1   Q.   Please provide the following Asset Management procedures utilized by Newfoundland

2   Hydro:

3

4   a.   *"Corporate Business System - ERP Assessment Business Process Document Bills of*

5   *Materials - Asset Management,"* December 20, 2016;

6

7   b.   *"Corporate Business System - ERP Assessment Business Process Document Create*

8   *and Manage Equipment Records,"* December 2016;

9

10   c.   *"Corporate Business System - ERP Assessment Business Process Document*

11   *Maintenance Work Centers - Asset Management,"* December 20, 2016;

12

13   d.   *"Corporate Business System - ERP Assessment Business Process Document Planning*

14   *- Asset Management,"* September 12, 2018;

15

16   e.   *"Corporate Business System - ERP Assessment Business Process Document - Asset*

17   *Management Preventive Maintenance PAAR Level 1,"* August 14, 2018;

18

19   f.   *"Corporate Business System - ERP Assessment Business Process Document Work*

20   *Order Prioritization Asset Management,"* August 10, 2018;

21

22   g.   *"Corporate Business System - ERP Assessment Business Process Document*

23   *Scheduling - Asset Management,"* August 14, 2018;

24

25   h.   *"Corporate Business System - ERP Assessment Business Process Document WO*

26   *Management- Asset Management,"* August 8, 2018

1   A.   a.   Please refer to PUB-NLH-030, Attachment 1: "Corporate Business System - ERP
2   Assessment Business Process Document Bills of Materials - Asset Management," December
3   20, 2016;
4
5   b.   Please refer to PUB-NLH-030, Attachment 2: "Corporate Business System - ERP
6   Assessment Business Process Document Create and Manage Equipment Records,"
7   December 2016;
8
9   c.   Please refer to PUB-NLH-030, Attachment 3: "Corporate Business System - ERP
10   Assessment Business Process Document Maintenance Work Centers - Asset Management,"
11   December 20, 2016;
12
13   d.   Please refer to PUB-NLH-030, Attachment 4: "Corporate Business System - ERP
14   Assessment Business Process Document Planning - Asset Management," September 12,
15   2018;
16
17   e.   Please refer to PUB-NLH-030, Attachment 5: "Corporate Business System - ERP
18   Assessment Business Process Document - Asset Management Preventive Maintenance
19   PAAR Level 1," August 14, 2018;
20
21   f.   Please refer to PUB-NLH-030, Attachment 6: "Corporate Business System - ERP
22   Assessment Business Process Document Work Order Prioritization Asset Management,"
23   August 10, 2018;
24
25   g.   Please refer to PUB-NLH-030, Attachment 7: "Corporate Business System - ERP
26   Assessment Business Process Document Scheduling - Asset Management," August 14,
27   2018;

1   h.   Please refer to PUB-NLH-030, Attachment 8: "Corporate Business System - ERP

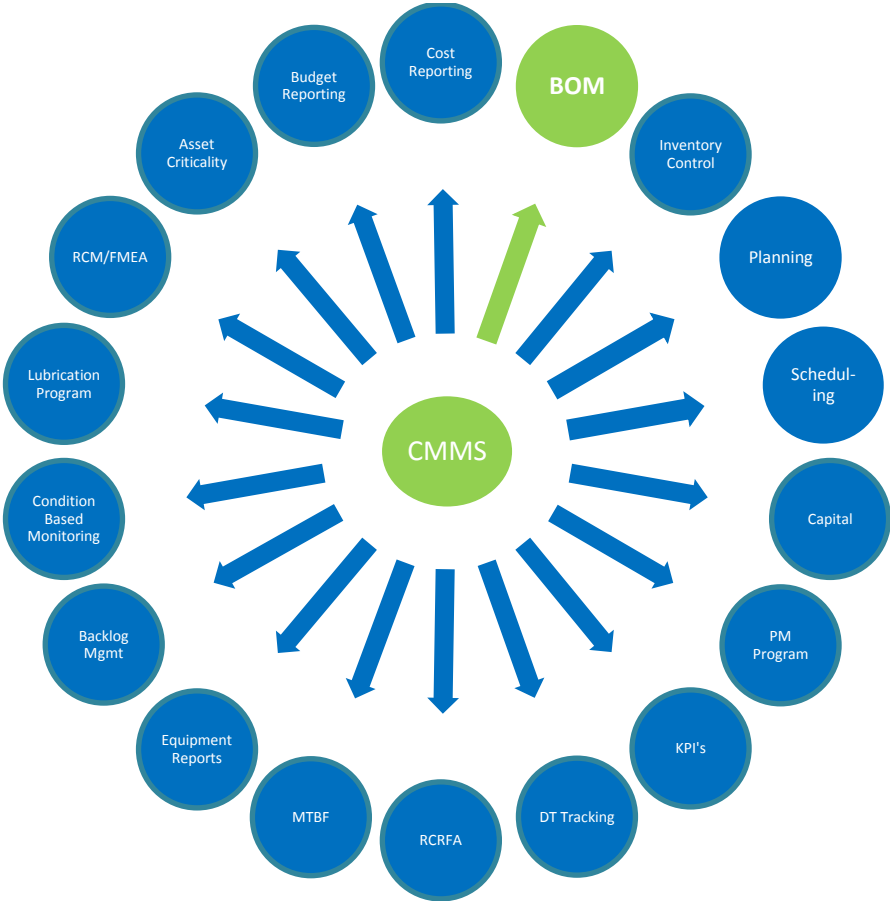2   Assessment Business Process Document WO Management- Asset Management," August 8,

3   2018.

Corporate Business System - ERP Assessment

Business Process Document

Bills of Materials - Asset Management

December 20th/2016

Version	Date	Description of Revision	Author
	2016-12-20	Updated after process review	S. McCarthy

Contents

Purpose

Spare parts are the lifeblood of operational reliability and plant capacity. No plant can operate at a high level of output without a reliable supply of functional spare parts. Efficient Maintenance planning requires detailed spare parts lists. Maintenance execution requires the right parts, in the right condition, at the right time. Yet, spare parts are often overlooked as a contributor to availability and reliability outcomes.

Spare Parts Management and an organized maintenance storeroom is one key process which supports effective maintenance planning and scheduling. Improved materials management and spare parts management will free up time for maintenance planners, maintenance supervisors, and hourly maintenance personnel. It is not unusual to see an average of 20-30% of maintenance crafts people's time to be used for finding parts and material.

This Bill of Materials (BOM) procedure contributes to the Materials Planning process and to the creation of efficient, effective and documented repair procedures for equipment through documenting the collective knowledge of the organization with regards to procedures, technical details, spare parts, and labour plans. Continually improving standard job plans and Planner resources such as equipment parts lists will improve Planner effectiveness and reduce downtime and work execution time.

The start of this process should be driven from the "Operational Readiness Process" and "Equipment Criticality process", which should assess what is needed to maintain the Equipment's reliability. The biggest failing of this process is often in its timing; it is at the time of Project / Construction that Equipment assessments and strategy should define parts, standard jobs, Preventive Maintenance / Condition Based Maintenance(PM/CBM) requirements. Often, consideration of making equipment ready to Operate and Maintain is not done before project handover and developing maintenance strategies and equipment data resources becomes a burden on Maintenance departments. Standard Nalcor Inventory procedure should be followed for the addition of items stored in Inventory as well as items that will be identified as ordered on demand.

Terminology

- *Bill of Materials (BOMs)*
  - *Bills of Material may be of two types, PM BOMs and Parts List BOMs*
    - *PM BOMs may contain both a Standard Parts List and Standard Instructions for a defined job. These Parts and Instructions are associated with a Model Work Order and a PM Service so that the Assigned Work Order Parts and Labour (Routings) are automatically created when the work order is created from the PM system.*
    - *Parts List BOMs contain only a Parts List associated with an equipment, and the Parts List BOM is attached to the equipment master record. When a Corrective WO is created for that equipment record, the WO Parts List may have the Parts*

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> List BOM copied onto the WO Parts List as a starting point for planning the
> materials requirements for the job.
>   - *In JD Edwards World software, the only way to assign a standard Parts List to an equipment record was by the use of a EPL BOM.*
>   - *All BOMs in JD Edwards World software require a virtual inventory item to be used as a header record to which the standard parts and/or standard PM labour are attached.*
>   - *In JD Edwards Enterprise One software, the same functionality exists for a BOM that is attached to a virtual Inventory Item header that is then attached to the equipment or a PM Model.*

- *Equipment Parts List (EPL)*
  - *In JD Edwards Enterprise One software, the functionality of the Parts List BOM has generally been replaced and enhanced by the use of Equipment Parts Lists, attached directly to the equipment record.*
  - *EPLs can contain stock and non-stock items the same as Parts List BOMs, but can also include non-catalogued items for which no SKU (Stock Keeping Unit or Inventory Item Number) has been created.*
  - *EPLs contain only a Parts List associated with an equipment, and the EPL is attached to the equipment master record. When a Corrective WO is created for that equipment record, the WO Parts List may have the EPL copied onto the WO Parts List in whole or in part in order to plan the materials requirements for the job.*
  - *Unlike Parts List BOMs, the EPL can have materials copied onto the WO Parts list on more than one occasion, and parts may be selected from EPLs associated with child equipment of the equipment number on the work order.*
  - *While Parts List BOMs may be included in an EPL, it is recommended to use EPLs in place of Parts List BOMs in most cases.*

Bill of Materials (BOMs) can be categorized to two unique types, the classic BOM that is attached to a virtual Inventory Item header that is then attached to the equipment or a PM Model, and Equipment Parts Lists that are attached directly to the equipment.

- ***Equipment Parts lists (EPLs)*** *- These parts should be the list of common replaceable items required for maintaining the asset and can be made up of single level with a list of Inventory items, or may include BOMs or Multi level BOMs. This should be considered the equipment specific list of parts from which parts can be assigned at time of planning. PM BOMs are not usually included in an EPL, since the parts contained in the BOM would usually be redundant to the list on the EPL. During WO Planning, parts may be selected from those attached to the EPL for the equipment number on the WO, and also from the EPLs connected to equipment that are children (in the equipment hierarchy) of the equipment number on the WO.*

Business Process – EPL and BOM Creation

Equipment Parts Lists (EPL's)

EPL creation consists of several steps:

- *Assess which assets require an EPL. Base the order of priority for EPL creation on the criticality ranking of the assets. Every critical equipment must have a EPL. All other equipment should have one. These should be developed in order of priority based on the criticality ranking.*
- *Determine what items should be on the BOM: In general, any spare parts or components for which there is a reasonable expectation of being repaired or replaced as a result of a preventive maintenance (PM) or repair maintenance work order should be included on the BOM. At a minimum, the BOM should reflect any item identified as a critical spare. In addition, the BOM should include any other materials used directly to repair the equipment, or any item for which it is necessary or beneficial to have usage history tied to the asset in the CMMS.*
  - *Items that typically don't need to appear in the BOM include consumables and free-issue material, expense materials (rags, disposable overalls, etc.) and personal protective equipment.*

Determine what data should be on the EPL: Some of the EPL data will default from the fields available on the Inventory Item Branch record.

- *For items with an inventory item number, the following elements should be considered the minimum required:*
  - *Inventory Item Number*
  - *Quantity*
- *For items with no inventory item number, the following elements should be considered the minimum required:*
  - *Inventory Item Number*
  - *Quantity*
  - *Description (properly formatted)*
  - *Unit of measurement*
  - *Manufacturer / Manufacturer's part number*
  - *Preferred supplier / Supplier's part number*
  - *Substitutes (whether allowed, and if so, manufacturer / Part Number)*

The data may come from a variety of sources, but the list of parts by equipment number is usually coordinated by a site Planner but may need assistance or approval by the Plant Engineer / Asset Specialists.

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For brown field sites where OEM information cannot be found possible sources for the information include the Vendor, Tradesmen, Plant Engineer / Asset Specialist, and purchasing history. The most important thing is not where the data comes from, but whether it is accurate.

EPL Management

Several types of events can necessitate EPL modifications. Once an EPL is created, it must be updated as necessary and reviewed periodically to ensure its continued accuracy. For example, the same EPL may have originally been attached to several pieces of equipment, but over time, parts substitutions have been done, necessitating creation of separate EPLs for each equipment. Also, often the parts specifications may change (i.e. substitute a Viton O-ring for a Buna-N O-ring) which would require an EPL update.

Consider the following:

- *Decommissioning*
- *Design changes*
- *Part substitution/standardization*

EPL review: The EPL is one of the principal tools used by the planner to properly plan work orders. As a result, the planner is the primary user of the EPL, and, therefore, is in the best position to monitor data accuracy. Periodic reviews should be done over time to assess the validity of these EPL's. In most cases, the planner will have the authority to document and make necessary corrections to the EPL's in the CMMS.

On the retirement of equipment, or during reviews of inventory spares requirements, the EPL "Where Used" inquiry should be used to identify on which equipment the spares under consideration are used.

Bills of Material (BOMs)

PM BOMs should always be created for Preventive Maintenance (PM) jobs, with Standard Labour Instructions and where appropriate, a list of Standard Parts for the job scope defined on the PM's Model WO.

Parts List BOMs should be created only in exceptional circumstances, where it is necessary to break an EPL down into groups of components and child equipment does not exist to which the EPL sub-component lists can be attached.

PM BOM creation consists of several steps:

- *First, the virtual BOM Header record must be created.*
- *Attach the PM BOM Header to the PM's Model WO.*
- *Attach to the PM BOM header the standard Instructions and Standard Labour specific to the job scope identified on the Model WO.*

- o *Items that typically don't need to appear in the PM BOM include consumables and free-issue material, expense materials (rags, disposable overalls, etc.) and personal protective equipment.*

Several types of events can necessitate BOM modifications. Once a BOM is created, it must be updated as necessary and reviewed periodically to ensure its continued accuracy. For example, the same PM BOM may have originally been attached to several Model WO's, but over time, parts substitutions have been done, necessitating creation of separate PM BOM's for each PM service. Also, often the parts specifications may change (i.e. substitute a Viton O-ring for a Buna-N O-ring) which would require an EPL update.

