Asset Management Info Sharing Group Agenda

Thu, Feb. 4, 2015 11:10 am – 1:00 pm
EBMUD

****Please e-mail the Chair, Dana Lawson, at dlawson@centralsan.org to be added to the e-mail list for future meetings.****

Meeting Notes

INTRODUCTIONS

1. David Williams (BACWA); Dana Lawson, PJ Turnham (CCCSD); Aaron Johnson (DSRSD); David Stoops (EBDA); Dillon Cowan (EBMUD); Robin Gamble (Napa Sanitation District); Paul Bonitz (SFPUC); Saeed Shams (City of San Jose WPCP); Felicia James, Rob Grantham (Carollo Engineers)

PRESENTATION

2. Condition Assessment of Pumping Stations (Dillon Cowan, EBMUD)
    - Staff defined the extent of the assessment and level of detail; considered staff expertise, availability and scheduling; approach included a multi-disciplined team (ops, maint, and engineering), mostly in-house with some specialty work contracted out; comprehensive evaluation of entire pumping station included simple visual assessment, basic functional test, interview of staff; CMMS audit for inventory, PM plan, trends in WO history; exercised gates and valves; evaluated data to prioritize and recommend capital replacements; also included O&M recommendations.

DISCUSSION

3. Lifecycle/ service life estimates for assets
    - Sample data provided from: EBDA, CCCSD, EPA asset management seminar, WERF SIMPLE tool
    - David Stoops shared sample data with the group, explained how he uses his spreadsheet for budgeting (3 year rolling budget, up to 30 year budget).
    - Dana Lawson shared sample data with group from CCCSD, explained how some assets were adjusted beyond industry standards because redundant assets share runtime. For example, CCCSD has A- and B-side power distribution systems and breakers installed with the plant expansion in the late 70s are now under-going a class 1 reconditioning instead of a replacement. Industry standard is about a 20 year service life, however we've adjusted ours to 40 years then reconditioning to extend the service life further.
    - Group also discussed how to account for rehab cycles instead of full replacement cost, what assets can be rehabbed, at what cost and for what extension of service life (will be discussed more in the future).

SUGGESTIONS FOR FUTURE AGENDA ITEMS

- Comprehensive schedule for condition assessment of all asset classes
- Replacement versus asset cost estimating
- Modifying planned maintenance schedules based on condition assessments, optimizing maintenance (may be more appropriate for maintenance infoshare group)

NEXT REGULAR MEETING

4. May 2016 at DSRSD with a presentation by David Stoops for estimating long-term capital budgets and Felicia James for Reva software as a tool for long-term capital budgeting.
5. Dana Lawson will follow-up with DSRSD, David Stoops and Felicia to coordinate date in May.

ADJOURNMENT 1:00PM

EAST BAY MUNICIPAL UTILITY DISTRICT

Pump Station Risk Assessment

Dillon Cowan
Associate Civil Engineer

About EBMUD
Wastewater Service Area

- 88 square miles (325 sq. miles in Water System)
- 650,000 people (1.3 million in Water System)
- Services provided to seven communities
  - Alameda
  - Albany
  - Berkeley
  - Emeryville
  - Oakland
  - Piedmont
  - Stege Sanitary District

2

About EBMUD
Key Wastewater Infrastructure

- Main Wastewater Treatment Plant (MWWTP) in Oakland
- Three wet weather facilities
- 15 pump stations
  - 9 miles of force mains
- EBMUD owns and operates large interceptor sewers
  - 29 miles of gravity interceptors
  - Stormwater "not included"
- Communities own their collection systems
  - ~1,600 miles of pipe

3

About EBMUD
Wastewater Pump Stations

- 15 pump stations
  - 13 lift flow into EBMUD interceptors
  - 1 lifts flow on EBMUD interceptor
  - 1 wet weather diversion station
- Design capacities range from 0.5 to 66 MGD (avg 10.5); most (9) are in the 2 to 8 MGD range

4

Typical Pump Station

5

Condition Assessment

6

Defining Risk

Risk = Likelihood x Consequence

7

Calculating Risk

Definition of risk is simple, but

- How do you come up with scores or ratings for likelihood and consequence?
- What factors should you consider?
- **Where will you get the data?**

Condition assessment lays the foundation for risk assessment

8

Key Decisions

- Decide who will do the work
- Define the scope of the assessment
- Determine the level of detail/sophistication

NOTE: there is no one right way to approach pump station condition assessment

9

Potential Scope of Work

- Main pumps and motors
- Auxiliary pumps
- Fans
- Transformers
- Motor Control Centers
- VFDs
- Compressors
- Chemical tanks & dosing systems
- Emergency generators
- Safety equipment
- Instrumentation
- Building/structure
- Landscaping
- Gates and fences

10

Potential Assessment Techniques

- Visual inspection
- Functional tests
- Performance tests
- Monitoring
- Review/audit of maintenance records and practices

11

Factors to Consider

- Staff expertise
- Staff availability
- Regulatory issues
- Management priorities
- Deadlines/schedule constraints
- Potential conflicts with other projects
- Budget available

12

EBMUD Approach

- Majority of work performed by EBMUD staff
- Multi-disciplinary team approach
- Comprehensive assessment
- Techniques used:
  - Simple visual inspection (EBMUD)
  - Basic functional tests (EBMUD)
  - Pump performance tests (consultant)
  - Thorough CMMS audit (EBMUD)

13

Schedule

- Visual inspections performed during Summer/Fall of 2013
- Standing weekly appointment with team members
- Inspection time per station: 1-2 hours
- Documentation completed in 2014

14

The Team

- Inspection led by engineer from Treatment Division
- Key participants
  - Operators
  - Mechanics
  - Electricians
  - Instrument technicians
  - Painters
  - Operations and Maintenance supervisors
  - Planning Section engineers

15

Visual Inspection

- General assessment of building and surrounding area
- Identification of safety concerns
- Observation of pumps for noise, vibration, leaks, etc. during operation
- Visual assessment of all assets
- Photo documentation of all assets

16

Functional Tests

- All gates and valves exercised to verify proper operation
- Where possible, instruments tested to verify proper operation

17

Pump Performance Tests

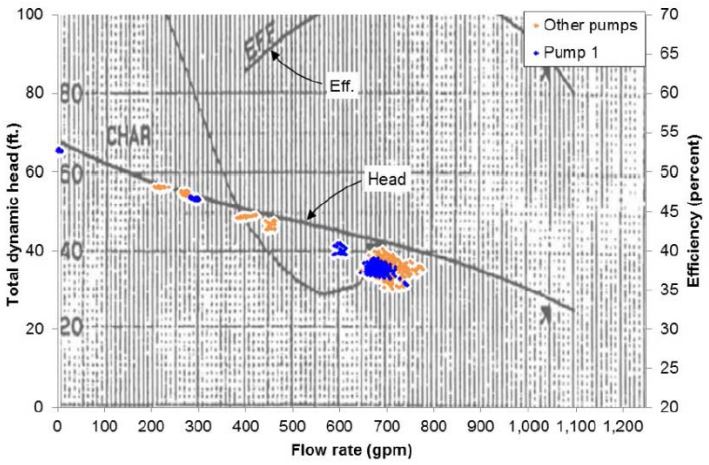


Figure 4-27. Performance Data for Pump Station G, Pump 1, Plotted on Test Curves

18

CMMS Audit

- Verification of asset registry
  - Add new/missing equipment
  - Remove old equipment
- Review of preventative maintenance
  - Determine 5-yr PM completion rates
  - Identify and address gaps in PM schedule
  - Correct errors and inconsistencies
- Review of corrective maintenance

