Asset Management at Mercury

Mathew Hunt
Strategic Asset Planner
PERSONAL INTRODUCTION

> BE Hons (Mech), University of Canterbury, 2010
> Master Of Maintenance and Reliability Engineering, Federation University (Melbourne, Australia), 2018
> Mercury (then Mighty River Power) in 2013
> For fun, I ride mountain bikes
ASSET MANAGEMENT AT MERCURY

Portfolio Strategy
(Market outlook, External Factors, Station performance objectives)

Asset Integrity Framework

AM Policy

Strategic Asset Management Plan
(Objectives for Maturity Growth)

Asset Group Guidelines
(Generic for asset group)

Fuel/Reservoir Plan
(routine and non-routine work)

Life Cycle Plan (15 year view)
(can be per asset group, per station, per portfolio etc.)

Condition - risk Asset Intervention Map (AIM)

Condition - risk GW001 Well Register

Maintenance
(routine and non-routine work)

Audit & Review
Portfolio Strategy
(Market outlook, External Factors, Station performance objectives)

Asset Integrity Framework

AM Policy

Strategic Asset Management Plan
(Objectives for Maturity Growth)

Asset Group Guidelines
(Generic for asset group)

Fuel/Reservoir Plan
(routine and non-routine work)

Life Cycle Plan (15 year view)
(can be per asset group, per station, per portfolio etc.)

Maintenance
(routine and non-routine work)

Audit & Review

Governance

Planning

Delivery

Review

4 ASSET MANAGEMENT AT MERCURY
ASSET MANAGEMENT AT MERCURY

Portfolio Strategy
(Market outlook, External Factors, Station performance objectives)

Asset Integrity Framework

AM Policy

Strategic Asset Management Plan
(Objectives for Maturity Growth)

Asset Group Guidelines
(Generic for asset group)

Fuel/Reservoir Plan
(routine and non-routine work)

Condition & Risk (W2W)

Condition & Risk (W2W)

Life Cycle Plan (15 year view)
(can be per asset group, per station, per portfolio etc.)

Maintenance
(routine and non-routine work)

Audit & Review
Two “strategies/guidelines” two different maturity levels
Guideline Implementation – Roles & Responsibilities

Guidelines

- Routine Maintenance
  - Maximo PM Creation
    - Reliability/Maint. Teams (Geo/Hydro)
  - Maximo WO creation
- One-off Maint/Engineering activity $<50k
- Project $>50k
  - Critical spare identification
- Contingency Prep
- Condition Assessments

- Production Engineer (Site)
- Critical spare evaluation (Excel criticality tool)
  - Dossiers, OWL, Procurement etc.
- Reliability & PE’s (Geo/Hydro)
- Maintenance teams & PE’s (Geo/Hydro)

Business Case

Annual Station Plan
(Station specific Life Cycle plan + Maintenance plan + budget + people + environment etc)
ASSET MANAGEMENT AT MERCURY

Portfolio Strategy
(Market outlook, External Factors, Station performance objectives)

Asset Integrity Framework

AM Policy

Strategic Asset Management Plan
(Objectives for Maturity Growth)

Asset Group Guidelines
(Generic for asset group)

Fuel/Reservoir Plan
(routine and non-routine work)

Life Cycle Plan (15 year view)
(can be per asset group, per station, per portfolio etc.)

Maintenance
(routine and non-routine work)

Audit & Review

Governance

Planning

Delivery

Review

Condition – Risk Asset Intervention Map (AIM)

Condition – Risk GW001 Well Register
The Heatmap represents the overall Intervention period and Critical Risk for each asset type (portfolio) and/or Station.

Within the Heatmap, users are able to access the details of that intervention or risk rating including its underlying condition score in the Asset’s Condition Assessment by clicking on an individual cell.
Condition – Risk Heatmap (Asset Intervention Map)

Legend:

- **A**: Intervene > 10 Years
- **B**: Intervene 5-10 Years
- **C**: Intervene 2-5 Years
- **D**: Intervene < 2 Years
- **X**: Intervene ASAP

Evidence:

- **L**: Low Evidence - Qualitative data, anecdotal or incomplete data or old condition assessment
- **M**: Medium Evidence - Quantitative data, may be incomplete or slightly dated condition assessment
- **H**: High Evidence - Observed failure, functional testing, formal, recent condition assessment