- • *Consider the following:*
  - o *Decommissioning*
  - o *Design changes*
  - o *Part substitution/standardization*
- • *PM BOM review: The PM BOM is one of the principal tools used by the planner to properly plan work orders with a recurring scope, principally PM WO's. As a result, the planner is the primary user of the PM BOML, and, therefore, is in the best position to monitor data accuracy. Periodic reviews should be done over time to assess the validity of these PM BOM's, and feedback from those executing the work will also be a source of required updates. In most cases, the planner will have the authority to document and make necessary corrections to the PM BOM's in the CMMS.*
- • *On the retirement of equipment, or during reviews of inventory spares requirements, the BOM "Where Used" report should be used to identify on which equipment and for which PM services the spares under consideration are used.*

BOM & EPL Metrics

- • *EPL completion: This is no more than a measure of whether an EPL exists in the CMMS for each functional equipment. The goal should be 100 percent for all critical equipment and 95 percent for others.*
- • *EPL accuracy: It usually reflects data captured during periodic reviews.*
- • *PM BOMs and Parts List BOMs are created in accordance with Naming Convention.*
- • *All PM's have a Model WO with an attached BOM Header, and the BOM contains at a minimum the Standard Labour Instructions (Labour Estimate) with the appropriate steps and durations for completing the defined job scope as defined on the Model WO.*
- • *Where appropriate, parts (stock and non-stock) are included on the PM BOMs in the Standard Parts Lists.*

BOM and EPL Benefits

The direct and indirect benefits of accurate EPLs and BOMs can be difficult to quantify, but aren't difficult to delineate.

- *Fewer incorrect material purchases: By utilizing the information contained in the EPL or BOM to generate purchase requisitions, there is less of an opportunity for guesswork, variation or errors in the transmission of material requirement data to suppliers.*
- *Faster execution of planned work: Accurate EPLs and BOMs reduce the amount of time spent researching required materials. This helps to streamline the planning and procurement processes, which in turn reduces the length of time required to obtain the necessary parts to complete the job. This allows faster execution of equipment PMs or CMs and gets equipment back on line sooner.*
- *Faster execution of unplanned work: An effective EPL or BOM provides craftsmen with quick access to accurate part requirements and descriptions in an emergency situation. Combined with a reliable inventory control system, craftsmen can quickly determine the on-hand quantity and location of available parts in stock. Should insufficient inventory be available, the BOM or EPL can also provide valuable manufacturer and supplier details to facilitate expedited procurement.*
- *Disposition of inactive inventory: Use EPLs or BOMs to determine whether a non-moving inventory item is required for an active asset.*
- *More effective reliability engineering: Use EPLs or BOMs to identify similar items or equipment where individual materials can be standardized or substituted.*
- *The CMMS will provide the capability to do an inverse examination of BOM data. Rather than querying an asset to see what parts are listed on the EPL or BOM, the system allows a query or report on a part and displays all the EPLs or BOMs where it is listed. This "where used" capability provides a tool for determining the impact of decommissioning and design changes on the continued need for specific material items.*
- *Critical Spares analysis is facilitated by accurate EPLs and BOMs. Critical Spares are identified on the Inventory Branch record.*

SUMMARY

As a rule, the Asset Specialist or Plant Engineer is primarily responsible for providing initial BOM information and all engineering-driven changes. The planner is responsible for ensuring BOM accuracy. But the key to overall BOM effectiveness is to recognize that data creation and maintenance is a collaborative process that requires teamwork and communication.

BOM Naming Convention

This section applies to BOMs that are based on Inventory Item Master "Header" records, and does not apply to Equipment Parts Lists (EPLs – P13017)) that are directly linked to an asset record without using a "BOM Header" record.

Parts List BOMs

The BOM Naming Standard suggested for BOMs that are solely for Equipment Parts (and not for Preventive Maintenance jobs (PMs)) is as follows: BOMLOCDESCRIPTION, where the total number of characters in the alpha-numeric name does not exceed 26. Different Standards are allowable in different areas.

All BOM Inventory Item Masters for equipment parts list (not PM) BOMs start with "BOM". The "BOM" will be followed by the three digit Location Code from the Address Book Standards. No spaces, dashes, or other special characters shall be used in the first six characters. The remaining 20 characters should be used for a clear text description of the BOM.

The first six characters should also be the first nine characters of both the Description field and the Search Text field in the item master. Note: the search text field for BOMs is 30 characters and should clearly describe the equipment for which the bill of material was created.

PM BOMs

The BOM Naming Standard suggested for BOMs that are solely for Preventive Maintenance jobs (PMs) is as follows: PMBOMLOCDESCRIPTION, where the total number of characters in the alpha-numeric name does not exceed 26. Different Standards are allowable in different areas.

All BOM Inventory Item Masters PM BOMs start with "PMBOM". The "PMBOM" will be followed by the three digit Location Code (refer to the Appendix in the Equipment Procedure). If the PM BOM is common to multiple sites, then use some agreed generic designator (i.e. like "TRO" or "TRON") or use a higher level area designator (i.e. "BDE" for work managed out of BDE). No spaces, dashes, or other special characters shall be used in the first eight characters. The remaining 18 characters may be used for a clear text description of the PM for which the BOM is created. It has been found useful to identify in the PM BOM number the Model Work Order Number to which the PM BOM is to be attached, since this clearly cross references that PM Master file and the Inventory Master file.

The first six characters should also be the first characters of both the Description field and the Search Text field in the item master. Note: the search text field for BOMs is 30 characters and should clearly describe the equipment for which the bill of material was created.

Approvals

	(name)	(signature)	(yyyy/mm/dd)
	(name)	(signature)	(yyyy/mm/dd)

Appendix I – Definitions and Business Rules

<< Add any agree upon business rules or definition associated to the business processes.>>

Business Process

Scheduling - The following sample business process provides only the first level of detail Information on the groups or individual positions, their associated tasks (steps) in the process and high level descriptions for each step.

Role	Step ID	Step Title	Step Description
	BM 1.10	Operational Readiness Process	Proceed to – Operational Readiness Process
	BM 1.11	PM/RCM Strategy for Assets	During your design process – identify PM requirements as well as Standard Job requirements that may not be triggered by a "time" or "meter" based even. Forward all Equipment Parts list requirements, PM, Standard Jobs and OEM Repair Manuals/Requirements to local Planning Group.
Long Term Asset Planner	BM 1.12	Spare Parts Assessment for Assets	Both the PM/RCM strategy and the Manufactures parts recommendations are required for this assessment. It is from this assessment that the Asset Specialists will assess the requirement for additional inventory parts to be assigned to their warehouses. This should include a yearly consumption assessment, required hold quantity, and if these parts are required to be stocked or be an order on request part.
	BM 1.13	Request for Inventory	Follow standard Nalcor "Request for Inventory" policies.
Inventory Control	BM 2.10	Create Inventory	Follow standard Nalcor "Create Inventory" Process
	BM 2.11	Notify Planner Group	Once the appropriate parts have be created in local warehouse forward the completed warehouse request to the Local Planning Group.
Planners	BM 3.00	Planning Group Assessment	Local Planning Department will receive appropriate documentation from Asset Specialists and assess the requirements for: • Equipment parts lists • Equipment BOM's • BOM for Standard Jobs and PM requirements. Many CMMS systems have many ways of tracking Equipment Parts list, some require a BOM created that is attached to the Asset, and others are directly attached to the asset. Equipment parts list are the Equipment's "shopping list", Equipment parts lists or BOM's, do not hold Labour requirements. This is the first building block for the Planner, and should be a primary focus when designing your system. It is important to assess the tractability or traceability that either way will may give you.

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Role	Step ID	Step Title	Step Description
			PM and Standard Job requirements, will have both the appropriate Labour requirements as well as Parts requirements and standard "PM Procedures" should be followed. Standard Jobs can be taken down only to the BOM level but may have association with standard PM Job that would require a Model Work Order Created. While PM requirements need the creation of Model work. *Policy should be considered for the management of Standard non Metered or Timed event should be used.*
	BM 3.10	Create Equipment Parts List (no BOM required)	Call up your equipment parts program; attach required parts and quantities to equipment record.
Planners – Equipment Parts List	BM 3.11	Add Inventory or Lower level BOM to Parts list	From the requirement gathering – add the following • Inventory Requirement – add part and quantity • Kit or Component level BOM – Component level BOM can be created to reflect major components. These component level BOM's usually are established where common components common through multiple units. Component level kits normally are named or numbered to reflect a Manufacturing spec for this component. • Non Catalogued parts – these are parts that do not have a company Inventory Item number. Normally if parts are identified for a Parts list it will be reordered it should be identified in your Warehouse list. ** Policy should be defined. *You will need to know how your system will hold nonstock parts, and order on request parts, and non-catalogued parts (some systems do not require a Company Part number and a policy should be written on how to handle these).*
	BM 3.20	Create BOM for Equipment Parts	Follow current "BOM Creation Procedure" *BOM for Equipment Parts list normally will be made as a one to one to the equipment*

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Role	Step ID	Step Title	Step Description
Planner – Equipment BOM			*and reflect the same Unit number identifier. Company Policies should be created for this.* `
	BM 3.21	Add Parts	Equipment BOM need to be created for the Branch Plant or Warehouse in which you source your materials and can have the following attached. • Inventory Requirement – add part and quantity • Kit or Component level BOM – Component level BOM can be created to reflect major components. These component level BOM's usually are established where common components common through multiple units. Component level kits normally are named or numbered to reflect a Manufacturing spec for this component. Normally these BOM's will copy or can be copied to the Corrective work orders – it is at this time the planner will have the visibility of what is held in this BOM, and determine if they would like to change the work order to the lower level kit. It should be noted that these BOM without a break levels for a high level equipment can get large and unmanageable. *Equipment BOM do not hold labour instructions just the Parts Requirements.*
	BM 3.22	Update Equipment Record	Once the parts list or BOM is completed – Update Equipment record with BOM number and Save.
Planner Standard Job BOM	BM 3.30	Create BOM for Standard Job / PM	Follow current "BOM Creation Procedure" *BOM for Standard Job / PM, normally have the service type or Model work order number Identified in the Numbering convention. Company Policies should be created for this* Considerations for Standard Job BOM: BOM's for Standard Job can just be left at the BOM level if desired without creating a Model Work Order, and this can be used for when managing the work order. The BOM

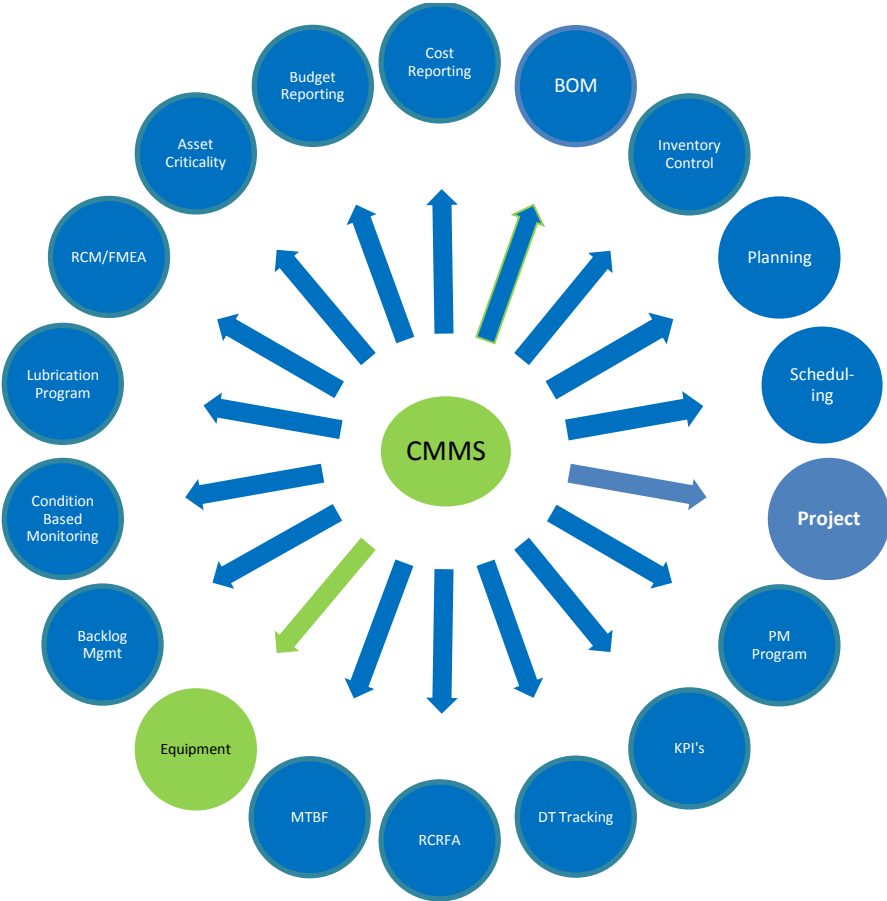| Role	Step ID	Step Title	Step Description
			can hold both the Parts and Labour requirements for this Task driven BOM, but recommending taking these events to Model Jobs.
			The missing in leaving it at the BOM level is that in most cases it is hard to find as well as not having the ability to fully describe the Task and Procedures for the completion of the job. These Models would be set up in the PM system without a Meter or time event that allows the generation of these jobs to be Conditional.
			Consideration for PM BOM
			In many cases these BOM are used incorrectly and hold to many parts or labour requirements, theses should not be used as catch alls. The PM BOM and its set up is the bases for parts commitment, and Forecasting. PM should be a specific set of task and with agreed upon parts requirement.
	BM 3.31	Add Parts Requirement	Add parts requirements
	BM 3.32	Add Labour Requirement	Add Labour requirements
			If you are only creating BOM for Standard Parts the process ends here.
	BM 3.33	Create Model Job	Use Nalcor "Model Work Order Creation"
	BM 3.34	Create PM Schedule	Use Nalcor "Creating a PM Schedule

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Corporate Business System - ERP Assessment

Business Process Document

Create and Manage Equipment Records

December/2016

Version	Date	Description of Revision	Author
	2016-12-20	Updated after process review	S. McCarthy

Contents

Purpose

The Manage Equipment Process covers several sub-processes, including:

- Setting up Functional Equipment Groups
- Creating Equipment and Fixed Asset Records
- Creating New Equipment from a Capital Project
- Setting up Equipment Hierarchies (Parent-Child Relationships)
- Defining Asset Criticality
- Changing Equipment Details
- Swapping out Rotable Equipment
- Transferring Equipment locations and Business Units
- Retiring / Disposing of Equipment

Background

Asset Hierarchy

In 2011, an effort was in progress to create standard asset hierarchies. "*The hierarchy is the actual decomposition or disaggregation of plants, facilities, lines, etc. into increasingly smaller systems and elements until a level is reached that meets both financial and maintenance needs. The registry of each asset in this hierarchy represents the one to one file containing all required asset information to support financial and maintenance needs. The application of prioritized condition assessments on these assets based on criticality and preliminary condition assessments are key inputs to a robust long term asset management plan.*" Standard Hierarchies by system are shown in Appendix 3.