19

Findings – Visual Inspections

- Overall, pump stations in good condition
- Problem areas at some stations:
  - Paint/coatings
  - Wet well ventilation
- Several safety issues identified and addressed
- No conditions identified that would present potential for an SSO

20

Paint/coatings

21

Paint/coatings

22

Wet Well Ventilation

23

Wet Well Ventilation

24

Wet Well Ventilation

25

Wet Well Ventilation

26

Wet Well Ventilation

27

Safety Issues

28

Findings – Functional & Performance Tests

- Very few valves found to be inoperable or not functioning correctly
- Work orders submitted for all valve problems
- Known pump performance problems confirmed
- Many older pumps performing better than expected, on or near original curve

29

Findings – CMMS Audit

- Edits made to asset registry at every station
- Edits made to PM schedules at every station
- High completion rates for mechanical and instrumentation PMs
- Low completion rates for electrical PMs
- Unable to determine completion rates for operations PMs

30

Follow-through

- 128 issues documented during inspection
- O&M supervisors met together to determine appropriate action for each issue:
  - Submit work order request (68)
  - No action (23)
  - Defer until next station upgrade (22)
  - Investigate further (8)
  - Other (7)

31

Risk Assessment

32

Defining Risk

Risk = Likelihood x Consequence

33

Risk Assessment

- Computed risk score for major assets at every station
- Used adapted EPA model to compute scores
- Planning Section used condition assessment data to compute risk scores for pump stations as part of master plan update (separate project)

34

Likelihood of Failure

Likelihood of failure based on:

- Estimated effective life
- Preventative maintenance history
- Condition rating
- Performance rating
- Reliability rating
- Effective life adjustment factor

35

Estimated Effective Life

- Based on type of asset
- Examples:
  - Main Pumps (40 yrs)
  - Motors (35 yrs)
  - Valves (30 yrs)
  - Controls (25 yrs)
  - Electrical (35 yrs)
- Adjusted as necessary based on input from maintenance supervisors

36

Preventative Maintenance History

- Does the equipment have adequate PMs?
- Are the PMs being completed as scheduled?

37

Condition Rating

1 – new or excellent condition

3 – minor defects only

5 – moderate deterioration

7 – significant deterioration

9 – virtually unserviceable

10 – unserviceable

38

Performance Rating

1 – exceeds/meets all performance targets

2 – minor performance deficiencies

3 – considerable performance deficiencies

4 – major performance deficiencies

5 – does not meet any performance targets

39

Reliability Rating

1 – as specified by manufacturer

2 – random breakdown (every 20 yrs)

3 – occasional breakdown (every 5 yrs)

4 – periodic breakdown (every 2 yrs)

5 – continuous breakdown

40

Effective Life Adjustment Factor

Based on condition, performance, and reliability ratings and PM robustness, is the estimated effective life reasonable?

If not, apply effective life adjustment factor

41

Effective Life Adjustment Factor

Example adjustment factors:

- Low PM completion rate (-20%)
- No bar screen and history of ragging/debris problems (-20%)
- Poor condition of protective coating (-10 to -30%)
- Pattern of frequent breakdowns (-10 to -60%)
- Age of asset suggests near end of useful life, but no signs of imminent failure (20%)

42

Remaining Useful Life

Example

- Pump has effective life of 40 yrs
- Pump installed in 1995 (20 yrs old)
- No bar screen and history of ragging problems (-20% reduction)

Remaining Useful Life = 0.8*40 - 20 = 12 yrs

43

Likelihood Score

$$L_f = Max\left[10\left(1 - \frac{U}{E}\right), 1\right]$$

Where U = remaining useful life and E = estimated effective life

44

Example

Pump from previous slide has estimated effective life (E) of 40 yrs and remaining useful life (U) of 12 yrs

$$L_f = Max\left[10\left(1-\frac{U}{E}\right),1\right] =$$

$$Max\left[10\left(1-\frac{12}{40}\right),1\right]=7$$

45

Consequence of Failure

Score based on four impact criteria:

- Service
- Safety
- Economic
- Environmental

46

Service Criteria Scoring

10 – cannot be out of service one hour

9 – cannot be out of service 8 hours

7 – cannot be out of service one day

5 – cannot be out of service one week

3 – cannot be out of service one month

1 – can be out of service indefinitely

47

Safety Criteria Scoring

10 – Substantial death, widespread injury, and sickness

9 – Major injury, sickness, some death

7 – Moderate injury and some sickness

5 – Minor injury

3 – Minor inconvenience

1 – No impact

48

Economic Criteria Scoring

10 – Likely to trigger rate increase, staff changes

9 – painful change of priorities

7 – high cost, high hassle, diverts money

5 – high cost, low hassle

3 – low cost, high hassle

1 – low cost, low hassle

49

Environmental Criteria Scoring

10 – sustained, large quantity, offsite, many complaints

9 – has not happened on this scale before

7 – substantial liability, many impacted

5 – aggressive complaints and liability

3 – backups, small number of complaints

1 – short duration, small quantity, onsite, no complaints

50

Consequence Scores

- Sum of four criteria scores, evenly weighted
- Scoring range converted from 4-40 to 1-10

51

Total Risk Score

- Product of likelihood and consequence scores (range: 1-100)
- Use adjustment factor to lower risk scores for redundant equipment

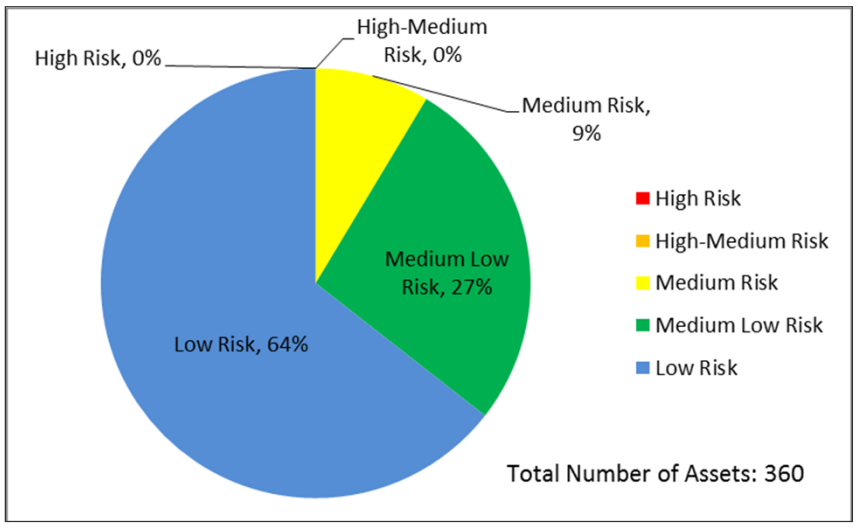
52

Total Risk Ratings

- **High**: risk score > 80
- **High-medium**: 60 < risk score < 80
- **Medium**: 40 < risk score < 60
- **Medium-low**: 20< risk score < 40
- **Low**: risk score < 20

53

Results



54

Recommendations

- Replacement of some assets with high likelihood of failure (4 VFDs, 2 transfer switches)
- Major rehabilitation of station constructed in 1950s
- Comprehensive paint/coating assessment

55

Recommendations

- Focus on complete documentation and implementation of PM program
- Capture condition data on an ongoing basis during PMs
- Perform annual review of CMMS database
- Based on annual CMMS reviews, update risk assessment and optimize PM program