Risk Type:

- **H&S**: Health & Safety
- **COM**: Legal/Compliance
- **PEO**: People
- **OPS**: Operational
- **REO**: Reputation
- **FIN**: Financial + BI

Risk Format:

1 2 3 4

Highest Risk Installed Capacity (MW)

<table>
<thead>
<tr>
<th>W2W Map 2018</th>
<th>Aratiatia</th>
<th>Ohakuri</th>
<th>Atiamuri</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generation Type</td>
<td>Hydro</td>
<td>Hydro</td>
<td>Hydro</td>
</tr>
<tr>
<td>Risk Format</td>
<td>Installed Capacity (MW)</td>
<td>90 MW Station Output</td>
<td>112 MW Station Output</td>
</tr>
<tr>
<td>Risk Type</td>
<td>Installed Year</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Asset Groups

- **Water Passages**
  - Intake Gates
  - Penstocks
  - Scroll Case
  - Draft Tube

- **Turbines**
  - Hydro Turbines

- **Governors**
  - Hydro Governors

- **Excitation**
  - Excitation

- **Generators**
  - Hydro Generators

- **Hydro Bearings**

- **Circuit Breakers**
  - HV Outdoor (110-220 kV)
  - HV Indoor (3.3-11 kV)

- **Transformers**

Risk Priority Level:

1 2 3 4 5
### Condition – Risk Heatmap (Asset Intervention Map)

#### KAW Hotwell Pumps

<table>
<thead>
<tr>
<th>Pump Component</th>
<th>Estimated Replacement Lifecycle</th>
<th>Maintenance Lifecycle</th>
<th>Original Install Date</th>
<th>Date Replaced or Maintained</th>
<th>Age Since Overhaul (yrs)</th>
<th>Time Until Intervention (yrs)</th>
<th>Comments</th>
<th>Adjusted Time Until Intervention (yrs)</th>
<th>Level of Evidence</th>
<th>Intervention Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impeller/Suction bowl</td>
<td>12</td>
<td>8</td>
<td>Jan-08</td>
<td>Jan-08</td>
<td>10.0</td>
<td>2.0</td>
<td>Impeller has 2 years remaining service life according to the strategies estimated 12 year service life. Substantial cavitation damage was found in the January 2018 inspection, which was repaired at the time. The impellers should be replaced within the next 4 years.</td>
<td>4.0</td>
<td>High</td>
<td>C-H</td>
</tr>
<tr>
<td>Motor</td>
<td>25</td>
<td>8</td>
<td>Jan-08</td>
<td>Jan-18</td>
<td>0.0</td>
<td>8.0</td>
<td>Motor was overhauled in Jan 2018 with new bearings installed. The electrical tests indicate that the rotor and stator are in good condition, it should be electrically tested in 4 years time but will last another 10 years until a routine overhaul is required.</td>
<td>10.0</td>
<td>High</td>
<td>B-H</td>
</tr>
<tr>
<td>Bearings, Seals, Shafts and Consumables</td>
<td>8</td>
<td>8</td>
<td>Jan-08</td>
<td>Jan-18</td>
<td>0.0</td>
<td>8.0</td>
<td>Labyrinth bush was found to be heavily worn at Jan 2018 inspection. The labyrinth bush housing was found to be out of round and oversize, going from an interference fit to a clearance one, so the bush was reinstalled with liberal quantities of coolant to hold in place. At the next overhaul opportunity consideration should be given to rebuilding and inspecting in 2018. Good condition. For outage reports and further evidence of condition see: <a href="http://example.com">link</a></td>
<td>8.0</td>
<td>High</td>
<td>B-H</td>
</tr>
<tr>
<td>Remainder of Pump (Discharge Bowl, column pipes etc.)</td>
<td>25</td>
<td>8</td>
<td>Jan-08</td>
<td>Jan-08</td>
<td>10.0</td>
<td>15.0</td>
<td><em>REMARKS</em></td>
<td>8.0</td>
<td>High</td>
<td>A-H</td>
</tr>
</tbody>
</table>

#### KAW A

**Intervention**

- **C-H**: Intervene 2-5 Years; High Evidence

**Critical Risk**

- **OPS**: Significant Consequence; Unlikely Probability (OPERATIONAL)