Functional Equipment Groups (FEGs)

A Functional Equipment (FE) is a group of equipment components that in their operating context perform or support a defined function. The boundary of the FE is drawn based on the border of the function. The FE process also supports consistent determination of equipment criticality. Maintenance groups think of equipment in terms of the ability to maintain a "function". For example, the function of a pump may be "to move water at up to 70°F from the sump to a storage tank at a rate of 30 USGPM, in the presence of a spare installed pump with automatic transfer". The FE would include the power supply, local controls, the motor, coupling, and pump.

While a Functional Equipment represents a specific group of assets or components, a FEG is a high level categorization of FE's by physical characteristics or design (i.e. Pumps, Heat Exchanger, Distribution Line). In the JD Edwards EnterpriseOne (JDE E1) software, the available selections of Failure Analysis Codes are specific to the FEG codes assigned to the equipment record. The FEG code is assigned in the fields called "Product Model" and "Product Family", which respectively are "Equipment Sub-Type" and "Equipment Type".

Functional Equipment is therefore usually equipment against which Work Orders are desired. Whether Work Orders are possible depends on two criteria:

- The asset record must also have an "Equipment" record (i.e. Both an F1201 and a F1217 record).
- The asset record must be coded to allow Work Orders (i.e. F1201:WOYN = Y).

How to code the equipment for Type and sub-type (i.e. Product Family and Product Model) and how to code the WOYN (i/e/ Work Order Allowed) field are shown in Appendix 3.

Equipment Master Records in JD Edwards EnterpriseOne (JDE E1)

The terms, "Asset". "Fixed Asset", and "Equipment" are often used interchangeably. The distinction, going forward, will be as follows:

- A Fixed Asset currently represents a depreciable asset created through a project.
- An Asset may or may not be a depreciable asset. Many asset records are created in JDE E1 to represent higher level "system" equipment needed to build the asset hierarchy. Many asset records are created for lower level equipment used to define the equipment but which may or may not be used on Work Orders.
- A Equipment record is an asset for which it is desired to create work orders. Functional Equipment is defined previously. If it is desired to create Work Orders for an equipment, then the equipment must have an FEG code (i.e. Equipment Type (Product Family) and Equipment Sub-Type (Product Model)).

A single functional equipment may be represented by many fixed assets, or vice versa. The rationale for having both Fixed Assets and Functional Equipment in the same asset hierarchy is that this makes it easier to keep fixed asset records in line with the facts on the ground.

In JDE E1 software, the FEG codes establish a hierarchy that supports several processes, including some that are not currently performed:

- Failure Analysis by Equipment Type – supported by JD Edwards E1 software's Failure Analysis functionality.
- Cost Analysis by Equipment Type – supported by JD Edwards E1 software's Equipment Cost Analysis (ECA) functionality.

Asset Criticality

In 2011, a Nalcor Criticality Assessment standard was published, requiring that "*the line of business plant/facility(s) rates their own maintainable equipment/assets in order of importance to the business*". The Asset Criticality assessment at the time was supported by a process led by a consulting company and resulted in the analysis results being captured on spreadsheets. The results have not been entered on the equipment records. The focus of the Asset Criticality effort was toward Long Term Asset Planning; discussions with plant and area personnel have revealed that this is still the common belief.

Asset Criticality is a useful benchmark for various metrics, given that the efforts of maintenance program analysis and improvement should focus primarily on the most critical assets. The asset criticality ranking should be included as a category code on the equipment record, but should not be carried across to the work order, nor should the asset criticality be used in work order prioritization.

Control of Equipment Records

Equipment records consist of a number of fields, in which both field values and the options available are the responsibility of various groups, including Fixed Assets, Cost of Service, and of course Asset Owners.

In JDE E1 software there is scope to allow multiple groups control of elements of the asset and equipment records or parts thereof through security. That is, JDE E1 security will allow Maintenance to change "Maintenance only" codes and fields, while protecting those fields of importance to Fixed Assets. As well, in JDE E1 software the "fixed asset only" records can be inhibited so that users can be prevented from creating work orders against them.

Equipment Locations

In JDE World software and for Fixed Assets in JD Edwards E1 software, the equipment location is tracked using a Location Code, which is actually a Business Unit (BU) type "LC". In JD Edwards E1 software the BU location is not much used for Equipment, but is still used by Fixed Assets. The Location tracking functionality has been supplemented for JDE E1 Equipment records through the use of Address Book Locations, which have repurposed existing Address Book fields in the Asset Master as "Location" fields called "Customer" and "Site" (F1201:LANO & F1201:AN8). Full history tracking is turned on for the Address Book locations, same as for BU Locations.

Typically, Address Book Locations are defined down to the system or sub-system level within a cost "Responsible BU", which provides a handy way to search for and summarize equipment history and cost.

Equipment Description Convention

This section does not apply to financial fixed assets that are created for Finance purposes only.

The name or description for <u>functional</u> equipment should follow the Noun, Modifier Format. Noun denotes the equipment type while the modifier denotes the service of the equipment. There are three (3) equipment description fields in E1.

A functional equipment such as a boiler feed pump, for example, may contain multiple components such as motors and control valves. The main item of equipment is the pump itself, so while the Description 1 field will identify the whole Functional Equipment assembly, the Description 2 field will provide pump information.

1. **Asset Description (Description 1)**: NOUN SERVICE LOCATION, e.g. PUMP BOILER FEED 3W
2. **Description 2**: MANUFACTURER MODEL e.g. BINGHAM 8 X 10 MULTISTAGE
3. **Description 3**: Operations' Equipment Name or how the equipment is called by the operators e.g. FEED PUMP 3 WEST

F1201

Element	Description	Type	Length
DL01	**Description**	Alpha Numeric	30
DL02	**Description 02**	Alpha Numeric	30
DL03	**Description 03**	Alpha Numeric	30

Equipment descriptions shall be entered in Upper Case letters with no special characters or punctuation. Spaces are allowed. Commas and Asterisks are forbidden.

Equipment Numbering Convention

This section does not apply to financial fixed assets that are created for Finance purposes only. This is because a "Finance only" asset record may only be assigned an Asset Number and neither a Unit Number nor a Serial Number.

There are three (3) equipment number fields in E1.

1. Asset Number: In JDE E1 software, this is the primary asset designator and it will always be the number used by the JDE E1 software as the unique key field for locating records.
2. Unit Number: The Unit Number is optional. If Unit numbers are input, since there is a technical requirement for the values in this field to be unique, then the Unit Number should be given a prefix location code (using the standard location abbreviation list in Appendix 4).
3. Equipment Number: The Equipment Number will be the primary equipment designator for functional equipment. As such, it will appear in all screens instead of the Asset Number. Where no Equipment Number is assigned manually, the Asset Number is used by default. The standard is to input in this field the equipment number as identified on the process flow diagrams, or the number that is commonly used by Maintainers and Operators to identify the equipment (e.g. HRDBFP3W). Since there is a requirement for the values in this field to be unique within Product Model / Product Family (PM-PF) combinations, then where there may be duplicates the Equipment Number should be prefixed by a location code (using the standard location abbreviation list in Appendix 4). An example exception to using the standard location designations for the prefix is Transmission lines, where the Line Number (i.e. TL236) meets the need.

Equipment Numbers shall be entered in Upper Case with no special characters or punctuation. Spaces are discouraged.

F1201

Element	Description	Type	Length
NUMB	Asset Number	Signed Numeric	8
APID	Unit Number	Alpha Numeric	12

ASID	Equipment Number	Alpha Numeric	25

Since when equipment is disposed or relocated the function of the equipment remains, equipment that replaces the moved or disposed equipment shall have the same Equipment Number applied as was used on the previous equipment. The Equipment Number field needs to be cleared or changed on the previously installed equipment.

Should it be desired to record the Manufacturer's Serial Number, and since Manufacturer's Serial Numbers are not unique across all Manufacturers, the new Serial Number field (F1201:KITL) field on the equipment master will be used. This is a 25 character field that will accept manual input.

Equipment Disposal or Replacement

Equipment that has been retired or removed from service must be identified as disposed in the equipment database so that no further charges will accrue to those equipment records. This activity is undertaken whenever an asset is retired or removed from service.

As part of disposing or replacing an asset there are various activities which need to be performed. An asset registered in E1 which has been physically retired and/or disposed of, must be marked in the asset database so that no further charges will be accrued to that asset record.

It is rare that the functional equipment record itself is being retired, since the functional equipment does not usually coincide with a depreciable asset record. If the asset being retired is also an equipment, then Work Orders, Inventory parts and PM Services associated with the equipment must also be removed or re-directed.

- Equipment
    - Change the description and Equipment Status
    - Check if equipment being disposed has any children in the hierarchical structure. If any exist, remove or relocate child equipment.
    - Supplemental or Specification Data may need to be entered for the replacement asset.
- Work Orders
    - Check if there are any outstanding work orders for the Equipment which is to be disposed. If some exist, evaluate need to complete or cancel.
- PM Services
    - Check if any PM Service types are registered against the equipment. If any exist, delete. Set the PM Services up against the replacement equipment if appropriate.
- Inventory Items
    - Check to find out if any inventory items are stocked solely for this equipment or if the number of equipments or services that use the parts is reduced, consider analysis of stock holdings for inventory reduction.
    - Delete equipment BOM components (F3002) and/or equipment parts list components.

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Business Processes

Setting up Functional Equipment Groups and Failure Component Codes

Creating New Combined Equipment and Fixed Asset Records

7

Process Step	Description
START – EQUIPMENT "DISCOVERED". NO EQUIP. RECORD	
47.0 DEFINE EQUIP MAINTENANCE STRATEGY; IDENTIFY TASKS; DEFINE CODES; SET UP EQUIP IN CMMS. SET UP PMs & STANDARD JOBS	
END DISCOVERED	
46.1 CREATE VIRTUAL NON-DEPRECIABLE ASSET AND THEN CREATE EQUIPMENT RECORD ON THE FIXED ASSET RECORD.	
46.0 CREATE EQUIPMENT RECORD TAG FILE ON FIXED ASSET RECORD.	
45.0 ADDRESS BOOK ADD/ CHANGE SUB-PROCESS	

THERE IS AN EXISTING FA RECORD SPECIFIC TO THE EQUIP. FUNCTION WITH THE CORRECT PARENT ASSET #. AB LOCATION EXISTS

NO EXISTING FIXED ASSET SPECIFIC TO EQUIP. FUNCTION

CHANGE TO AB LOCATION OR NEW AB NUMBER NEEDED

EXIST. FA RECORD

NO EXIST FA RECORD

Asset Owner

ADDRESS BOOK MASTER OWNER

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Creating New Equipment from a Capital Project

	Process flow diagram

FIXED ASSETS

20.0 CREATE FA. EQUIPMENT DESCRIPTION DIFFERENT THAN PHYSICAL EQUIP. ASSIGN ORIGINAL PARENT ASSET #.

END NEW PROJECT. NO NEW EQUIP.

22.0 CREATE FA. UPDATE EQUIPMENT DESCRIPTION, RESPONSIBLE BU AS REQ'D.

Asset Owner

NO NEW PHYSICAL PROPERTY CREATED I.E. STUDY OR OVERHAUL

23.0 DEFINE MAINTENANCE STRATEGY FOR EQP.
IDENTIFY TASKS & SPARES.
23.1 DEFINE EQUIPMENT CRITICALITY
23.2 SET UP PM ROUTINES FOR PMs & STANDARD JOBS
24.0 CREATE EQUIPMENT RECORD TAG FILE ON FIXED ASSET RECORD, UPDATE "MAINTENANCE ONLY" CATEGORY CODES, METER, OR WO Y/N CODES ON EQUIP.RECORD

END NEW PROJECT

Project Engineer

PHYSICAL EQUIP. REPLACED. EXISTING FIXED ASSET SPECIFIC TO EQUIP. FUNCTION, WITH EXISTING EQUIPMENT RECORD

21.1 INITIATE RETIRE ASSET PROCESS. SWAP OUT EQUIP. RECORD.

21.2 INITIATE RETIRE ASSET PROCESS. SWAP OUT FA RECORD.

PHYSICAL EQUIP. REPLACED. EXISTING FIXED ASSET SPECIFIC TO EQUIP. FUNCTION WITH THE CORRECT PARENT ASSET #, WITH NO EQUIP. RECORD

NO EXISTING FIXED ASSET SPECIFIC TO EQUIP. FUNCTION

START – NEW EQUIPMENT FROM PROJECT

Changing Equipment Details

ADDRESS BOOK MASTER OWNER	Asset Owner	FIXED ASSETS

START – CHANGE TO EXISTING ASSET/ EQUIPMENT. NOT TRANSFER

35.0 ADDRESS BOOK NUMBER CHANGE OR UPDATE NEEDED ON EQUIPMENT RECORD

CHANGE TO AB OR NEW AB NUMBER NEEDED

36.0 ADDRESS BOOK ADD/ CHANGE SUB-PROCESS

35.1 UPDATE EQUIPMENT RECORD (LANO & AN8) WITH NEW AB#

35.2 UPDATE "MAINTENANCE ONLY" CATEGORY CODES, METER, OR WO Y/N CODES ON EQUIP. RECORD

Update to Fixed Assets Controlled Field(s); Or Disposal

Changes to non-FA-Controlled Fields on Asset/ Equip. record

35.3 CHANGE ASSET/EQUIPMENT RECORD AS REQ'D.

END CHANGE

37.0 CHANGE EQUIP. CODE 1/2; AFE#; DEPRECIATION ACCT; COMPANY

END CHANGE

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Transferring Equipment locations and Business Units

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Retiring / Disposing of Equipment

PROJECT ENGINEER	FIXED ASSETS	Asset Owner

40.0 NOTIFY FIXED ASSETS AND ASSET MANAGER

START – EXISTING EQUIPMENT TO BE DISPOSED AS A RESULT OF PROJECT

START – EXISTING EQUIPMENT TO BE DISPOSED

41.0 FA DISPOSAL SUB-PROCESS.

NOTIFY FIXED ASSETS

END EQUIP. DISPOSAL

42.0 UPDATE "MAINTENANCE ONLY" CATEGORY CODES, METER, OR WO Y/N CODES ON EQUIP. RECORD

42.1 CHANGE EQUIPMENT DESCRIPTION TO "DISPOSED", EQUIP. STATUS TO APPROPRIATE DISPOSED CODE. CHANGE PARENT ASSET # AS REQ'D.