56

	Class ID	Asset Class	Count	Total Replacement Cost	Average Replacement Cost	Expected Life	Rehab Interval	Rehab Desc	$	Consequence of Failure	Type
PIPELINE											
	FM	Forcemain	36	$ 225,132,720	$ 6,253,687	80	40	Inspect	5%	5	Pipeline
	MH	Manhole	28	$ 2,100,000	$ 75,000	80	20	Inspect	10%	1	Pipeline
	ARV	Air Releif Valve	27	$ 112,000	$ 4,148	20	5	Rehab	10%	1	Pipeline
CIVIL / SITE											
	BLD	Building	4	$ 23,058,800	$ 5,764,700	60	20	Painting / Roof	$ 45,000	5	Civil
	OFFICE	Office Building	1	$ 750,000	$ 750,000	60	10	Tenant Improvement	5%	2	Civil
	WW	Wet Well	5	$ 2,950,000	$ 590,000	80	15	Inspect/ Rehab	5%	4	Civil
	ST	Surge Tower	4	$ 8,000,000	$ 2,000,000	60	20	Repairs	5%	5	Civil
	STR	Structure	4	$ 4,552,764	$ 1,138,191	60	20	Rehab	25%	4	Civil
	YP	Yard Piping	6	$ 1,957,500	$ 326,250	60	10	Inspect / Repair	15%	4	Civil
	PAV	Pavement	2	$ 10,000	$ 5,000	60	10	Rehab	10%	1	Civil
	FNC	Fencing	2	$ 22,000	$ 11,000	20	2	Repairs	20%	1	Civil
ELEC / INST											
	SCD	SCADA	7	$ 173,451	$ 24,779	10	5	Rehab/ Update	50%	3	Elec/Inst
	ANL	Analyzer	4	$ 55,000	$ 13,750	10	2	Inspect/ Testing	2%	3	Elec/Inst
	FLM	Flow Meter	9	$ 144,312	$ 16,035	10	5	Rehab/ Update	50%	2	Elec/Inst
	SMP	Sampler	2	$ 9,075	$ 4,537	10	5	Rehab/ Update	50%	2	Elec/Inst
	CPU	Computer Equipment / Software	19	$ 74,769	$ 3,935	5	1	Software Update	10%	1	Elec/Inst
	INST	Instruments	15	$ 124,107	$ 8,274	10	5	Rehab/ Update	50%	3	Elec/Inst
	MCC	Motor Control Center	9	$ 852,692	$ 94,744	40	10	Inspect/ Testing	10%	5	Elec/Inst
	EFM	Motor - Effluent	16	$ 489,760	$ 30,610	40	10	Rehab	$ 5,000	3	Elec/Inst
	MDM	Motor - Medium	6	$ 37,187	$ 6,198	20	10	Rehab	5000	3	Elec/Inst
	SM	Motor - Small	4	$ 12,106	$ 3,027	10	5	Rehab	2000	2	Elec/Inst
	TR	Transformer	2	$ 100,053	$ 50,026	30	10	Inspect/ Testing	10%	3	Elec/Inst
	TSW	Transfer Switch	5	$ 58,756	$ 11,751	20	5	Inspect/ Testing	25%	4	Elec/Inst
	PNL	Panel	16	$ 518,343	$ 32,396	20	3	Inspect/ Testing	10%	3	Elec/Inst
	PLC	Programmable Logic Controller	5	$ 49,102	$ 9,820	10	1	Software Update	50%	5	Elec/Inst
	VFD	Variable Frequency Drive	16	$ 582,820	$ 36,426	20	5	Inspect/ Testing	25%	3	Elec/Inst
MECHANICAL											
	CRN	Overhead Crane	1	$ 116,651	$ 116,651	30	4	Certification	$ 10,000	1	Mech
	HC	Hoist / Crane	5	$ 33,079	$ 6,616	30	10	Rehab	20%	1	Mech
	LV	Valve - Large	52	$ 1,942,008	$ 37,346	50	25	Rehab	50%	3	Mech
	MV	Valve - Medium	2	$ 13,825	$ 6,913	20	10	Rehab	50%	2	Mech
	AVA	Automatic Valve Actuator	9	$ 56,579	$ 6,287	30	5	Rehab	25%	2	Mech
	CMP	Compressor	3	$ 8,583	$ 2,861	15	5	Rehab	25%	1	Mech
	DS	Drive Shaft	12	$ 67,054	$ 5,588	40	25	Rehab	30%	3	Mech
	GEN	Genset	7	$ 716,471	$ 102,353	30	15	Rehab	30%	4	Mech
	EFP	Pump - Effluent	18	$ 1,786,029	$ 99,224	40	20	Major Rehab	30%	3	Mech
	MP	Pump - Medium	12	$ 123,785	$ 10,315	25	15	Rebuild	40%	3	Mech
	SP	Pump - Small	11	$ 55,995	$ 5,090	15	10	Rebuild	20%	2	Mech
	SG	Gate - Sluice or Slide	20	$ 857,565	$ 42,878	60	30	Rehab	40%	3	Mech
	BAS	Bio Assay System	1	$ 34,030	$ 34,030	10	3	Rehab	33%	1	Mech
	CPS	Cathodic Protection System	1	$ 10,000	$ 10,000	30	10	Sac Anodes	$ 5,000	3	Mech
	EGT	Electric Entry Gate	1	$ 15,000	$ 15,000	30	10	Rehab	10%	1	Mech
	GB	Gearbox	4	$ 560,000	$ 140,000	40	20	Rebuild	40%	3	Mech
	HEX	Heat Exchanger	2	$ 93,511	$ 46,756	30	5	Rebuild	20%	3	Mech
	HVAC	HVAC System / Components	5	$ 47,250	$ 9,450	15	5	Rehab	33%	2	Mech
	MX	Mixer	2	$ 46,264	$ 23,132	40	20	Rebuild	20%	2	Mech
	ITK	Tank - Indoor	4	$ 67,198	$ 16,799	40	10	Rehab	15%	3	Mech
	OTK	Tank - Outdoor	2	$ 18,000	$ 9,000	20	5	Rehab	10%	2	Mech
	UTK	Tank - Underground	2	$ 55,090	$ 27,545	30	1	Inspection	8%	4	Mech
	VEH	Vehicle	1	$ 21,762	$ 21,762	8	2	Inspect/ Testing	5%	1	Mech

SAMPLE

APPENDIX 10

EXPECTED USEFUL LIFE OF CAPITAL PROJECTS

The estimated useful life of the MWRA's capital projects are summarized below:

Type of Capital Improvement	Estimated Useful Life (in years)
Buildings (includes all substantial above ground structures or enclosures)	40
Mechanical Equipment (includes pumps, chains, fans, HVAC, valves, etc.)	20
Electrical Equipment (motors, generators, motor control centers, lighting, conduit, etc)	20
Control Systems (computers, SCADA, PLCs, programming, etc)	10
Water Pipes	50 – 75
Water Pipe appurtenances (blow offs, air valves)	40
Sewer Pipes – gravity	50
Sewer Pipes – pressure	50
Sewer Pipe appurtenances (manholes, chambers)	50
Tunnels – Water	100
Tunnels – Wastewater	100
Tunnel appurtenances (shafts, control valves)	40
Distribution Reservoirs – above ground	40
Distribution Reservoirs – below ground	75 -100
Dams and Dam improvements	100
Motor Vehicles	10 – 15
Furniture and Fixtures	5 – 15
Leasehold Improvements	Period of lease
Study	5
Design – if constructed	20
Design – if not used	5
Inflow/Infiltration - Repair	20
Inflow/Infiltration - Replacement	50
Covered Storage	50