**Intervention Assessment**

- **Assessment Date**: Jan-18
- **Inspection Type**: Biennial Shut

**Comments**

- For outage reports and further evidence of condition see: [link](http://example.com)
ASSET MANAGEMENT AT MERCURY

12

AM Policy

Portfolio Strategy
(Market outlook, External Factors, Station performance objectives)

Strategic Asset Management Plan
(Objectives for Maturity Growth)

Asset Group Guidelines
(Generic for asset group)

Fuel/Reservoir Plan
(routine and non-routine work)

Asset Intervention Map (AIM)

Life Cycle Plan (15 year view)
(can be per asset group, per station, per portfolio etc.)

Maintenance
(routine and non-routine work)

Audit & Review

Governance
Planning
Delivery
Review

Asset Integrity Framework

AM Policy

Strategic Asset Management Plan
(Objectives for Maturity Growth)

Asset Group Guidelines
(Generic for asset group)

Fuel/Reservoir Plan
(routine and non-routine work)

Life Cycle Plan (15 year view)
(can be per asset group, per station, per portfolio etc.)

Maintenance
(routine and non-routine work)

Audit & Review

GW001 Well Register
<table>
<thead>
<tr>
<th>Project Name</th>
<th>Life Cycle Plan</th>
<th>Operations Work List (OWL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project D</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project E</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project F</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Life Cycle Plan**

**Operations Work List (OWL)**

---

13 ASSET MANAGEMENT AT MERCURY
Life Cycle Plan - Operations Work List (OWL)
Monthly All Teams Resource Requirements for FY19 July to FY19 June
(sorted by Role)
Operations Work List (OWL)

Monthly Electrical Engineering Resource Requirements for FY19 July to FY19 June
(sorted by Fuel Type and filtered to show Proposed activities)
ASSET MANAGEMENT AT MERCURY

Portfolio Strategy
(Market outlook, External Factors, Station performance objectives)

Asset Integrity Framework

AM Policy

Strategic Asset Management Plan
(Objectives for Maturity Growth)

Asset Group Guidelines
(Generic for asset group)

Fuel/Reservoir Plan
(routine and non-routine work)

Life Cycle Plan (15 year view)
(can be per asset group, per station, per portfolio etc.)

Management
(routine and non-routine work)

Audit & Review
Maintenance Management – Maximo, Eclipse and Asset Cataloguing

> Maximo is used as the company’s computerised maintenance management system
> PM tasks are informed by the asset group guidelines:
  > FMECA studies
  > Compliance requirements (Geothermal Regulations, PECPR, EIPC etc.)
> Current challenge with Maintenance management is lack of consistency (Maximo, Eclipse, Drawings etc.)
  > unreliable OEM drawings
  > Assets exist physically but not on drawings, in maximo or in eclipse & Vice versa
  > Typo’s and language used (e.g. vaporizer, vaporiser, vaporizor, vapouriser)
  > Inconsistency within sites and across the business
Maintenance Management – Maximo, Eclipse and Asset Cataloguing

> Development of the Asset Catalogue Standard

  > KKS Location Coding system adapted for use at Mercury

  > It provides standard rules that establish asset location code and description uniformity across Mercury (Geo, Hydro and Southdown)

  > Asset Catalog Standard reviewed and endorsed by representatives from across the business

  > Common terminology to be utilized, excess data moved to appropriate fields in Maximo, typos and spelling corrected.

  > Will be applied in conjunction with the Asset Tagging Standard to ensure that equipment on site is appropriately labeled.
### DATA EXAMPLE