42.2 REVIEW SPARE PARTS HOLDINGS AS A RESULT OF EQUIPMENT DISPOSAL

42.3 TURN OFF PM SCHEDULES & PM LOOPS AS A RESULT OF EQUIP. DISPOSAL

42.4 CLOSE OUTSTANDING WORK ORDERS ON DISPOSED EQUIP.

Replacing Assets that are Also Inventory Items

Metrics for Create & Manage Equipment Records Processes

- Number of Criticality Assessments Completed
  - Number of equipment records, including neither records that are solely Financial fixed assets nor disposed equipment, for which a criticality assessment has been completed, the result entered as a category code on the equipment record, and the assessment worksheet attached to the equipment record.
- Active Equipment Count
  - Total count of equipment records, including neither records that are solely Financial fixed assets nor disposed equipment, that require a criticality assessment.
- Critical Equipment Count
  - Total count of equipment records, including neither records that are solely Financial fixed assets nor disposed equipment, that are identified as Most Critical.
  - Identify Critical Assets from the Criticality Worksheets and ensure that the equipment has the appropriate criticality ranking on the Equipment Master.
- Number of Equipment Parts Lists created
  - Total count of Most Critical equipment, including neither records that are solely Financial fixed assets nor disposed equipment, that have an Equipment Parts List (EPL) created containing more than one SKU (i.e. Item Master exists).
- Failure Analysis Tree Health
  - Number of Repair Work Orders completed during the month that have Component Code identified as "Other".
  - Number of Repair Work Orders completed during the month that do not have entries in each of the failure codes, or do not have a bottom level code specified.
- Number of improperly disposed equipment records
  - Equipment records that have the words "disposed" or "do not use" in the description fields, but are not at an equipment status used for a disposed code.
  - Disposed equipment records that do not have the description changed.
- Local procedure in place in agreement with Nalcor process and in standard format, with responsibilities assigned to positions. A RACI (Responsible, Accountable, Consulted, Informed) diagram is an example of an appropriate approach.
  - Local procedure is published and there is awareness of the procedure and its contents among the affected personnel and positions.
- BOMs that contain parts and are linked to disposed equipment or no equipment.
  - In support of inventory analysis, measures whether spare parts are disconnected from BOMs once the equipment is disposed. The "Where Used" report for BOMs identifies the BOM on which the part is used, and not the equipment on which the BOM is used. This measures whether Parts List BOMs are being cleared when equipment is disposed.
    - PM BOMs are excluded.

- This is not an issue for Equipment Parts Lists (EPL) since unlike the "BOM Where Used" report the Equipment is referenced directly on the "EPL Where Used" inquiry, with a description.

- Confirm that the lowest usual level of equipment for which work orders are allowed corresponds to the defined "Functional Equipment Groups" (FEGs). The process and system design is based on creating equipment records against which work orders may be created only at the "functional equipment" level, and not at the component level.

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Approvals

	(name)	(signature)	(yyyy/mm/dd)
	(name)	(signature)	(yyyy/mm/dd)

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Role	Step ID	Step Title	Step Description
Process			**Functional Equipment Group (FEG) Definition**
	1.0	DEFINE SYSTEM FUNCTIONS	The equipment function is the equipment type. Where Work Orders are permitted against the equipment, the equipment type shall be a type defined in the equipment type/sub-type codes (i.e. Product Family and Model). This assignment will drive analysis by equipment type and provide a equipment type specific tree of failure analysis codes to be applied to Repair Work Orders.
Long Term Asset Planning	2.0	DEFINE & REQUEST NEW EQUIPMENT TYPE/SUB-TYPE (PRODUCT FAMILY & MODEL) AND/OR CHANGES TO COMPONENT LIST	If the needed Product Family and Model code combination does not exist, then an application must be made to the Office of Asset Management for a new set of codes, and newly defined failure analysis code trees specific to the equipment type.

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Role	Step ID	Step Title	Step Description
Process			**Functional Equipment Group (FEG) Definition**
	3.0	APPROVE OR REJECT REQUEST	The Office of asset Management is the Owner of the Maintenance Business Processes, and has the responsibility to maintain conformity of use of the CMMS across Nalcor. The IT group is not responsible for approving the content of the codes, but the IT Asset Management BA should be consulted to ensure that integration points and arcane details of software functionality are considered.
OFFICE OF ASSET MANAGEMENT	3.1	SET A TEAM TO REVIEW REQUEST & REFINE LIST	The Office of asset Management may wish to form an ad-hoc committee of knowledge experts to review the proposed additions and changes to the Product Family and Model code combinations and develop the associated failure analysis codes, including the component list.
	3.2	IDENTIFY THE MAJOR COMPONENT OF THE FUNCTION	The Major Component is the newly proposed Product Model, i.e. "Pump Centrifugal Electric Motor drive"
	3.3	DEVELOP FEG COMPONENTS LIST	The Components List is the tree of components and sub-components of the defined Product Model, including all of the parts of the functional equipment group. For the electric motor driven centrifugal pump, this would include the power supply, local controls, valves, instrumentation, switches, the motor, coupling, and the pump itself. There also may be a gear-box or a VSD.

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Functional Equipment Group (FEG) Definition

Role	Step ID	Step Title	Step Description
Process			
	4.0	SET UP EQUIPMENT TYPE/SUB-TYPE (PRODUCT FAMILY & MODEL)	The Product Model and Family Code should be set up in the CMMS and linked to the Failure Analysis Code trees, so that the Failure Analysis codes specific to the defined Product Family/Model codes may be available when a Repair work order against that equipment is being processed.
ASSET MANAGEMENT BA (IT)	4.1	SET UP FAILURE ANALYSIS COMPONENT CODES	When approved, the Failure Analysis Codes should be set up in the CMMS.
Long Term Asset Planning	5.0 – 5.3	Continue with the equipment set-up.	Regardless of whether the equipment is shared with Fixed Assets, the maintenance strategy, equipment criticality, and PM routines and spare parts must be set up in the CMMS. Codes like the Product Family and Model are "Maintenance-Only" codes that can be updated without a need to get approval from Fixed Assets.

Role	Step ID	Step Title	Step Description
Process			**Creating New Equipment from a Capital Project**
	20.0	CREATE FIXED ASSET (FA). EQUIPMENT DESCRIPTION DIFFERENT THAN PHYSICAL EQUIP. ASSIGN ORIGINAL PARENT ASSET #.	If there is no new physical property created as a result of a capital project, for instance when a maintenance overhaul is capitalized, or a study done, then there is no need for Maintenance to see or have created an Equipment record. A Fixed Asset record may be created for the project if the cost is not going to be rolled into the existing asset (as at Q1 2015 it appears to be the practice to create separate fixed assets for all new work.) The asset's WO Allowed field (F1201:WOYN) should be set to NOT allow Work Orders.
Fixed Assets	22.0	CREATE FA. UPDATE EQUIPMENT DESCRIPTION, RESPONSIBLE BU AS REQ'D.	In the event that a fixed asset is replaced or a new fixed asset and unit of physical maintainable property is created, then one or many fixed asset records should be created, but only if the fixed asset record and the physical equipment record are to share the same F1201 Asset record (i.e. Poles have separate fixed asset and equipment (structure) records.) As well, if the fixed asset record and the physical equipment record are to share the same F1201 Asset record the Fixed Asset record must be created in accordance with the standard equipment hierarchies defined by the Office of Asset Management, and defined in accordance with the approved list of Equipment codes for Equipment type and sub-type, Product Model and Family.
Long Term Asset Planning --and-- Project Engineer	23.0 23.1 23.2	DEFINE MTCE. STRATEGY FOR EQP. IDENTIFY TASKS & SPARES. 23.1 DEFINE EQUIPMENT CRITICALITY 23.2 SET UP PM ROUTINES FOR PMs & STANDARD JOBS	On any new equipment, there are a number of hand-off activities that are the responsibility of the Project Engineer, among them is to work with the Plant Engineer or Asset Specialist to set up the appropriate maintenance program and spares, and to define the equipment criticality using the approved methodology.

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Creating New Equipment from a Capital Project

Role	Step ID	Step Title	Step Description
Process			
Project Engineer	21.1	INITIATE RETIRE ASSET PROCESS. SWAP OUT EQUIP. RECORD.	IF THE PHYSICAL EQUIP. IS REPLACED, AND THERE IS AN EXISTING FIXED ASSET SPECIFIC TO THE EQUIPMENT FUNCTION, WITH AN EXISTING EQUIPMENT RECORD, THEN THE BEST APPROACH IS TO SWAP OUT BOTH THE FIXED ASSET AND THE EQUIPMENT RECORD TOGETHER, AND REPLACE THEM WITH THE NEW ASSET/EQUIPMENT.
	21.2	INITIATE RETIRE ASSET PROCESS. SWAP OUT FA RECORD.	IF THE PHYSICAL EQUIP.IS REPLACED, AND THERE IS AN EXISTING FIXED ASSET SPECIFIC TO THE EQUIPMENT FUNCTION, WITHOUT AN EXISTING EQUIPMENT RECORD, BUT WITH THE CORRECT PARENT ASSET #, THEN THE BEST APPROACH IS TO SWAP OUT THE FIXED ASSET RECORD, AND REPLACE IT WITH THE NEW ASSET.
	24.0	CREATE EQUIPMENT RECORD TAG FILE ON FIXED ASSET RECORD, UPDATE "MAINTENANCE ONLY" CATEGORY CODES, METER, OR WO Y/N CODES ON EQUIP.RECORD	If in either of the previous two steps, a new fixed asset is created, then a corresponding Equipment record must be created. The category codes designed for Maintenance use must be filled. The meter and "Work Order Allowed" check boxes must be filled with the appropriate values.

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Role	Step ID	Step Title	Step Description
Process			**EQUIPMENT TRANSFER**
Long Term Asset Planning	30.0	UPDATE EQUIPMENT RECORD (LANO & AN8) WITH NEW AB#	WHEN EQUIPMENT IS TO BE TRANSFERRED WITHIN THE SAME COMPANY, BEYOND ANY DEPRECIATION ACCOUNT CHANGES, CHANGES ARE NEEDED TO SEVERAL OTHER ELEMENTS OFF THE EQUIPMENT RECORD: (1) SOME EQUIPMENT CATEGORY CODES; (2) BU LOCATION; AND (3) EQUIPMENT PARENT; (4) EQUIPMENT ADDRESS BOOK LOCATIONS; (5) PMS, (6) SPARE PARTS & BOMs.
	30.1	UPDATE "MAINTENANCE ONLY" CATEGORY CODES, METER, OR WO Y/N CODES ON EQUIP. RECORD	THE METER READINGS WILL STAY WITH THE EQUIPMENT WITHOUT ANY ADJUSTMENTS. THE PLANNER CODES OR ANY OTHERS SPECIFIC TO THE LOCATION OR SITE WILL HAVE TO BE ADJUSTED.
	30.2	CHANGE EQUIPMENT DESCRIPTION, RESPONSIBLE BU AS REQ'D.	IF THE EQUIPMENT IS VIRTUAL EQUIP. FOR MAINTENANCE PURPOSES ONLY (i.e. NOT A DEPRECIABLE FIXED ASSET), THEN THE DESCRIPTION WILL HAVE TO CHANGE, AND POSSIBLY THE RESPONSIBLE BUSINESS UNIT.
FIXED ASSETS	31.0	CHANGE EQUIPMENT DESCRIPTION, RESPONSIBLE BU AS REQ'D.	IF THE RECORD REPRESENTS BOTH A DEPRECIABLE FIXED ASSET AND A FUNCTIONAL EQUIPMENT, THEN TOO THEN THE DESCRIPTION WILL HAVE TO CHANGE, AND POSSIBLY THE RESPONSIBLE BUSINESS UNIT.
	31.1	CHANGE EQUIPMENT LOCATION BU.	IF THE RECORD REPRESENTS A DEPRECIABLE FIXED ASSET, THEN THE LOCATION BU MAY HAVE TO BE CHANGED AS WELL.

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Role	Step ID	Step Title	Step Description
Process			**RETIRING / DISPOSING OF EQUIPMENT**
PROJECT ENGINEER	40.0	NOTIFY FIXED ASSETS AND ASSET MANAGER	IF EXISTING EQUIPMENT IS TO BE DISPOSED AS A RESULT OF PROJECT, THEN THE RECORDS IN THE ERP SYSTEM MUST BE UPDATED. THE APPROPRIATE PERSONNEL MUST BE NOTIFIED IN FIXED ASSETS AND IN THE PLANTS OR AREAS.
FIXED ASSETS	41.0	FA DISPOSAL SUB-PROCESS.	IF THE EQUIP. IS BOTH FA DEPRECIABLE FIXED ASSET AND A FUNCTIONAL EQUIP. FOR MAINTENANCE PURPOSES, THEN CHANGE EQUIP. DESCRIPTION TO "DISPOSED", EQUIP. STATUS TO APPROPRIATE DISPOSED CODE. CHANGE PARENT ASSET # AS REQ'D.
Long Term Asset Planning	42.0	UPDATE "MAINT. ONLY" CATEGORY CODES, METER, OR WO Y/N CODES ON EQUIP. RECORD	REGARDLESS OF WHETHER THE EQUIPMENT IS A FIXED ASSET, EQUIPMENT OR BOTH, THE ASSET RECORD SHOULD BE ADJUSTED SO THAT IT IS OBVIOUS FROM ALL THE SEARCH SCREENS THAT THE EQUIPMENT HAS BEEN DISPOSED AND TO ENSURE THAT NO MORE WORK ORDERS CAN BE CREATED AGAINST IT.
	42.1	CHANGE EQUIPMENT DESCRIPTION, STATUS & PARENT ASSET #	IF THE EQUIPMENT RECORD IS A VIRTUAL EQUIPMENT FOR MAINTENANCE PURPOSES ONLY, THEN THE AREA PLANNER SHOULD BE ABLE TO ADJUST THE RECORD. CHANGE EQUIPMENT DESCRIPTION TO "DISPOSED", EQUIP. STATUS TO APPROPRIATE DISPOSED CODE. CHANGE PARENT ASSET # AS REQ'D. IF A FIXED ASSET IS BEING REPLACED, AND IT IS ALSO A FUNCTIONAL EQUIPMENT RECORD, REMOVE THE UNIT NUMBER (REPRESENTING THE EQUIPMENT NUMBER AS FOUND ON FLOW DIAGRAMS OR SINGLE LINE DIAGRAMS) FROM THE DISPOSED EQUIPMENT AND ENTER IT ON THE NEW EQUIPMENT. ALSO CHANGE THE 'WORK ORDER Y/N' CODE ON THE DISPOSED EQUIPMENT TO 'N'.
	42.2	REVIEW SPARE PARTS HOLDINGS	REVIEW SPARE PARTS HOLDINGS AS A RESULT OF EQUIPMENT DISPOSAL. REDUCING THE EXISTENCE OF OR QUANTITY OF EQUIPMENT SHOULD HAVE AN IMPACT ON SPARES HOLDINGS. THERE ARE "WHERE USED" REPORTS TO BE RUN FOR EACH OF THE SPARE PARTS HELD FOR THE DISPOSED EQUIPMENT. THIS REQUIRES THAT EQUIPMENT PARTS LISTS AND PM BOMS HAVE BEEN CREATED AND ENTERED IN THE CMMS.
	42.3	TURN OFF PMs	TURN OFF PM SCHEDULES & PM LOOPS AS A RESULT OF EQUIP. DISPOSAL
	42.4	CLOSE OUT-STANDING WOs ON DISPOSED EQUIP.	CLOSE OUT ANY WOs IN BACKLOG FOR THIS EQUIP.