Nominal Life Expectancy for Building Components

A. HVAC	YEARS
a. Air Conditioner	
i. Window Unit	10
ii. Residential Single or Split Package	15
iii. Commercial Through-the-Wall	10
iv. Water-Cooled Package	15
v. Computer Room Unit	15
b. Air Handling Units	
i. Built-Up	30
ii. Packaged	25
c. Heat Pumps	
i. Residential Air-to-Air	12
ii. Commercial Air-to-Air	15
iii. Commercial Water-to-Air	18
d. Roof-Top Air Conditioners	
i. Single Zone	15
ii. Multi-zone	15
iii. VAV	15
e. Boilers, Hot Water	
i. Steel Water-Tube	24
ii. Steel Fire-tube	25
iii. Cast Iron	35
iv. Electric	15
f. Boilers, Steam	
i. Steel Water-Tube	28
ii. Steel Fire-Tube	25
iii. Cast Iron	30
iv. Electric	15
v. Burners	18
g. Furnaces	
i. Gas Fired	18
ii. Oil Fired	18
h. Unit Heaters	
i. Gas	13

ii. Electric	10
iii. Hot Water	20
iv. Steam	19
i. Radiant Heaters	
i. Electric	10
ii. Hot Water	25
iii. Gas	18
j. Air Terminals	
i. Diffusers, Grilles, Registers	27
ii. Induction Units	25
iii. Fan-Coil Units	20
iv. VAV Boxes Cooling Only	25
v. CAV Boxes	25
vi. Double Duct Boxes	25
vii. Fan Powered VAV Boxes	17
viii. Variable Volume Temperature Boxes	15
k. Air Washers	15
l. Ductwork	30
m. Dampers	20
n. Fans	
i. Centrifugal	25
ii. Axial	20
iii. Propeller	15
iv. Ventilating Roof-Mounted	20
o. Coils	
i. Direct Expansion	18
ii. Water	18
iii. Steam	22
iv. Electric	12
p. Heat Exchangers	
i. Commercial – Shell and Tube	
1. Steam to Domestic Water	13
2. Steam to Heating Water	20
3. Water to Domestic Water	20
4. Water to Water	25

ii. Residential Immersion Coil	25
iii. Plate and Frame	25
q. Reciprocating Air Compressors	15
r. Package Chillers	
i. Reciprocating	20
ii. Centrifugal	28
iii. Absorption	30
iv. Screw	20
v. Scroll	15
s. Cooling Towers	
i. Galvanized Metal	18
ii. Wood	20
iii. Ceramic	34
iv. Fiberglass	35
t. Condensers	
i. Air-Cooled	20
ii. Evaporative	15
u. Insulation	
i. Molded	20
ii. Blanket	24
v. Pumps	
i. Base Mounted	25
ii. Pipe Mounted	10
iii. Sump-Submerged	10
iv. Well-Submerged	10
v. Condensate	15
w. Reciprocating Engines	
i. Continuous Service	5
ii. Back-Up Service	20
x. Steam Turbines	30
y. Electric Motors	18
z. Motor Starters	20
aa. Electric Transformers	
i. Oil-Filled	30
ii. Dry Type	30

bb. Controls
- i. Pneumatic 18
- ii. Electric 20
- iii. Electronic 20
- iv. Computer-Direct Digital Controls 20

cc. Valve Actuators
- i. Hydraulic 15
- ii. Pneumatic 20
- iii. Self-Contained 10

dd. Damper Actuators
- i. Pneumatic 20
- ii. Electric 18

ee. Heating and Cooling Piping System 30

B. Elevator/Escalator

a. Elevator	
i. Hydraulic	
1. High Use	15
2. Low Use	35
ii. Gearless Traction	50
iii. Geared Traction	
1. High Use	20
2. Low Use	35
iv. Cab Interior Finish	10
v. Carpet – Cab	0.5
b. Escalator	40
c. Controllers – Computer Based	20
d. Elevator Door Operations	20

C. Plumbing

a. Hot Water Heaters	
i. Electric	10
ii. Oil Fired	10
iii. Gas Fired	10
b. Flush Valves	12
c. Fixtures - Commercial	
i. Faucets	7
ii. Water Closets	30
iii. Urinals	30
iv. Sinks	30
d. Pumps	
i. Base Mounted	25
ii. Pipe Mounted	10
iii. Sewage Ejector	10
iv. Sump-Submerged	10
v. Well-Submerged	10
e. Backflow Preventers	5
f. Domestic Water Piping System	30

D. Roofing

a. 4-Ply Built-Up
   i. Asphalt
      1. Flat (dead level) 18
      2. Sloped (1/4 " per foot) 25
   ii. Cold Tar 35
   iii. Hot Applied Rubberized Asphalt 30

(Protected Membrane Assembly)

b. Ply Modified Bitumen (Mopped Down)
   i. Flat (dead level) 15
   ii. Sloped (1/4" per foot) 20

c. Single Ply
   i. EPDM
      1. Flat (dead level) 5
      2. Sloped (1/4" per foot) 20
   ii. Thermoplastic (Hypalon, PVC) 15
   iii. Modified Bitumen (Touched On)
      1. Flat (dead level) 10
      2. Sloped (1/4" per foot) 15

d. Metal
   i. Structural Roof Panels (Prefinished Galv. Steel) 25
   ii. Pre-manufactured Architectural Roof Panels (Alum or Galvanized Steel) 25
   iii. Custom Fabricated Standing Seam Roofing (Copper, Lead Coated Copper, Terne Coated Stainless Steel) 75
   iv. Custom Fabricated Flat Seam (Copper, Lead Coated Copper, Terne Coated Stainless Steel) 50

e. Asphalt Shingles
   i. 15 Year 15
   ii. 20 Year 20
   iii. 25 Year 25
   iv. 30 Year 30

f. Slate

i. S-1	100
ii. S-2	75
iii. S-3	50
g. Clay/Concrete Tile	50+
h. Spray-On Polyurethane Foam Roofing	10

E. Electrical

a. Electric Motors	18
b. Electric Transformers	
i. Oil Filled	30
ii. Dry Type	30
c. Motor Control Center	30
d. Uninterrupted Power Supply	
i. Battery	10
ii. Rotary	15
e. Batteries	5
f. Main Service Panels	30
g. Sub Panels	
i. 120/280 V	30
ii. 277/480 V	30
h. Circuit Breakers	30
i. Light Fixtures	20
j. Emergency Engine Generator Set	20
k. Ground Fault Switch	30

F. Fire Life Safety, Access Control, Security System

a. Fire Alarm	15
b. Fire Pumps	25
c. Sprinklers	25
d. Security System	10
e. Access Control System	10
f. CCTV	
i. Monitors	5
ii. Pan & Tilt Motors	5
iii. Cameras – Tube	2
iv. Cameras – Chip	6
v. Computer Control	10
vi. Standby Power Supply – Battery	5

G. Interior Finishes

a. Flooring	
i. Vinyl	
1. Tile	12
2. Sheet	12
ii. Carpet – Common Area	
1. Broad Loom	6
2. Carpet Tiles	6
3. Loop Pile	7
iii. Epoxy	15
iv. Ceramic Tile	20
v. Stone	
1. Granite	75+
2. Marble	50
3. Slate	50
vi. Terrazzo	50
vii. Wood	15
viii. Concrete	50
b. Walls	
i. Plaster/Drywall with skim coat	30
ii. Vinyl Wall Covering	10
iii. Paint	5
iv. Wall Paper	4
v. Epoxy (two part)	7
vi. Fabric	5
vii. Wood	15
c. Ceilings	
i. Plaster/Drywall with skim coat	30
ii. Suspended	
1. Spline System	20
2. Lay-In System	25
3. Ceiling Tiles	13
iii. Metal	25
iv. Wood	30
d. Door Hardware	