#### Current Maximo Data

<table>
<thead>
<tr>
<th>Asset Number</th>
<th>Asset Description</th>
<th>Location</th>
<th>Location Description</th>
<th>DCS Tag</th>
<th>Official Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1005134</td>
<td>OEC3 Preheater (M&amp;I A1140102)</td>
<td>MOK03/HAB53/AC001</td>
<td>OEC3 Preheater (M&amp;I A1140102)</td>
<td>A1140102</td>
<td>A1140102</td>
</tr>
<tr>
<td>1002885</td>
<td>OEC11 LH Preheater (M&amp;I 143073)</td>
<td>MOK11/HAB51/AC001</td>
<td>OEC11 LH Preheater (M&amp;I 143073)</td>
<td>11-H-1101A</td>
<td>11-H-1101A</td>
</tr>
<tr>
<td>1002886</td>
<td>OEC11 RH Preheater (M&amp;I 143071)</td>
<td>MOK11/HAB52/AC001</td>
<td>OEC11 RH Preheater (M&amp;I 143071)</td>
<td>11-H-1101B</td>
<td>11-H-1101B</td>
</tr>
<tr>
<td>350874</td>
<td>OEC-1 Preheater HE-9102C ON# A1121008</td>
<td>NTM01/LGD51/AC001</td>
<td>OEC-1 Preheater HE-9102C ON# A1121008</td>
<td>1-HE-9102C</td>
<td></td>
</tr>
<tr>
<td>350875</td>
<td>OEC-1 Preheater HE-9102B ON# A1121008</td>
<td>NTM01/LGD52/AC001</td>
<td>OEC-1 Preheater HE-9102B ON# A1121008</td>
<td>1-HE-9102B</td>
<td></td>
</tr>
<tr>
<td>350876</td>
<td>OEC-1 Preheater HE-9102A ON# A1121007</td>
<td>NTM01/LGD54/AC001</td>
<td>OEC-1 Preheater HE-9102A ON# A1121007</td>
<td>1-HE-9102A</td>
<td></td>
</tr>
<tr>
<td>1002932</td>
<td>OEC01 Preheater</td>
<td>RKA01/HAB50/AC001</td>
<td>OEC01 Preheater</td>
<td>MI 166040</td>
<td>MI 166040</td>
</tr>
<tr>
<td>1000152</td>
<td>OEC21 Preheater</td>
<td>RKA21/HAB50/AC001</td>
<td>OEC21 Preheater</td>
<td>H-1101</td>
<td>MI 144119</td>
</tr>
</tbody>
</table>

#### Asset Catalogue Standard Implemented Maximo Data

<table>
<thead>
<tr>
<th>Asset Number</th>
<th>Asset Description</th>
<th>Location</th>
<th>Location Description</th>
<th>DCS Tag</th>
<th>Official Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1005134</td>
<td>Heat Exchanger; Shell and Tube; Horizontal</td>
<td>MOK03/HAB53/AC001</td>
<td>OEC3 Preheater</td>
<td>MI A1140102</td>
<td></td>
</tr>
<tr>
<td>1002885</td>
<td>Heat Exchanger; Shell and Tube; Horizontal</td>
<td>MOK11/HAB51/AC001</td>
<td>OEC11 LH Preheater</td>
<td>MI 143073</td>
<td></td>
</tr>
<tr>
<td>1002886</td>
<td>Heat Exchanger; Shell and Tube; Horizontal</td>
<td>MOK11/HAB52/AC001</td>
<td>OEC11 RH Preheater</td>
<td>MI 143071</td>
<td></td>
</tr>
<tr>
<td>350874</td>
<td>Heat Exchanger; Shell and Tube; Horizontal</td>
<td>NTM01/HAB51/AC001</td>
<td>OEC01 Preheater C</td>
<td>01-HE-9102C</td>
<td>MI A1121008</td>
</tr>
<tr>
<td>350875</td>
<td>Heat Exchanger; Shell and Tube; Horizontal</td>
<td>NTM01/HAB52/AC001</td>
<td>OEC01 Preheater B</td>
<td>01-HE-9102B</td>
<td>MI A1121008</td>
</tr>
<tr>
<td>350876</td>
<td>Heat Exchanger; Shell and Tube; Horizontal</td>
<td>NTM01/HAB54/AC001</td>
<td>OEC01 Preheater A</td>
<td>01-HE-9102A</td>
<td>MI A1121007</td>
</tr>
<tr>
<td>1002932</td>
<td>Heat Exchanger; Shell and Tube; Horizontal</td>
<td>RKA01/HAB50/AC001</td>
<td>OEC01 Preheater</td>
<td>MI 166040</td>
<td></td>
</tr>
<tr>
<td>1000152</td>
<td>Heat Exchanger; Shell and Tube; Horizontal</td>
<td>RKA21/HAB50/AC001</td>
<td>OEC21 Preheater</td>
<td>21-H-1101</td>
<td>MI 144119</td>
</tr>
</tbody>
</table>
Questions?