Role	Step ID	Step Title	Step Description
Process			**Creating New Combined Equipment and Fixed Asset Records**
Long Term Asset Planning	46.0	CREATE EQUIPMENT RECORD TAG FILE ON FIXED ASSET RECORD.	IF THERE IS AN EXISTING FIXED ASSET RECORD SPECIFIC TO THE EQUIP. FUNCTION WITH THE CORRECT PARENT ASSET #, AND THE APPROPRIATE ADDRESS BOOK LOCATION ALREADY EXISTS, THEN THE EQUIPMENT RECORD CAN BE CREATED USING THE FIXED ASSET RECORD AS A BASE. ALSO, UPDATE "MAINTENANCE ONLY" CATEGORY CODES, AND THE CHECK BOXES FOR METER AND WO Y/N ON THE EQUIPMENT RECORD
	46.1	CREATE VIRTUAL NON-DEPRECIABLE EQUIPMENT RECORD.	IF THERE IS NO EXISTING FIXED ASSET SPECIFIC TO THE EQUIPMENT FUNCTION, THEN CREATE A VIRTUAL NON-DEPRECIABLE EQUIPMENT RECORD, FILLING ALL DESCRIPTION, FINANCIAL & CAT. CODES. ENTER PARENT ASSET #.
	47.0	DEFINE EQUIP MAINTENANCE STRATEG; IDENTIFY TASKS; DEFINE CODES; SET UP EQUIP IN CMMS. SET UP PMs & STANDARD JOBS	47.0 DEFINE MAINTENANCE STRATEGY FOR EQP. IDENTIFY TASKS. 47.1 DEFINE EQUIPMENT CRITICALITY 47.2 SET UP EQUIPMENT RECORD(S) IN CMMS. 47.3 SET UP PM ROUTINES FOR PMs & STANDARD JOBS
ADDRESS BOOK MASTER OWNER	45.0	ADDRESS BOOK ADD/CHANGE SUB-PROCESS	A CHANGE TO THE ADDRESS BOOK LOCATION MASTER (AB SEARCH TYPE 'MA' OR A NEW AB NUMBER MAY BE NEEDED TO APPROPRIATELY CATEGORIZE THE NEWLY DISCOVERED EQUIPMENT

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In this process, individual Units of Property are both Fixed Assets (quantity = 1) and also Inventory Items with separate Lot Numbers (Lot Quantity = 1). As such, they can be tracked in Inventory as well as being an Asset, from receipt in the warehouse through installation, disposal, and restock.

Role	Step ID	Step Title	Step Description
Process			**Replacing Asset that are also Inventory Items**
Maintenance Supervisor	RA 1.0	Mark Equipment Status of New Asset as "Asset Owner In Service"	In this scenario, as an example, a pole mounted transformer has been previously installed and is to be removed and replaced. The replacement transformer has an asset record and also has an inventory record, and is being issued from Stores. The Equipment Status "Asset Owner in Service" is recorded on the asset record by the Maintenance Supervisor to trigger action by Fixed Assets group to update the Asset record and begin depreciation.
	RA 1.1	Do Asset Swap	The Maintenance Supervisor can replace do an "asset swap" as part of changing the work order status. This removes the old asset and replaces it with the new asset. This process works best when dealing with Unit-of-property items like pole mounted transformers that are also inventory items. The transformers, when purchased, are already tagged with the transformer numbers. The extra configuration step when receiving the transformer from the vendor is to create both inventory records and individual, not group, asset records.
	RA 1.2	Preliminary evaluation of whether Removed Asset is Repairable	If the equipment is being upgraded (i.e. a 75 kVA transformer is replacing a 50 kVA transformer), then the removed 50 kVA unit may still be fit-for-service, and may still have a capital asset value.
ASSET OWNER	RA 2.0	Mark Equipment Status of Removed Asset as "Asset Owner Disposed Repair"	The Equipment Status "Asset Owner Disposed Repair" is recorded on the asset record by the Maintenance Supervisor to trigger action by Fixed Assets group to update the Asset record and cease depreciation by disposing of the asset.
	RA 2.1	Mark Equipment Status of Removed Asset as "Asset Owner Disposed Final"	The Equipment Status "Asset Owner Disposed Final" is recorded on the asset record by the Maintenance Supervisor to trigger action by Fixed Assets group to update the Asset record and cease depreciation by disposing of the asset.
	RA 2.2	Mark Equipment Status of Removed Asset as "Asset Owner Disposed Return to Inventory"	If the equipment is being upgraded (i.e. a 75 kVA transformer is replacing a 50 kVA transformer), then the removed 50 kVA unit may still be fit-for-service, and may still have a capital asset value. The Equipment Status "Asset Owner Disposed Return to Inventory" is recorded on the asset record by the Maintenance Supervisor to trigger action by Fixed Assets group to update the Asset record and cease depreciation by disposing of the asset.

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Role	Step ID	Step Title	Step Description
Process			**Replacing Asset that are also Inventory Items**
Maintenance Supervisor	RA 3.0	Physically tag and Return to Stores for Repair Assessment	There are a lot of items being shipped to warehouses. The tag will record details of why the item removed from service is being shipped and what is to be done with it when it arrives in the warehouse (i.e. dispose, environmental disposal, repair and restock, take back to inventory)
	RA 3.1	Physically tag and Return to Stores for Disposal or Environmental storage, as appropriate	See 3.0
	RA 3.2	Physically tag and Return to Inventory	See 3.0

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Replacing Asset that are also Inventory Items

Role	Step ID	Step Title	Step Description
Process			
Fixed Assets	RA 4.0	Start Depreciation. Change Equip. Status to "In Service"	The use of the equipment status "Asset Owner in Service" is the trigger for the Fixed Assets group to set up depreciation for the fixed asset.
	RA 4.1	Dispose at $0 value. Change Equip. Status to disposed	If the item removed from service is to be repaired, or just disposed, then it is to be disposed at $0 value. Using either the status "Asset Owner Disposed Final" or "Asset Owner Disposed Repair" will be the trigger for Fixed Assets to write off any remaining asset value.
	RA 4.2	Dispose at $0 value. Change Equip. Status to disposed	See 4.1
	RA 4.3	Define "Disposal" value and "Return to Inventory" Value. Change Equip. Status to disposed	Under IFRS rules, an asset, once installed, cannot be re-capitalized. This means that, for example, if a used transformer were used where the transformer had been capitalized in a different installation, then the labour to install the transformer the second time could not be capitalized. It is also important to know what inventory is available, so "ghost" or unofficial inventories are discouraged. If the item is just being put back in inventory, and it has remaining asset value, the Fixed Assets group may have to determine remaining asset value prior to receiving the item into Stores. Xxx the accounts needed for this transaction need to be defined. Xxx Remember to get a new asset set up for the item being returned to Stores.
Stores	RA 5.0	Repairable Spares Procedure	Remember to get an asset set up for the repaired item before it is returned to Stores..
	RA 5.1	Investment Recovery Process or Environmental Disposal as appropriate	Refer to the Inventory "Investment Recovery" process and the Environmental standards for disposal of contaminated materials.
	RA 5.2	Receive Into Inventory	The item, if fit-for-service, is taken back into inventory at the value defined by Fixed Assets and with a new associated asset.

Appendix I – Definitions and Business Rules

1. Work Orders will be created at the lowest available level in the equipment hierarchy that allows work orders.

2. Standard equipment hierarchies will be implemented for the equipment or type of operation involved.

3. The lowest level of equipment for which work orders are allowed shall correspond to the defined "Functional Equipment Groups" (FEGs).

4. Depreciable equipment cannot be transferred between companies without being disposed in the old company and created anew as a separate asset in the new company.

Appendix 2 – Nalcor Location Code Examples

- BDE   Bay D'Espoir
- BDEUNIT1   Bay D'Espoir Unit 1
- HLK   Hinds Lake
- CAT   Cat Arm
- CATUNIT1   Cat Arm Unit 1
- USL   Upper Salmon
- USLWSDAM   West Salmon Dam & Spillway
- CHF   Churchill Falls
- CHFUNIT4   Churchill Falls Unit 4
- BLATS   Bay L'Argent Terminal Station
- MDRTS   Massey Drive Terminal Station
- HBYTS   Hawkes Bay Terminal Station
- HBYDSLGEN   Hawkes Bay Diesel Plant
- HBYUNIT1   Hawkes Bay Diesel Generator Unit 1
- HBYDIST201   Hawkes Bay Distribution System 201
- SVLGTGEN   Stephenville Gas Turbine
- For Transmission Lines, just use the line number (i.e. TL236)
-

Appendix 3 – Standard Equipment Hierarchies and Type Coding

Supplemental Data on Assets that are children of Functional Equipment

Should it be desired to store specification or supplemental data against an asset record that is a child of a Functional Equipment, then it is convenient to use the same equipment application to see that asset as is used to view the parent Functional Equipment. In order to accomplish this, an equipment record (F1217) should be created for the asset containing the supplemental data and the "Allow WO?" (F1201:WOYN) field set to "N".

- The Customer and Site Address Book Location fields (F1201:LANO & F1201:AN8) should be set the same as the next immediate parent Functional Equipment in the asset hierarchy.
- The Product Model and Family fields can also be set the same as the next immediate parent Functional Equipment in the asset hierarchy.

Creating Equipment that are children of Functional Equipment

Should it be desired to create work orders at a level in the equipment hierarchy that is a child of a Functional Equipment, then this is possible, but not usually recommended. In order to accomplish this, an equipment record (F1217) should be created for the asset containing the supplemental data and the "Allow WO?" (F1201:WOYN) field set to "N".

- The Customer and Site Address Book Location fields (F1201:LANO & F1201:AN8) should be set the same as the next immediate parent Functional Equipment in the asset hierarchy.
- The Product Model and Family fields has to be set the same as the next immediate parent Functional Equipment in the asset hierarchy.

Product Model – Product Family Combinations

Product Family Code	Product Family Description	Product Model Code	Product Model Description	Component Tree Available?
SAUX	Auxiliary Systems/Equipment	SACSS	AC Station Service	
		SCMPA	Compressed Air System	
		SDCSS	DC Station Service	
PY	Building & Property	BGAH	Building - Accommodation & Housing	
		BGEE	Building - Equipment Enclosure	
		PYINTK	Intake Structure	
		PYPH	Powerhouse	
		PYPR	Property	
		PYWH	Warehouse	
SCMPA	Compressed Air System	ADRY	Air Dryer	
		ARECV	Air Receiver Tank	
		ACOMP	Compressor	

S	System	SPV	Pressure Vessel	
		SACC	Accumulator	
		SWT	Water Treatment System	
		SWWT	Waste Water Treatment System	
		SPIPING	Piping System	
		SENVM	Environmental Monitoring System	
		SAUX	Auxiliary Systems/Equipment	
		SCOMM	Communication System	
		SCLGW	Cooling Water Systems	
		SDIESL	Diesel System	
		SDIST	Distribution System	
		SEXCT	Excitation System	
		FPS	Fall Protection System	
		SFSS	Fire Sprinkler/Deluge System	
		SFWM	Fire Water Mains	
		SFGA	Gaseous Fire Suppression System	
		SCLRS	Generator Coolers	
		SGOV	Governor System	
		SGRD	Grounding System	
CE	**Control Equipment**	DVC	Distribution Voltage control	
CL	**Control Logic**	DCS	PLC/DCS/SCADA	
SDCSS	**DC Station Service**	SBATT	Battery System	
DP	**Diesel Plant**	DPE	Diesel Plant Equipment	
XFMRD	**Distribution Transformer**	XFDPM	Distribution Transformer - Pad Mount	
		XFDPL	Distribution Transformer - Pole Mount	
		XFSS	Station Service Transformer	
XFMRBD	Distribution Transformer Bank	XFDBPM	Distribution Transformer Bank - Pad Mount	
		XFDBPL	Distribution Transformer Bank - Pole Mount	

EG	**Electric Generator**	EGCT	Electric Generator - Combustion Turbine Driven	
		EGED	Electric Generator - Engine Driven	
		EGST	Electric Generator - Steam Turbine Driven	
		EGWT	Electric Generator - Water Turbine Driven	
		EGWNDT	Electric Generator - Wind Turbine Driven	
		HPVDC	125 VDC Systems	
		HPAUX	Auxiliary Equipment	
		HPCAP	Capital Spares	
		HPCMPA	Compressed Air	
		HPCLGW	Cooling Water Systems	
		HPEXCT	Excitation System	
		HPCLRS	Generator Coolers	
		HPGOV	Governor System	
		HPBRG	Main Generator Bearings	
		HPPNC	Protection and Controls	
		SAFE	Safety Equipment and Systems	
		HPSS	Station Service	
		HPTLS	Tools and Test Equipment	
		HPTRBN	Turbine System	
FS	**Fuel System**	FSHS	Fuel Storage & Handling System	
TLHV	**High Voltage Transmission Line**	TLSTR	Transmission Line Structure - Steel	
		TLSTRW	Transmission Line Structure - Wood	

PD	**Power Distribution**	XFDPM	Distribution - Pad Mounted Transformers	
		DSS	Distribution - Substation	
XFMRP	**Power Transformer**	XFPPM XFPPL XFVR	Power Transformer - Pad Mount Power Transformer - Pole Mount Voltage Regulating Transformer	
XFMRBP				

Asset Hierarchy Templates

Transmission Line Asset Hierarchy

Asset Description	Work Orders Allowed?	Equipment Record Needed?	Product Family	Product Model