SAMPLE

i.	Entry Lock sets	10
ii.	Door Closures	10
iii.	Coordinating Door Mechanism	7
iv.	Handicap Door Opener	10
v.	Rollup Door (Commercial)	15
vi.	Rollup Door (Industrial)	20

H. Structural

a. Steel	Life of Building
b. Concrete	Life of Building
c. Wood	30
d. Facade	
i. Brick, Block and Stone	Life of Building
ii. Concrete – Poured in Place	Life of Building
iii. Metal Curtain Wall	40
iv. Glass Curtain Wall	30
v. Precast Panels	35
vi. Stone Veneer	35
vii. Windows	30

I. Parking Decks

a. Underground Structures	Life of Building
b. Outside	
i. Exposed	30
ii. Covered	40

Draft

Assigning the Service Life to an Asset

Purpose

The purpose of this procedure is to assign the expected service life to an asset which is used to predict the residual remaining lives of assets and, subsequently, the timing of asset renewals.

When to Use

Use this procedure when an asset is acquired.

Adjustments to Service Life

The remaining expected service life may be higher or lower than the calculated value based on the initial assigned service life due to the environment, maintenance or operations practices, or quality of the specific make or model. The remaining expected service life shall typically be adjusted based on a condition assessment.

If numerous condition assessments of similar equipment suggest that the assigned service life be adjusted, then the tables in this procedure shall be updated to reflect that evaluation.

Procedure

Follow these steps to assign the expected service life to an asset.

Step	Action
1	Determine the asset type. • Civil • Mechanical • Electrical • Instrumentation
2	Using the tables provided in this procedure, determine the group the asset belongs to.
3	Then use the table to determine the service life of the asset.
4	Enter this value in the appropriate field in the CMMS system. *Note:* For assets inventori… …er, the service life shall be converted t… …*depr_term* field.

NEED TO UPDATE FOR NEW CMMS, NEW ASSET CODES

Continued on next page

Assigning the Service Life to an Asset, Continued

Service Life Table: Civil

Use the following table to assign service life to assets based on their asset group or type.

Asset Group	Service Life (years)
BLDG - ROOF	20
BLDG (building)	60
DOOR	35
FENCE & GATE	75
LAND	300
OCU (odor control unit)	25
PAVEMENT	15
PIPING	35
PIPING - CONCRETE GRAVITY	100
PIPING - CS - ACP	70
PIPING - CS - CIP	75
PIPING - CS - CL & C	100
PIPING - CS - DAMPER	25
PIPING - CS - DIP	110
PIPING - CS - GATE VALVE	30
PIPING - CS - HDPE	100
PIPING - CS - Permastran	50
PIPING - CS - Polyethylene	100
PIPING - CS - PVC	100
PIPING - CS - STL, CL&TW	75
PIPING - GRAVITY	75
PIPING - PRESSURE	50
PIPING - SEVERE SERVICE	15
PIPING - STRAINER	25
PIPING - TRAP	50
PIPING - VALVE	25
STORAGE BOX	50
STRUCTURE	30-75
TANK	30
TRAILER - CONTAINER	40
TRAILER - PREFAB	20

Continued on next page

Assigning the Service Life to an Asset, Continued

Service Life Table: Electrical

Use the following table to assign service life to assets based on their asset group or type.

Asset Group	Description	Service Life (years)
BAT	Batteries	15
BREAKER	Electrical - general	35
CABINET	Control Cabinet	20
CHARGER	Battery charger	20
DIST PNL	Elec Distribution Panel	35
DROP	Elec drop for power distribution center	35
FEEDER	Electrical Feeder	35
LIGHT	Light, typically emergency lighting	40
LOAD BANK	Electrical load bank	40
MCC	Motor Control Center	40
MVMC	Medium Voltage Motor Control Center	40
PDC	Power distribution center for lampbank	35
SWBD	Electrical switchboard	40
SWGR	Electrical switchgear	40
SWITCH	Electrical disconnect switches	40
THERMOCOUPLE	Thermocouple	35
UPS	Uninterruptable power source	40
XFMR	Elec Transformer - oil filled	40
XFMR1	Elec Transformer - dry	40

Service Life Table: Instrumentation

Use the following table to assign service life to assets based on their asset group or type.

Asset Group	Description	Service Life (years)
ALARM	Alarm	20
ANALYZER	Instrument - analyzer	20
CAMERA	Cameras, video cameras, monitors	20
COMM SYSTEM	Communication system	20
CONTROL PNL	System control panel, LCP, HMI, monitor	35
INST	Instrument - general	20
INST - LVL	Instrument - level indicator	20
INST - PH	Instrument - pH meter	20
INST-FLOW	Instrument - flow measuring or indicating	20
INST-PIT	Instrument - pressure indicating transmitter	20
INST-TEMP	Instrument - temperature	20
LAB EQUIP	Lab equipment	15

PLC/CPU	Prog logic controller, central processing unit	20
SCADA	SCADA, control system	20
XMTR	Instrument - transmitter	20

Service Life: Civil, Structures, Non-mechanical

Use the following table to assign service life to assets based on their asset group or type.

Asset Group	Description	Service Life (years)
BLDG	Building	75
LAND	Land	300
LANDSCAPING	Landscaping	75
PAVEMENT	Asphalt, concrete pavement	20
PROCESS	PROCESS - general treatment process	75
PROGRAM	PROGRAM - based on budget	75
PS	Pump station	75
PV	Pressure Vessel or air receiver	35
ROOF	Roof	75
STORAGE BOX	Storage box or container	50
STRUCTURE	Structure, typically large, made of concrete	75
SUB-PROCESS	SUB-PROCESS	75
SUBSTATIONS	Power substation	75
SUMP	Sump, drainage pit	75
SYSTEM	SYSTEM - functional group of assets	75
TANK	Storage tank - FRP, HDPE, steel, etc.	50
TRAILER	Trailer, container	75

Service Life Table: Mechanical

Use the following table to assign service life to assets based on their asset group or type.

Asset Group	Service Life (years)
AIR DRYER	25
AIRPORT	30
APPLIANCE	15
BARSCREEN	25
BIOFILTER	35
BLOWER	25
BOILER	27
BRG (bridge)	30
BURNER	15
CFG (Centrifuge)	13
CLASSIFIER	20
CLUTCH	30
COLLECTOR	40
COMPRESSOR	30

CONDENSER	35
CONVEYOR	20
CRANE	40
CYCLONE	25
DEAERATOR	35
DEIONIZER	35
DIVERTER	25
DRIVE	25
DROP (electrical drop)	35
ELEV (elevator)	35
EYEWASH	35
FAN	30
FIRE SUPPRESS	50
FLT (filter)	15
FURNACE	40
GEAR	35
GRINDER	25
GUIDE VANES	25
H2O SOFTENER (water softener)	35
HEATER	20
HOPPER	25
HRSG	25
HR-SYS (heat recovery system)	25
HYD UNIT (hydraulic unit)	25
INJECTOR	15
LAB EQUIP	15

