBDG** **Whole Building Design Guide** More information on BIM is available on the [WBDG](#).

# Thank you!...any questions??

## Building Information Model Model ?

BIM Model



**Birgitta Foster**  
[btfoste@sandia.gov](mailto:btfoste@sandia.gov)  
**Facilities BIM Champion**