Appendix 4 – Standard Equipment Location Abbreviations

Standard 3 Letter Community and Plant Codes

Code	Description
ANP	Anchor Point
BAB	Bakers Brook
BAI	Barrd Island
BCN	Bear Cove North
BCS	Bear Cove South
BCV	Bear Cove
BCX	Barachoix
BDC	Black Duck Cove
BDE	Bay D'Espoir
BED	Beachside
BES	Beaches
BGB	Brig Bay
BGH	Blue Grass Hill
BHC	Burnt Head Cove
BHL	Berry Hill
BIA	Bide Arm
BIC	Bird Cove
BIF	Bishops Falls
BIH	Birchy Head
BKT	Black Tickle
BLA	Bay L'Argent
BLB	Belburns
BLC	Blue Cove
BLP	Belldowns Point
BMN	Beaumont North
BMS	Beaumont South
BMT	Beaumont
BOX	Boxey
BRC	Brents Cove
BRH	Bartlett's Harbour
BRK	Bottom Brook
BRM	Belloram
BRT	Brighton
BSD	Bayside
BTH	Boat Harbour
BUC	Buchans
BUD	Burnt Dam
BUH	Burnt Hill
BUL	Burlington

BUR	Burgeo
BVM	Baie Verte
BWT	Bottom Waters
CAB	Camp Boggy
CAI	Capstan Island
CAM	Coney Arm
CAT	Cat Arm
CBA	Capr Bauld
CBC	Come by Chance
CBF	Corner Brook
CFC	Coffee Cove
CHD	Cow Head
CHF	Churchill Falls
CHT	Charlottetown
CIS	Change Islands
CMC	Coombs Cove
CNO	Cape Norman
COC	Coachmans Cove
COH	Cooks Harbour
CON	Conche
CPO	Cape Onion
CRQ	Croque
CRR	Castors River
CRV	Conne River
CTW	Cartwright
CUZ	Curzon
DAC	Dawsons Cove
DAV	Davis Inlet
DEB	Deep Bay
DEC	Deadmans Cove
DHR	Daniels Harbour
DLK	Deer Lake
DLS	Doyles
DMM	Dome Mountain
DOC	Dock Cove
DOM	Domino
EAB	Eastern Brook
EBE	Ebbegunbaeg
EDC	Eddies Cove
EHW	English Hr. West
ENG	Englee
ENP	English Point
FDL	Fleur de Lys

FGO	Fogo
FHD	Farewell Head
FLC	Flowers Cove
FOA	Fortune Arm
FOP	Forresters Point
FRC	Frankies Cove
FRS	Francois
FRU	Forteau
FXC	Fox Cove
GAU	Gaultois
GBA	Grand Bay
GBH	Great Brehat
GBK	Grandy Brook
GBU	Grand Bruit
GBY	Goose Bay
GDH	Godfathers Cove
GDY	Goodyear
GFC	Grand Falls
GIB	Green Island Brook
GIC	Green Island Cove
GLB	Glenburnie
GOC	Goose Cove
GOH	Godaleigh Hill
GPH	Gull Pond Hill
GQT	Griquet
GRL	Granite Lake
GRO	Grole
GRP	Green Point
GRS	Grandois
GUC	Gunners Cove
GWD	Glenwood
GYR	Grey River
HAB	Hare Bay
HAH	Harrys Harbour
HAW	Haywards Cove
HAY	Hay Cove
HBK	Hope Brook
HBR	Harbour Breton
HBY	Hawkes Bay
HDE	Harbour Deep
HDN	Hampden
HEB	Head of Bay D'Espoir
HKD	Hawke Hill

HLK	Hinds Lake
HLY	Howley
HPD	Hopedale
HRD	Holyrood
HRL	Harrie Lake
HRO	Harbour Round
HTG	Hermitage
HVY	Happy Valley
HWD	Hardwoods
HYP	Hydro Place
IRV	Indian River
ISH	Island Harbour
JAC	Jacksons Cove
JAM	Jacksons Arm
JBA	Joe Batts Arm
KGH	Kings Harbour
KGP	Kings Point
KOB	Kona Beach
LAA	L'Amour
LAC	L'Anse au Clair
LAD	L'Anse au Diable
LAL	L'Anse au Loup
LAM	L'Anse au Meadows
LAP	Lapoile
LAS	LaScie
LBC	Labrador City
LBI	Little Bay Islands
LBY	Little Bay
LGC	Langdon Cove
LHR	Long Harbour
LIB	Lushes Bight
LLK	Linton Lake
LOB	Lodge Bay
LOC	Lobster Cove
LSD	Little Seldom
LWC	Lower Cove
MAK	Makkovik
MBK	Main Brook
MCC	McCallum
MDL	Mud Lake
MDR	Massey Drive
MFA	Muskrat Falls
MIA	Middle Arm

MIB	Mings Bight
MIC	Miles Cove
MKS	Monkstown
MLT	Milltown
MMH	Mary March Hill
MOA	Mose Ambrose
MRV	Morrisville
MSH	Mary's Harbour
MSM	Mount St. Margaret
NAC	Nameless Cove
NAN	Nain
NEF	New Ferrole
NHR	Neddy Harbour
NIH	Nippers Harbour
NNC	Nickey's Nose Cove
NOB	Norman Bay
NOD	Noddy Bay
NOP	Norris Point
NWR	Northwest River
OPD	Oxen Pond
PAC	Port au Choix
PAH	Paynes Harbour
PAI	Pass Island
PAQ	Pacquet
PBN	Peters Barren
PDC	Pond Cove
PEF	Petit Forte
PET	Petites
PGC	Pigeon Cove
PHS	Port Hope Simpson
PIA	Pinsents Arm
PIW	Pinware
PLD	Portland Creek
PLI	Pilleys Island
PNC	Pines Cove
POA	Port Anson
POC	Pools Cove
POP	Pollards Point
POR	Point Rich
POS	Port Saunders
POV	Postville
PPD	Parsons Pond
PPT	Plum Point

PRB	Paradise River
PUC	Purbecks Cove
PUD	Pudops
QUP	Quirpon
RAB	Rattling Brook
RAL	Raleigh
RAM	Ramea
RAR	Roberts Arm
RCE	Rencontre East
REB	Red Bay
REH	Reefs Harbour
RHC	Rocky Harbour Cove
RHR	Rocky Harbour
RIG	Rigolet
ROH	Round Harbour
ROM	Rooms
ROP	River of Ponds
RWC	Roddickton
SAB	St. Anthony Bight
SAL	St. Albans
SAM	Snooks Arm
SAV	Sandyville
SBA	St. Barbe
SBH	Sandy Brook Hill
SBK	Shoal Brook
SBN	St. Brendans
SBY	Shoal Bay
SCA	St. Carols
SCB	Seldom Come By
SCC	Schooner Cove
SCF	Sandy Cove (Fogo)
SCG	Sandy Cove (GNP)
SCR	Savage Cove
SCV	Sally's Cove
SDM	Seldom
SEB	Sourheast Bight
SGC	Swangers Cove
SGE	St. Genevive
SHC	Shoe Cove
SHO	Shoal Cove
SID	Silverdale
SJA	St. Jacques
SJC	St. Josephs Cove

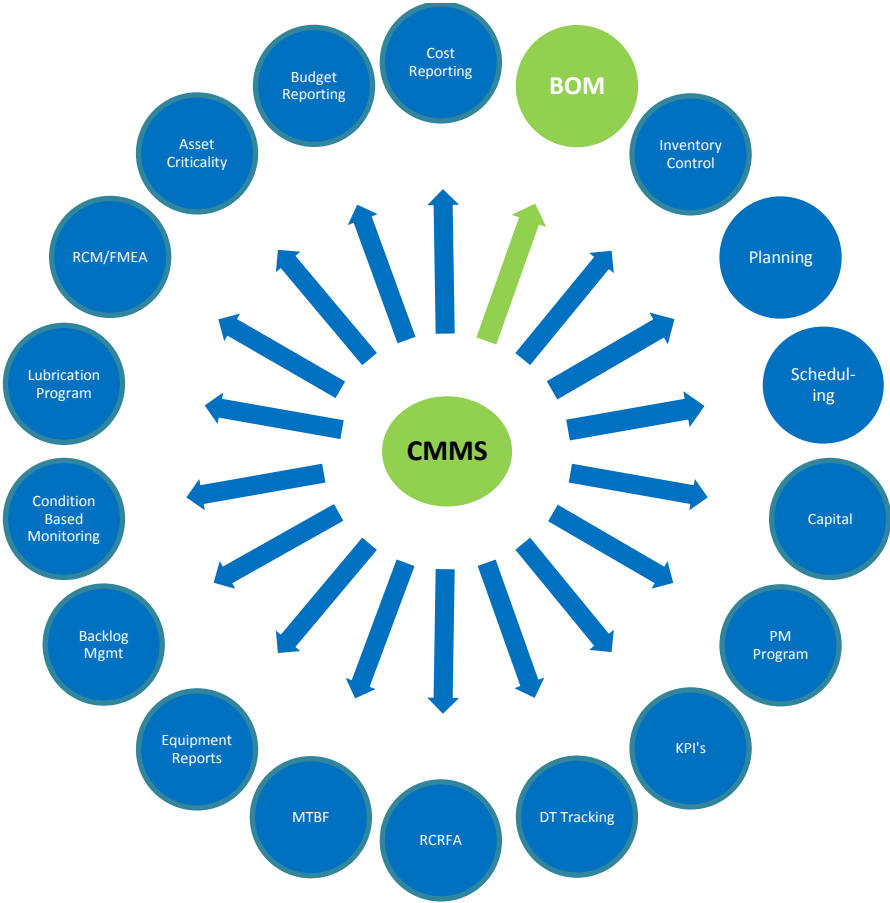|	
SJU	St. Julians
SLE	St. Lewis
SLU	St. Lunaire
SMH	Smiths Harbour
SOA	Sops Arm
SOK	South Brook
SPC	Ship Cove
SPK	St. Patricks
SPL	Springdale
SPS	St. Pauls
SRF	Seal Cove
SSD	Sunnyside
STA	St. Anthony
STB	Stoney Brook
STH	Stag Harbour
STV	Straitsview
SVE	St. Veronicas
SVL	Stephenville
SWC	South West Crouse
SYC	Shalloway Cove
TIC	Tilt Cove
TIL	Tilting
TMR	Three Mile Rock
TRR	Trout River
TRT	Triton
TWF	Twin Falls
USL	Upper Salmon
VBT	Bvenam's Bight
VIC	Victoria
WAB	Wabush
WAV	Western Avalon
WDL	Wiltondale
WEP	Westport
WHB	Whitbourne
WHR	Williams Harbour
WIB	Wild Bight
WIC	Wicks Cove
WOO	Woodstock
WOP	Woody Point
WRC	Wreck Cove
WSM	West St. Modeste
WTB	Winterhouse Brook

Corporate Business System - ERP Assessment

Business Process Document

Maintenance Work Centers - Asset Management

December 20th/2016

Version	Date	Description of Revision	Author
	2016-12-20	Updated after process review	S. McCarthy

Contents

Purpose

Work Centers, (Crafts or trades) define groups of Maintainers under general trade classifications. Work Centers are the basis for planning labour on work orders and for comparisons to crew labour capacity available to perform that work. Defining Work Centers is one key process which supports effective maintenance planning and scheduling.

Work Centers are defined at the Branch/Plant level, where the Branch/Plant is defined as the source of resources, both material and human.

The intent of this procedure is to ensure that Work Centers are defined at an appropriate level of detail to aid in Maintenance Planning and Scheduling.

What is a Work Center?

- Work Centers are used to Plan and Schedule Work Orders at a Craft level.
    - Labour plans are constructed by Craft.
    - Schedules are loaded by Craft.
    - Maintenance Backlog is measured by Craft.
- Crafts are "loaded" to the desired level in the weekly and 30 Day schedules. Schedule loading is the percent of available craft capacity utilized in a schedule.
    - Detailed Craft estimating must be done in order to move to higher levels of Scheduling Maturity using the CMMS.
- Crafts are not defined to a trade competency level. Typically, an Electrician is an electrician, and a welder or millwright is a mechanic. Keeping track of certifications or competencies in certain skills or equipment is done at a level of detail below the craft.
- Crafts may be defined by area, if there are different crews assigned to those areas (i.e. "North" and "South") and the geographic boundaries of the area are defined.
- Central Maintenance groups like personnel dedicated to Machine Shops need to be a different craft than area maintenance crafts, since scheduling central maintenance groups is usually an iterative process bringing together and reconciling the area scheduling requirements for the Central Maintenance crafts.
- Crafts are not defined by pay rate, job classification within a trade or in a union agreement, or progression steps within a classification (i.e General Maintenance "A" and "B" should just be "General Maintenance")
- If a Maintainer is to be charged out through recharge time writing, then that person should be assigned to a craft which has a rate.
- Equipment is usually not defined as a craft in Maintenance environments. If it is necessary to schedule equipment, this should be done by defining the equipment as a resource in the Maintenance Scheduling process.

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Business Process – Work Centers

Creating Work Center Business Units

Work Center Business Unit creation consists of two steps:

1. Create the Work Center BU Master (F0006)
2. Assign the Category Code on the BU Master that defines the basic trade type.

Creating Work Center Masters and Assigning Rates

A rate is assigned to a Work Center for estimating purposes if the cost of that trade is going to be recovered through Recharge Time Writing.

The hourly rate assigned to the Work Center Master also has to be set up on the recharge rate associated with the employees who are associated with that Work Center.

Work Center Masters are created in two steps:

1. Create the Work Center Master Record and set the hourly rate.
2. Fix the "Frozen" Rate by running the batch update report.