Continued on next page

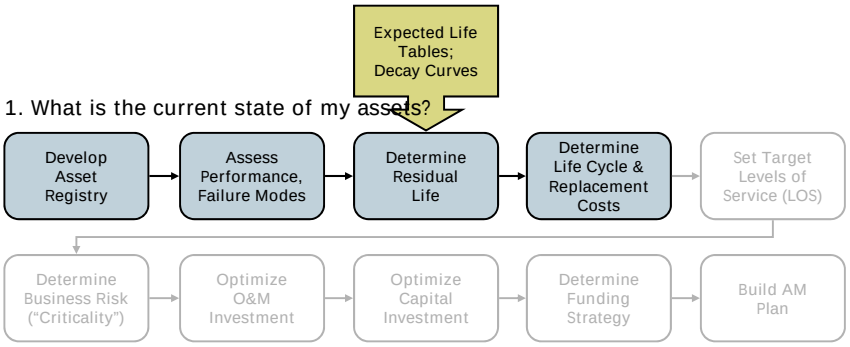
Assigning the Service Life to an Asset, Continued

Service Life Table: Mechanical (continued)

Asset Group	Service Life (years)
MIXER	25
MIXER - STATIC	40
MOTOR	30
MOV (motor operated valve)	25
Pump - Chemical	10
Pump - Diaphragm	10
Pump - Hydraulic	20
Pump - Lobe / Gear	15
Pump - Metering	12
Pump - Portable with trailer	15
Pump - Progressive Cavity	20
Pump - Sump, 5 HP or Less	20
Pump - Sump, greater than 5HP	25
Pump - Vertical Turbine	25
Pump, centr. - 60 MGD and above	40
Pump, centr. - Recessed Impeller type (WEMCO)	30
Pump, centr. - Small circulating close coupled units	15
PV (pressure vessel)	25
RAL	25
REGULATOR (pressure regulator)	30
SCALE	25
SCRUBBER	25
SEPARATOR	35
SHOP EQUIP	15-35
SILENCER	30
TURBINE	30
VEHICLE, CART	15
VEHICLE, CCTV Truck	15
VEHICLE, Pool Vehicle	15
VEHICLE, Rodding Truck	15
VEHICLE, Vactor Truck	15

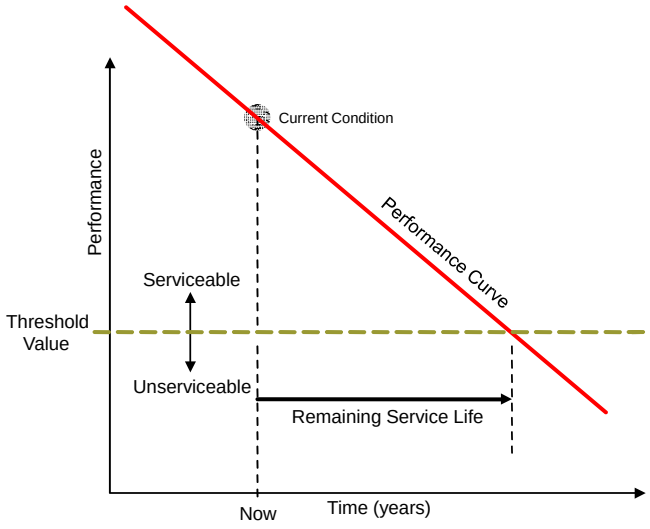
Revision Date 09/03/2014 DRAFT

AM plan 10-step process



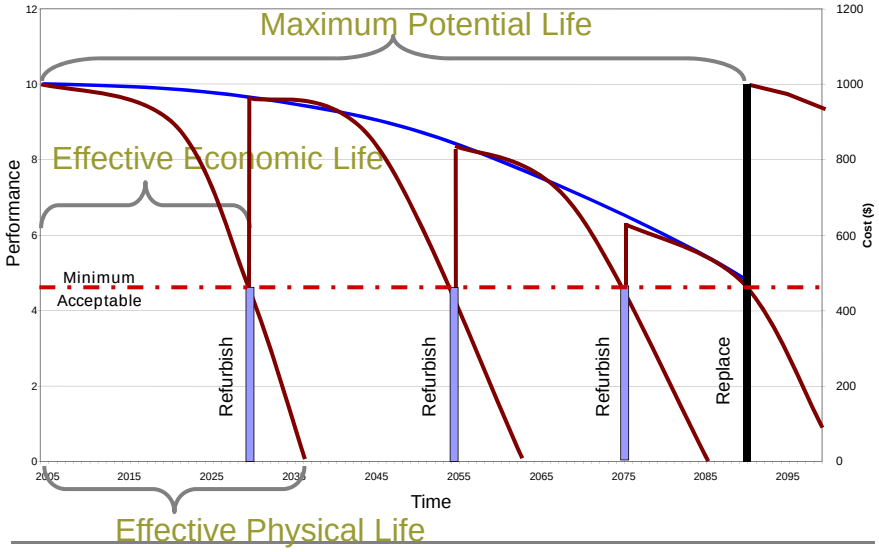
Fundamentals of Asset Management 4

Determining Residual Life



Fundamentals of Asset Management 5

Asset Lives



Fundamentals of Asset Management 6

"Physical life" vs. "economic life"

Effective Economic life is

- The period from the acquisition of the asset to the time when the asset, while physically able to provide a service, *ceases to be the lowest cost alternative to satisfy a particular service requirement*.
- At a maximum, equal to the physical life, but obsolescence often will ensure that *the economic life is less than the physical life*.

Fundamentals of Asset Management 7

SAMPLE

Support Tables

SAMPLE

A-1 Condition Assessment

Condition Rating	Description	Maintenance Level	Description
1	New or Excellent Condition	Normal PM	
2			
3	Minor Defects Only	Normal PM, Minor CM	
4			
5	Moderate Deterioration	Normal PM, Major CM	
6			
7	Significant Deterioration	Major repair, rehabilitate	
8			
9	Virtually Unserviceable	Rehab unlikely	
10	Unserviceable	Replace	

A-2 Performance

Performance Rating	Description
1	Exceeds / Meets all Performance Targets
2	Minor Performance Deficiencies
3	Considerable Performance Deficiencies
4	Major Performance Deficiencies
5	Does not meet any Performance Targets

A-3 Reliability

Reliability Rating	Description	Failure Timing
1	As Specified by Manufacturer	Never
2	Random Breakdown	Every 20 Years
3	Occasional Breakdown	Every 5 Years
4	Periodic Breakdown	Every 2 Years
5	Continuous Breakdown	= 1 year

B-1 Effective Lives (Years)

Class	Asset Type	Exp Life
1	**Civil**	75
2	**Pressure Pipework**	60
3	**Sewers**	100
4	**Pumps**	40
5	**Valves**	30
6	**Motors**	35
7	**Electrical**	35
8	**Controls**	25
9	**Building Assets**	60
10	**Land**	300

B-2 Conditon - Residual Life Factors

	Condition/Residual Life									
Effective Lives	1	2	3	4	5	6	7	8	9	10
Civil	0.9	0.8	0.7	0.6	0.5	0.4	0.3	0.2	0.1	0
Pressure Pipework	0.9	0.8	0.7	0.6	0.5	0.4	0.3	0.2	0.1	0
Sewers	0.9	0.8	0.7	0.6	0.5	0.4	0.3	0.2	0.1	0
Pumps	0.9	0.8	0.7	0.6	0.5	0.4	0.3	0.2	0.1	0
Valves	0.9	0.8	0.7	0.6	0.5	0.4	0.3	0.2	0.1	0
Motors	0.9	0.8	0.7	0.6	0.5	0.4	0.3	0.2	0.1	0
Electrical	0.9	0.8	0.7	0.6	0.5	0.4	0.3	0.2	0.1	0
Controls	0.9	0.8	0.7	0.6	0.5	0.4	0.3	0.2	0.1	0
Building Assets	0.9	0.8	0.7	0.6	0.5	0.4	0.3	0.2	0.1	0
Land	1	1	1	1	1	1	1	1	1	1

B-3 Condition Based Effective Lives

	Condition/Residual Life									
Effective Lives	1	2	3	4	5	6	7	8	9	10
Civil	67.5	60	52.5	45	37.5	30	22.5	15	7.5	0
Pressure Pipework	54	48	42	36	30	24	18	12	6	0
Sewers	90	80	70	60	50	40	30	20	10	0
Pumps	36	32	28	24	20	16	12	8	4	0
Valves	27	24	21	18	15	12	9	6	3	0
Motors	31.5	28	24.5	21	17.5	14	10.5	7	3.5	0
Electrical	31.5	28	24.5	21	17.5	14	10.5	7	3.5	0
Controls	22.5	20	17.5	15	12.5	10	7.5	5	2.5	0
Building Assets	54	48	42	36	30	24	18	12	6	0
Land	300	300	300	300	300	300	300	300	300	300

C-1 Consequence of Failure

CoF Rating	Description	% Affected	Level
1	Minor Component Failure	0-25%	Asset
2	Major Component Failure	25-50%	Asset
3	Major Asset	0-25%	Asset
4	Multiple Asset Failure	25-50%	Facility / Sub-System
5	Major Facilty Failure	50-100%	Facility
6	Minor Sanitory System Failure	20-40%	Total System
7	Medium	40-60%	Total System
8	Intermediate	60-80%	Total System
9	Significant	80-90%	Total System
10	Total	90-100%	Total System

D-1 Probability of Failure

% of Effective Life Consumed	PoF Rating
0%	**1**
10%	**2**
20%	**3**
30%	**4**
40%	**5**
50%	**6**
60%	**7**
70%	**8**
80%	**9**
90%	**10**

D-2 Don't Forget Redundancy!

Level of Redundancy	Reduce PoF by:
50% Backup	50%
100% Backup	90%
200% Secondary Backup	98%

E-1 Renewal Strategies

Option	Description	Type
1	Do nothing	Non-Capital
2	Continue with Status Quo	Non-Capital
3	Maintain differently	Non-Capital
4	Operate differently	Non-Capital
5	Repair	Capital
6	Refurbish/rehabilitate	Capital
7	Replace asset with similar	Capital
8	Replace with improved asset	Capital
9	Reduce Levels of Service	Non-Asset

SAMPLE

Remaining Effective Life Tool

Version 4.0 (BETA Prototype)

Current Year	2012

									STEP 1: Load Base Data				STEP 2: Determine Modification Factors
													Modification Factors
No.	Asset ID	Asset Name	Asset Class	Install Year	Refurb Year	Current Age (years)	Condition Rating	Estimated Design Service Life (years)	Design Standard	Construction Quality	Material Quality	Operational History	Operating Environment
1	MCR-YH8002	11-HE-01; HEAT EXCHANGER	Heat exchanger - air	1999		13		15	5%	5%			
2	MCR-ISP1005	1-P-5 INF. SUM PUMP	Pump - Sump, greater than 5HP	2002	2009	3		25					
3	MB-BLDG3013	ODOR CONTROL/PRIMARY SLUDGE	Odor Control unit	2000		12	7	12					
4	MCR-MCC1001	MOTOR CONTROL CENTER "A"	Motor Control Center	1991		21	8	30					
5	MM-CMP9001	CENT SOD HYDRO CHEMICAL PUMP	Pump - Chemical	2007		5	7	10					
6	MCR-PKG1001	PACKAGE COOL UNIT MCPKGA1	Air Handling Unit - Small wall mounted	2004		8		25	2%				
7	BR-AC7001	AIR COMPRESSOR-BRAC1	Compressor - Reciprocating , Large Capacity	1992		20	1	25					
8	MCR-BRC4001	7.5 TON BRIDGE CRANE 7.5	Crane	1996		16	5	30					
9	MB-VAC1007	INFLUENT VALVE ACTUATOR LPP7	Actuator - Valve	2005		7	6	25	-3%				-2%
10	PBE-VLV1014	CHECK VALVE 14"	Valves - 4" and larger	2001		11	7	20					
11	TC-BOL8001	TCBOLK1-WATER TUBE BOILER	Boiler - Hot water	1989		23	3	27		3%		-5%	
12	PBE-XFM1001	LP1 TRANSFORMER	Transformers	1990		22	6	25					
13	PBE-XFM1002	LP2 TRANSFORMER	Transformers			-		25					
14	PCC-GEN1001	BACKUP GENERATOR	Generator - Emergency Portable	1997		15	5	20					
15	PCC-GRD1001	GRINDER	Grinder - Digested Sludge	2005		7	3	17					
16	PBE-VLV1016	INFLUENT SLUICE GATE #2	Gate - Sluice	1995		17	9	30					
17	PBE-VLV1017	SURGE RELIEF VALVE 1	Valves - 4" and smaller	1996		16	8	25					
18	MCR-CS3004	1-ME-4 MECHANICAL BAR SCREEN M	Barscreen - Bar and Rack	1994		18	4	25			7%		-3%
19	MCR-ISP1006	1-P-6 INF. RAW SEWAGE PUMP RAW	Pump, centr. - 60 MGD and above (Raw Sewage)	1987		25	9	40					
20	PHC-TNK9001	CHEMICAL TANK	Tank - Chemical	1999		13	5	25					
21						-		-					
22						-		-					
23						-		-					
24						-		-					
25						-		-					

SAMPLE

Remaining Effective Life Tool

Version 4.0 (BETA Prototype)

Current Year	2012

				STEP 3: Determine End of Asset Life				STEP 4: Determine Remaining Effective Life			STEP 5: Validate and F	
				Capacity	Level of Service	Financial Efficiency	Physical Mortality					
Asset ID	Asset Name	External Stresses	Time to Capacity Failure (years)	Time to Level of Service Failure (years)	Time to Efficiency Failure (years)	Time to Physical Failure (years)	Imminent Failure mode	Remaining Effective Life (years)	% Effective Life Consumed (PELC)	Override Remaining Life (years)	Remaining Effective Life - Validated (years)
MCR-YH8002	11-HE-01; HEAT EXCHANGER			5	1	2.2	Financial Efficiency	1.0	93%		1.0
MCR-ISP1005	1-P-5 INF. SUM PUMP					22.0	Physical Mortality	22.0	12%		22.0
MB-BLDG3013	ODOR CONTROL/PRIMARY SLUDGE					3.6	Physical Mortality	3.6	70%		3.6
MCR-MCC1001	MOTOR CONTROL CENTER "A"					6.0	Physical Mortality	6.0	80%		6.0
MM-CMP9001	CENT SOD HYDRO CHEMICAL PUMP					3.0	Physical Mortality	3.0	70%		3.0
MCR-PKG1001	PACKAGE COOL UNIT MCPKGA1				7	17.3	Financial Efficiency	7.0	72%	3	3.0
BR-AC7001	AIR COMPRESSOR-BRAC1					22.5	Physical Mortality	22.5	10%		22.5
MCR-BRC4001	7.5 TON BRIDGE CRANE 7.5		5			15.0	Capacity	5.0	83%		5.0
MB-VAC1007	INFLUENT VALVE ACTUATOR LPP7					9.5	Physical Mortality	9.5	62%		9.5
PBE-VLV1014	CHECK VALVE 14"					6.0	Physical Mortality	6.0	70%	3	3.0
TC-BOL8001	TCBOLK1-WATER TUBE BOILER					18.5	Physical Mortality	18.5	31%		18.5
PBE-XFM1001	LP1 TRANSFORMER		1			10.0	Capacity	1.0	96%		1.0
PBE-XFM1002	LP2 TRANSFORMER					-	-	-	-		-
PCC-GEN1001	BACKUP GENERATOR				3	10.0	Financial Efficiency	3.0	85%		3.0
PCC-GRD1001	GRINDER					11.9	Physical Mortality	11.9	30%		11.9
PBE-VLV1016	INFLUENT SLUICE GATE #2					3.0	Physical Mortality	3.0	90%		3.0
PBE-VLV1017	SURGE RELIEF VALVE 1					5.0	Physical Mortality	5.0	80%		5.0
MCR-CS3004	1-ME-4 MECHANICAL BAR SCREEN M					15.6	Physical Mortality	15.6	38%		15.6
MCR-ISP1006	1-P-6 INF. RAW SEWAGE PUMP RAW					4.0	Physical Mortality	4.0	90%		4.0
PHC-TNK9001	CHEMICAL TANK					12.5	Physical Mortality	12.5	50%		12.5
						-	-	-	-		-
						-	-	-	-		-
						-	-	-	-		-
						-	-	-	-		-
						-	-	-	-		-