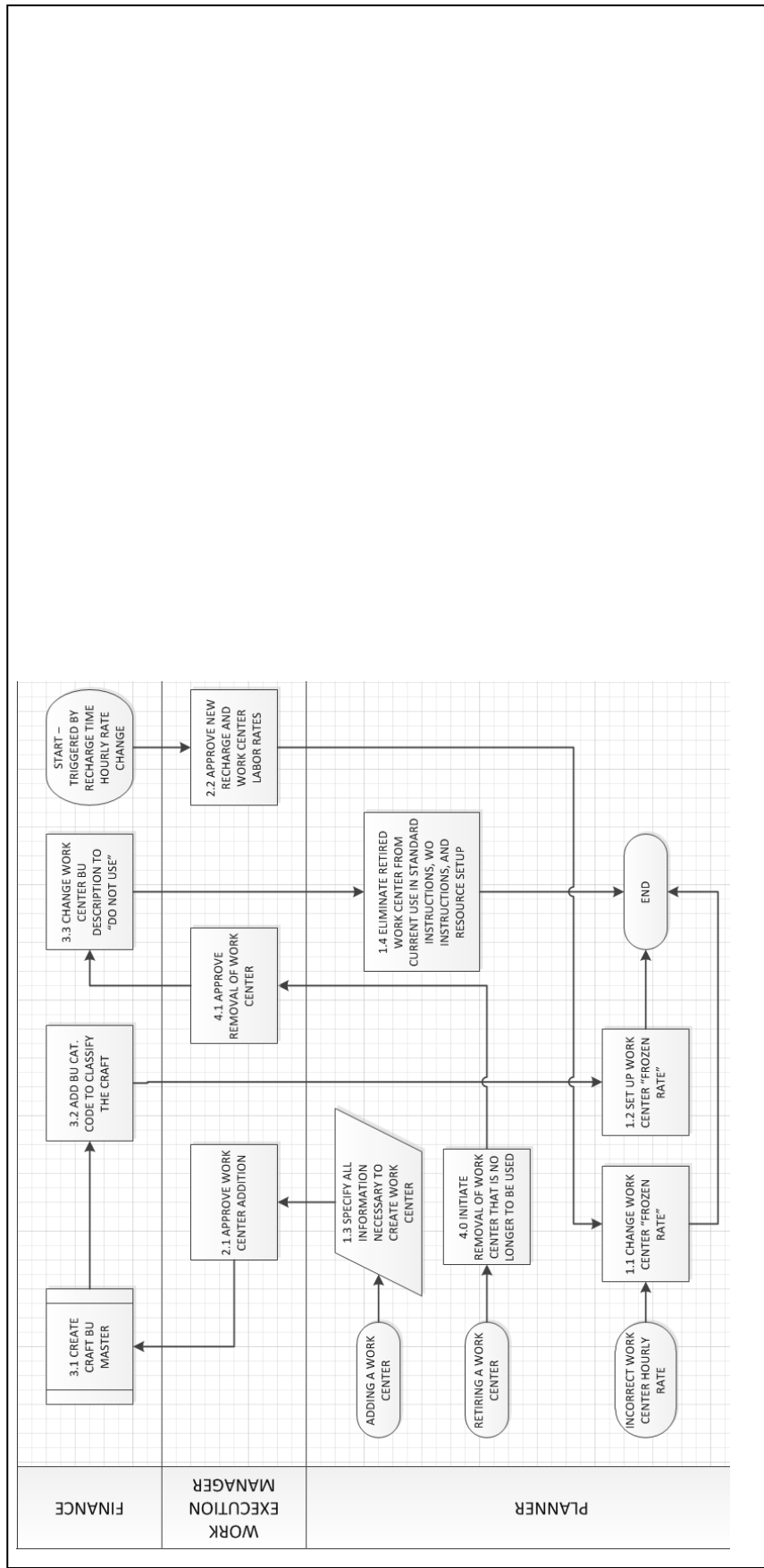## Approvals

	(name)	(signature)	(yyyy/mm/dd)
	(name)	(signature)	(yyyy/mm/dd)

Appendix I – Definitions and Business Rules

<< Add any agree upon business rules or definition associated to the business processes.>>

4

Business Process

Role	Step ID	Step Title	Step Description
Planner	1.1	CHANGE WORK CENTER "FROZEN RATE"	If the Work Center Hourly Rate is incorrect, and the appropriate rate has been approved already, then the frozen hourly rate needs to be adjusted.
	1.2	SET UP WORK CENTER "FROZEN	After a new Craft BU is set up, the next step is to set up the Frozen hourly rate.

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Role	Step ID	Step Title	Step Description
		RATE"	
	1.3	SPECIFY ALL INFORMATION NECESSARY TO CREATE WORK CENTER	In order to create a New Work Center, the addition must first be approved by the Work Execution Manager. All the data must be submitted for approval, including the name (using the naming standard), the members of the Craft, the estimating hourly rate, how the creation of the craft will affect other crafts or their membership, and the generic craft code to be assigned to the Work Center BU for backlog reporting purposes.
	1.4	ELIMINATE RETIRED WORK CENTER FROM CURRENT USE IN STANDARD INSTRUCTIONS, WO INSTRUCTIONS, AND RESOURCE SETUP	When a Work Center is to be retired, then it should be changed in order that it will no longer be used. Also, any active places where the Craft is used should be changed.
	4.0	INITIATE REMOVAL OF WORK CENTER THAT IS NO LONGER TO BE USED	
	2.1	APPROVE WORK CENTER ADDITION	What a new Work Center is requested, the Work Execution Manager has the responsibility to approve the addition, with advice from the Planner or whomever else is felt necessary to consult.
Work Execution Manager	2.2	APPROVE NEW RECHARGE AND WORK CENTER LABOR RATES	If the recharge rates have been recalculated, and the analysis shows that a change is needed, then the Work Execution Manager has the responsibility to approve the change, with advice from the Planner or whomever else is felt necessary to consult.
	4.1	APPROVE REMOVAL OF WORK CENTER	
Finance	3.1	CREATE CRAFT BU	Work Centers are Business Units, and as at 2015-August are the responsibility of the

Role	Step ID	Step Title	Step Description
		MASTER	Finance group to add or change, regardless of whether they are "Financial Business Units" (i.e. with accounts and transactions) or not.
	3.2	ADD BU CAT. CODE TO CLASSIFY THE CRAFT	The BU generic craft code to be assigned to the Work Center BU for backlog reporting purposes must be added by Finance, since as at 2015-August are the responsibility of the Finance group to add or change, regardless of whether they are "Financial Business Units" (i.e. with accounts and transactions) or not.
	3.3	CHANGE WORK CENTER BU DESCRIPTION TO "DO NOT USE"	When you retire a Work Center, it is appropriate to change the BU description so that the craft will obviously be not in use. It is important that Finance not delete Business Units (F0006) and leave the Work Center Master files (F30006 & F30008) in place.

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Corporate Business System - ERP Assessment

Business Process Document

Planning - Asset Management

September 12th/2018

Version	Date	Description of Revision	Author
R0	2016-12-20	Updated after process review	S. McCarthy
R1	2018-09-12	Updated with AM Champions comments	S. McCarthy

Contents

Purpose

Planning and Scheduling determines when work should be performed based upon priorities, the availability of personnel, material, parts, outside resources, transportation, and the equipment criticality. This allows for optimizing resources and minimizing downtime.

Planning and scheduling are two distinct activities. Maximum efficiency is achieved when properly planned jobs are scheduled and executed in accordance with the schedule.[1]

- Planning – the analysis and determination of the required information, materials, human resources, time, tools, procedures, safety requirements, permits and procedures.
- Scheduling – determining when an activity can be accomplished based on available resources and the scope of work[2].

Planning is the process of breaking down work into manageable activities. This is achieved by using the details within a work order system to identify the required Materials, Labour and resources. This is used to evaluate estimated costs and timing required to complete these activities[3].

Planning processes or tasks should include the following process flows, or have a Company Procedures which should include the following:

- Field scoping (as required)
- Materials (Materials Plan)
- External services
- All Job steps, including Operations, Scaffold, etc.
  - Scaffolding erection and removal are separate steps.
  - Equipment removal and replacement are separate steps only if separated by the work or another trade or removal and replacement will be done in different scheduling periods.
- Identification of and linking to the applicable "Safe Work Methods".
- Job safety assessment including Permit to Work requirements identified
- Job Procedures
- Post-work testing requirements
- Monitoring of Backlog
  - Validate Priority
  - Eliminate Duplication

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[1] Revision 1: Some efficiency gains are possible through scheduling alone, which may help to avoid delays in equipment release for maintenance and isolation/de-energization. Proper scoping and planning are essential to avoiding delays in acquiring materials and equipment return to service.
[2] Revision 1: Scheduling needs to consider work scope and the equipment condition required to complete the tasks on the work order.
[3] Revision 1: Multiple trades necessary to complete a job are included on a single work order, using routing steps.

- Assign proper responsible group or organization
- Assess Equipment condition for Work Order and impact on Production
- Labor by skill and estimating Resource Requirements - Man-hour estimates & durations, based on execution by an experienced technician, without unforeseeable delays [4]for:
  - Internal resources (employees or core (embedded) contractors)
  - External – Contracted resources
  - Major tools or Equipment
- Estimating Materials
  - Internal – Inventory issues
  - External – Direct Purchase
- Expediting and follow up for Purchase Orders
- Hand over to Scheduling personnel – Propose start date
- Continuous improvement
  - Monitor PM work Plans against actual and feedback to appropriate PM Planner
  - Feedback results for Continuous improvement.

The Planning objective is to help boost labour productivity and improve equipment availability, and not to provide perfect time estimates. The time required to perform the same maintenance tasks is variable because field and equipment conditions vary. We provide time estimates for work orders because:

- Schedulers need time estimates to help schedule work assignments.
- Maintenance Supervision needs a time estimate in order to assign and control work assignments.

The time estimate used for any task (a routing step or operation on a work order) should be the amount of time it takes for a competent worker to perform the defined work activity at the required level of quality, under optimum operating conditions. The estimate should not include allowances for lost time, exceptional conditions, waiting time, or travel. Through the estimate, the Planner sets a standard for performance, and not an ambitious target or goal.

Business Process - Planning Work Orders

Gate Keeper

Planning does not include the following "Gate Keeper" activities. The Gate Keepers should be able to represent Operation Personnel, Maintenance, and Asset Specialist to code and promote new work (good work) to be assessed by Planning. This position allows the Planning Group to focus actively on planning and coordinating the efforts of fully scoping work orders.

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[4] Revision 1: Unforeseen delays are those that the Planner could not reasonably predict. The identification of Unforeseen delays is a critical aspect of planning improvement, an input to closer alignment of estimated versus actual work order cost, and one outcome from Schedule Compliance reviews.

Local procedure shall be in place to identify the following for Work Order Accuracy:

- Accept/Approve or reject New Work Priority
- Eliminate Duplication
- Identify requirement against long term plan
- Description – Clarify the problem, and extent of what the plan should include [5](repair, replace)
- Additional coding – failure, reporting ….. required to support ongoing assessments
- Proper Equipment identification
- Cost accounting (Ops vs. Capital)
- Estimated Start Date (first cut requirement)
- Required Date Complete
- Promote to Planning
- Approve as Break in Work – Emergencies or Break in Work bypasses the Planning stage and goes directly to active work.

Additional related activities for the Gate Keeper role but not defined in this document

- Receive feedback from planning – where job scope creep occurs or planning process reveals that the work cannot be executed prior to the Planned Complete Date
- Receive feedback from Scheduling – when complete dates are going to be missed work orders need to be reprioritized.

Planning Level of Detail

If Planners put too much detail into individual work orders, then they won't get all the work planned. It is always better to plan 100% of the work hours than to turn unplanned work over to Work Execution. It is the Planners responsibility to take the new work promoted from the Gate Keepers, to assess and scope these jobs. It is up to the planning personnel to feedback any scope creep that was found during the planning process to the Gate Keepers and or the Work Execution Managers. The level of detail or completeness of job packages can be broken up into several categories. The accepted level of planning needs to be completed before forwarding these jobs on to the Scheduling process. In all cases estimated hours need to be assigned. Planning LOD can be broken up into the following categories:

- Minimal Planning - It is generally not cost effective to spend excessive time planning certain small jobs. Jobs that are considered needing Minimal Planning will just have job duration and manpower requirements planned (craft/skill needed, number of persons, and total craft labour hours needed). Typically, jobs that fit into the Minimal Planning category should have an agreed upon company standard, the following are <u>examples</u>:
  - Work less than 4 work hours – usually one step activity

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[5] Revision 1: It is a fallacy to say that most corrective jobs can't be planned until the equipment is opened up and inspected. This is not true of proactive corrective work, since trouble shooting can be done to further define the problem. It is not true of many reactive corrective jobs, since experience and history should offer clues to the scope of work, and consequently the resources needed.

- Materials/parts common and available (No ordering or reserving needed)
- No production impact
- Simple Work routine with hazards that are well understood. The Planner is responsible for making the decision as to whether to minimally or extensively plan the work. Work that is to be minimally planned proceeds directly to manpower requirements. The Description of work is identified in the Work Order description field.

- PM or Routine Standard Jobs: (not triggered by PM Scheduler but by condition) – These jobs can be identified as fully planned, or scoped, and are the accepted standards for the site. These jobs do not require planning as much as verifying dates and availability of parts or contract requirements.

- Fully Planned – these are where the bulk of a Planner's time will be consumed. The Maintenance Planner is responsible to identify all the work required to accomplish a job. The job plan or scope typically includes:

  - A site visit (recommended when feasible) – It is important to understand the Planner's expertise for the equipment and work scope; if the Planner has the necessary experience this is not a requirement. *If in remote areas* additional Maintenance support may assist with this step.
  - A review of the maintenance history for the equipment, in order to identify foreseeable delays and design mitigations.
  - The key steps/tasks in the job and time assessments.
  - Tools and special equipment for the completion of the job
  - Material list – both Warehouse controlled and Purchase requirements
  - Special job safety requirements (confined space requirements, hot work, scaffolding, etc.). Which equipment will be required to be shut down to proceed (outages required)
  - Required drawings, schematics, etc.: Special expertise may be required to properly plan some jobs. The planner may need to enlist the support of specialists (such as a vibration analysis technician, engineering, etc.) in order to properly develop a job plan. Most work, however, is routine and should not be difficult to plan.
  - Purchase Requests for external materials, Service Orders and Rental requirements

Regardless of whether the work order is fully or minimally planned, standard repair procedures and standard documents associated with the work should be attached to the work order.

The plan is documented in the Routing steps (tasks or operations) in the Work Orders' Labour Plans. The intent of the labour plan is not to merely provide an overall estimate of labour requirements in hours, but rather to lay out the steps necessary to progress the work in the appropriate order, by trade, each with a labour estimate (duration and crew size).

- Include separate steps for scaffolding construction and removal, where another trade has to use the scaffold to perform some intermediate task..
- Include separate steps for insulation removal and replacement, where some other trade has a task to be performed once the insulation is removed.

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- Disassembly and re-assembly may be different steps depending on the duration or whether there is some other intermediate step.
- Include steps for tasks that have to be performed by Work Execution after the equipment is ready for return to service, such as confirmation of vibration levels after an alignment on rotating equipment, where appropriate.

It is not the intention of the individual routing steps to define a detailed process or maintenance procedure. Standards and procedure documents may be attached to the work order or to individual routing steps.