SAMPLE

Remaining Effective Life Tool

Version 4.0 (BETA Prototype)

Current Year: 2012

Asset ID	Asset Name	% Effective Life Consumed (PELC) - Validated	Physical Remaining Life: Condition Based Remaining Effective Life (CBREL)	Physical Remaining Life: Age Based Remaining Effective Life (ABREL)	Physical Remaining Life	Modification Factors: Design Standard	Construction Quality	Material Quality	Operational History	Operating Environment
MCR-YH8002	11-HE-01; HEAT EXCHANGER	93%	-	2.0	2.0	0.1	0.1	0.0	0.0	0.0
MCR-ISP1005	1-P-5 INF. SUM PUMP	12%	-	22.0	22.0	0.0	0.0	0.0	0.0	0.0
MB-BLDG3013	ODOR CONTROL/PRIMARY SLUDGE	70%	3.6	0.0	3.6	0.0	0.0	0.0	0.0	0.0
MCR-MCC1001	MOTOR CONTROL CENTER "A"	80%	6.0	9.0	6.0	0.0	0.0	0.0	0.0	0.0
MM-CMP9001	CENT SOD HYDRO CHEMICAL PUMP	70%	3.0	5.0	3.0	0.0	0.0	0.0	0.0	0.0
MCR-PKG1001	PACKAGE COOL UNIT MCPKGA1	88%	-	17.0	17.0	0.3	0.0	0.0	0.0	0.0
BR-AC7001	AIR COMPRESSOR-BRAC1	10%	22.5	5.0	22.5	0.0	0.0	0.0	0.0	0.0
MCR-BRC4001	7.5 TON BRIDGE CRANE 7.5	83%	15.0	14.0	15.0	0.0	0.0	0.0	0.0	0.0
MB-VAC1007	INFLUENT VALVE ACTUATOR LPP7	62%	10.0	18.0	10.0	-0.3	0.0	0.0	0.0	-0.2
PBE-VLV1014	CHECK VALVE 14"	85%	6.0	9.0	6.0	0.0	0.0	0.0	0.0	0.0
TC-BOL8001	TCBOLK1-WATER TUBE BOILER	31%	18.9	4.0	18.9	0.0	0.6	0.0	-0.9	0.0
PBE-XFM1001	LP1 TRANSFORMER	96%	10.0	3.0	10.0	0.0	0.0	0.0	0.0	0.0
PBE-XFM1002	LP2 TRANSFORMER	-	-	-	-	-	-	-	-	-
PCC-GEN1001	BACKUP GENERATOR	85%	10.0	5.0	10.0	0.0	0.0	0.0	0.0	0.0
PCC-GRD1001	GRINDER	30%	11.9	10.0	11.9	0.0	0.0	0.0	0.0	0.0
PBE-VLV1016	INFLUENT SLUICE GATE #2	90%	3.0	13.0	3.0	0.0	0.0	0.0	0.0	0.0
PBE-VLV1017	SURGE RELIEF VALVE 1	80%	5.0	9.0	5.0	0.0	0.0	0.0	0.0	0.0
MCR-CS3004	1-ME-4 MECHANICAL BAR SCREEN M	38%	15.0	7.0	15.0	0.0	0.0	1.1	0.0	-0.5
MCR-ISP1006	1-P-6 INF. RAW SEWAGE PUMP RAW	90%	4.0	15.0	4.0	0.0	0.0	0.0	0.0	0.0
PHC-TNK9001	CHEMICAL TANK	50%	12.5	12.0	12.5	0.0	0.0	0.0	0.0	0.0
		-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-

SAMPLE

Remaining Effective Life Tool

Version 4.0 (BETA Prototype)

Current Year 2012

Asset Count vs. PELC Chart

% Effective Life Consumed - Validated	Assets count
10%	1
20%	1
30%	1
40%	2
50%	1
60%	1
70%	2
80%	6
90%	2
100%	2
Total	19

Asset Condition vs. PELC Chart

Asset ID	Asset Name	External Stresses	Adjusted Physical Remaining Effective Life	PELC	Condition Rating
MCR-YH8002	11-HE-01; HEAT EXCHANGER	0.0	2.2	93%	0
MCR-ISP1005	1-P-5 INF. SUM PUMP	0.0	22.0	12%	0
MB-BLDG3013	ODOR CONTROL/PRIMARY SLUDGE	0.0	3.6	70%	7
MCR-MCC1001	MOTOR CONTROL CENTER "A"	0.0	6.0	80%	8
MM-CMP9001	CENT SOD HYDRO CHEMICAL PUMP	0.0	3.0	70%	7
MCR-PKG1001	PACKAGE COOL UNIT MCPKGA1	0.0	17.3	88%	0
BR-AC7001	AIR COMPRESSOR-BRAC1	0.0	22.5	10%	1
MCR-BRC4001	7.5 TON BRIDGE CRANE 7.5	0.0	15.0	83%	5
MB-VAC1007	INFLUENT VALVE ACTUATOR LPP7	0.0	9.5	62%	6
PBE-VLV1014	CHECK VALVE 14"	0.0	6.0	85%	7
TC-BOL8001	TCBOLK1-WATER TUBE BOILER	0.0	18.5	31%	3
PBE-XFM1001	LP1 TRANSFORMER	0.0	10.0	96%	6
PBE-XFM1002	LP2 TRANSFORMER	-	-	#N/A	0
PCC-GEN1001	BACKUP GENERATOR	0.0	10.0	85%	5
PCC-GRD1001	GRINDER	0.0	11.9	30%	3
PBE-VLV1016	INFLUENT SLUICE GATE #2	0.0	3.0	90%	9
PBE-VLV1017	SURGE RELIEF VALVE 1	0.0	5.0	80%	8
MCR-CS3004	1-ME-4 MECHANICAL BAR SCREEN M	0.0	15.6	38%	4
MCR-ISP1006	1-P-6 INF. RAW SEWAGE PUMP RAW	0.0	4.0	90%	9
PHC-TNK9001	CHEMICAL TANK	0.0	12.5	50%	5
		-	-	#N/A	0
		-	-	#N/A	0
		-	-	#N/A	0
		-	-	#N/A	0
		-	-	#N/A	0