- Planners count on the workforce being sufficiently skilled so that a minimal level of detail can be put into the job plans.
- Planners must respect that the Maintainers know how to do the job, and there are frequently several acceptable ways to perform any task. (If there is one best way to perform a job, or if best practices have been defined, then the task should be the subject of a standard or directive) The Planner should describe in the Routing Steps what needs to be done, and not necessarily how best to accomplish it. The Planner's responsibility is to provide value through scoping and scheduling, and to attach standards that have already been developed.
    - o In any plant or area there is a base trade-by-trade assumption of the trade's knowledge, which is analogous to the toolbox carried by each Maintainer. Above that, Maintenance Procedures define how to perform tasks where special knowledge or controls are needed; which is analogous to the Special Tools held in the tool crib. The Planner is responsible to ensure that "What to do" is defined, with an appropriate estimate.
    - o Each task description or its associated text should contain an Item and a Task, and where appropriate, a Specification.
        - ▪ The Item is where or on which component the task is to be carried out (I.e., "Air Filter").
        - ▪ The Task is what has to be done (i.e. "Clean").
        - ▪ The Item and Task meet the basic requirements for a Planner, but for important tasks the detail should be improved to define how to perform the task. The Planner cannot write a Specification for each step and still expect to be able to plan all of the crews' work. If a procedure exists, the Planner should reference it. There must be a process to write procedures for critical tasks, and make them available to Planners and Maintainers to reference when needed.
- Routing steps should have no shorter duration than one half hour.
- Routing steps should never be longer in duration than a weekly scheduling period. (For shutdown work and closely managed projects, the maximum duration should be reduced to one shift)
- Routing steps, like work orders, should have a defined scope and defined start and end points.
- When describing a task, Planners should never use the word "Check" without following it with a defined standard.

Strict adherence to the Job Plan is not required as long as feedback is provided from Work Execution to the Planner at Job Completion, in order that the job plan may be improved the next time the same work scope comes up.

Defining and Assigning Crafts (Work Centers or trades)

A craft is defined by a major trade group and a geographical area. Refer to the Work Centers procedure for more detail.

Crafts should be assigned to each task using the lowest competency level that can perform the work. During work assignment, anyone can be assigned to any task only limited by jurisdictional agreements.

Planning and Reporting Travel Time

For work orders that are to be executed at sites remote from the home base of the Work Execution group (i.e. Maintenance):

1. Estimate travel time on work orders using separate routing steps.
2. Estimate travel time on each Corrective work order as if the work order would be scheduled by itself at that location and for that crew.
3. Do not include an estimate for travel time on PM Work Orders. The work order labor estimate should be for the real work person-hours needed to perform the defined scope of work on the work order.
   a. The use of Standing Work Orders and Non-Maintenance Work Orders for the purpose of tracking Maintenance Travel time is not approved practice. Such practice would open the door to the use of Standing Work Orders for "collecting costs" for maintenance activities, and that is a worse problem than any perceived lack of accuracy in Work Order Costs.
   b. This assumes that the PM Activities in each area will be scheduled and grouped so that they may be performed in the most efficient manner.
   c. When building the weekly schedule, or where the Scheduler is bundling "opportunity work orders" together for an area, the Scheduler may add or adjust a routing step for travel time for each trade to a one or more work orders for each location or business unit and include the travel hours expected.
4. Reporting Travel Time is covered in this procedure to provide an overall view of how estimates and actual values match up, and because accurate time and cost reporting are inputs to future plans.
   a. If there is a single work order to be performed at the remote site, then the travel time will be reported to the Work Order involved.
      i. If the job is Planned and Scheduled, then the time will be written to the Work Order and potentially also to the routing step for travel.
      ii. If the job is unplanned, then the time will be written to the Work Order.
   b. If there are multiple work order to be performed at the remote site:
      i. If the jobs are Planned and Scheduled, then the time will be written to the Work Order(s) that have time estimates and potentially the routing step(s) for travel.

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    ii. If the jobs are unplanned or incompletely scheduled, then the time will be written to a Work Order most representative of the reason for being at the remote site, or one selected by the Maintenance Supervisor.

c. Any extra or unforeseen travel time associated with a single work order may be charged to that work order.

d. There will be a separate Pay Type for reporting travel time.

Reporting Planner Time

Planners shall not report time to work orders for repairs, maintenance, or improvements. Planners are overhead to the Work Execution function and their payroll and overhead costs should be included in the numerator for the calculation of the Maintainer recharge rates.

Validation of the Work Order Planning Process[6]

- Confirm that Gate Keepers review all new work orders of all types and require that the work scope be defined before sending the WO for planning, as much as possible.
- An assessment should be made of the level of awareness of the Work Order Planning procedure through interviews with Maintenance Planners and observation of gate keepers.
- Work Orders should be sampled to assess the level of adherence.
- Planers' and Gate Keepers' Training records for this process should be reviewed.
- There should be evidence that the effects of foreseen delays are mitigated through Planning.
- There should be evidence that unforeseen delays are identified and are one source of continual improvement guidance provided to, and used by, Maintenance Planners.
- There should be a local process, approved by area management, defining in what ways this process is implemented across the local area, including scope and personnel or position assignments, and exceptions associated with specific work order types.

Planning Metrics

Metrics used as KPI's for the Planning function

- Percent Work Planned
- Percent Proactive Repair Work
- PM Compliance
- Backlog by Craft (measured in weeks and trended over a rolling twelve month period)
- Planning Efficiency - estimated (scoped) hours vs. actual (booked) hours (absolute value)
- Steady and continual improvement of existing standard repair plans and procedures, based on feedback from schedule compliance and from work execution.
- Number of Reactive Maintenance Work Orders with Planning Complete, but awaiting materials or services (trend)
- Number of work orders planned per week by Planner.

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[6] Revision 1: Added the "Validation.." section.

- Reactive Backlog by work center (trade)
- Repair backlog by trade.
- Percent non-stock requests achieving required on-site date based on WO Planned Start Date.
- Percent Unplanned work executed.
- Number of work orders completed and awaiting review by Work Execution, and by Planner (trend)
- Number of Repair Work Orders completed with no failure coding or insufficient detail in the failure coding.
- Number of Repair Work Orders coded with "Other" in any Failure code.
  - Review work orders to confirm text added to describe what the "Other" Failure Code means.
- Percent of Work Orders completed with no reported labour hours – by WO Type and by Supervisor or Main Trade.

Approvals

	(name)	(signature)	(yyyy/mm/dd)
	(name)	(signature)	(yyyy/mm/dd)

Appendix I – Definitions and Business Rules

<< Add any agree upon business rules or definition associated to the business processes. >>

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Business Process
Work Order Planning

The following sample business process provides only the first level of detail Information on the groups or individual positions, their associated tasks (steps) in the process and high level descriptions for each step.

WP 1.0 Work Order Planning

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Role	Step ID	Step Title	Step Description
Gate Keeper	1.00	Work Order Assessment	Gate Keeper(s) which can be made up from a combination of Maintenance, Operations and Engineering are to assess the validity of new work. The accuracy and the completeness of these jobs are to be verified at this time. Priority, Shutdown requirements, proper equipment, coding and accounting will be completed before moving on to the planning stage. Full description or scope definition as well the first cut Planned Complete date to assist the planner in scope and priority. Gate Keepers can also reject or assess work as break in. – bypassing Planning Stages
	2.00	Backlog Unplanned	The Planner Position will search the open work order to select which jobs are to be planned first (see prioritization / criticality document). The Planner will then decide which level of planning is appropriate for these work orders. • Minimum – Matching the agreed to parameters. • PM or Standard Jobs – these jobs are fully scoped jobs • Full Plan Required – New jobs that have not been planned before or corrective actions that need full assessment
Planner – Minimal Planning	2.10	Minimal Planning	These jobs are simple 1 to 4 hour jobs that require no specialty tools, or resources, and have standard consumable stores or shop parts. Standard Procedures and Safety Assessment minimal effort.
	2.11	Labour Estimate	Every work order or job requires an estimate for labour. Minimal Planned jobs consist of simple one task labour requirement that can be managed by normal complement of crew.
	2.12	Assign Start Date	Planners after scoping the job will assign the proposed start date as to meet the planned complete date or can be affected by the Annual or Long Term Plan. This information will be used to communicate the requirement to the Scheduler. The Scheduler and area supervisors will assess the validity of these dates and will adjust these accordingly when establishing the upcoming schedule.
	2.13	Promote for Scheduler	Usually a step or status that the Planner will promote jobs to.

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Role	Step ID	Step Title	Step Description
	3.10	PM or Standard Jobs	These are agreed upon Pre-planned jobs, the planner at this time has little to do with the formulation or scoping of these jobs. The main task for the planner would be to assess the completeness of these jobs before promoting to the scheduler. All documentation, Procedures, and Job Safety Assessment forms are attached or identified. It can also be a good time to look at the historical correctness of these jobs, for the continuous improvement of the current PM system. *It is usual to have a policy in place to assess the accuracy of the plans attached to these generated jobs. PM formulation may not be part of your Planning function if so a procedure for the continuous improvement and feedback is required.*
Planner – PM or Standard Jobs	3.11	Check Availability	These fully scoped jobs may not be ready for Scheduling due to parts availability or the requirement of outside services. The planner and inventory policies will determine if this will be satisfied by inventory replenishment, or if creating direct purchase request are required. Timing and confirmation dates for these purchase requests are important for defining the start date of the work order. *Follow the Site or Company policy.*
	3.12	Propose Start Date	Planners after scoping the job will assign the proposed start date as to meet the planned complete date or to be completed in the outage or campaign windows established in the Annual or Long Term Plan. This information will be used to communicate the requirement to the Scheduler. The Scheduler and area supervisors will assess the validity of these dates and will adjust these accordingly when establishing the upcoming schedule.
	3.13	Promote to Scheduler	Usually a step or status to which the Planner will promote work orders.
Planner – Fully Planned Required	4.10	Field Assessment	For non-regular repairs that have had no historical plan, a field assessment can be a critical step in the planning procedure. The planner may require assistance from other Maintenance personnel when *area or conditions are remote*, or Engineering if changes or additional "as built" or "red line markups" are required. It is at this time the Planner

Role	Step ID	Step Title	Step Description
			may change the work requirements and scope of the job. It will be up to the planner to communicate the findings from the Field Assessment if there is job scope creep. These jobs may require an additional approval from management, or require assessment from Engineering, and/ or the Capital Managers. It is important that these jobs are fully scoped. Tool requirements or rental requirements should also be assessed during field assessment.
Planner – Fully Planned Required	4.11	Risk and Job Safety Assessment/Analysis	Depending on the scope of the job, a first-cut safety analysis (Task Based Risk Assessment (TBRA) or Job Safety Analysis (JSA)) may be required or created for the intent of the job and recorded against the job to be used at time of scheduling and/or execution.
	4.12	Procedures and Documentation	It is up to the planner to identify the required procedures, and additional documentation that are needed for the completion of the job. i.e. Drawings, OEM manuals, SOP's, and/or Engineering requirements (Standards or Directives).
	4.20	Parts Requirements	Identify standard warehouse parts and availability as well as direct buy requirements. *Tool requirements may be under parts.*
	4.21	Create Purchase Request	Under the site buying policy, identify and create the non- stock parts requirement for purchase. Availability and delivery need to be understood to establish a reasonable start date.
	4.30	Labour Requirements	Assess the steps required for the completion of the job, this should include all affected trade groups, operational, and contract personnel.
	4.31	Contract Request	Blanket orders should be considered prior to creating a new request for services or rental agreements. Create appropriate Service or Rental request, proposed start date and availability is required for a first cut Start Date.
	4.40	Assign Start Date	Planners after scoping the job will assign the proposed start date as to meet the planned complete date or can be affected by the Annual or Long Term Plan. This information will be used to communicate the requirement to the Scheduler. The Scheduler and area supervisors will assess the validity of these dates and will adjust

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Role	Step ID	Step Title	Step Description
			these accordingly when establishing the upcoming schedule.
	4.41	Promote to Scheduler	Usually a step or status to which the Planner will promote Work Orders.

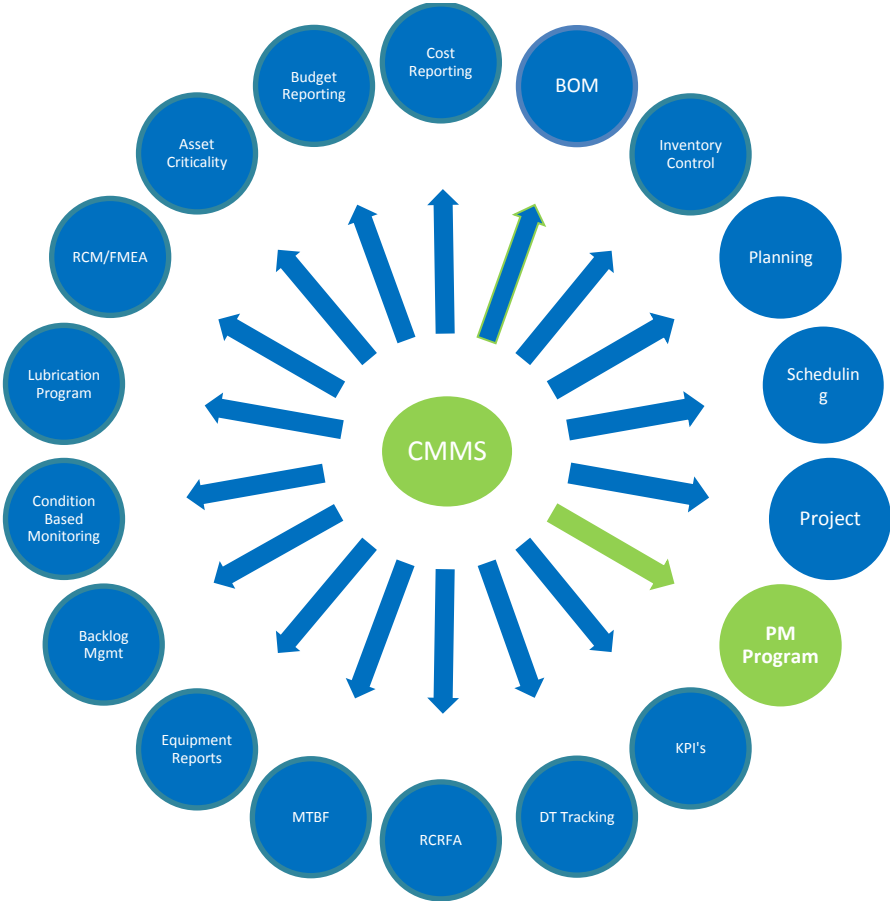# Corporate Business System - ERP Assessment

Business Process Document - Asset Management

Preventive Maintenance PAAR Level 1

August 14th/2018

Version	Date	Description of Revision	Author
R1	2016-12-20	Updated after process review	S. McCarthy
R2	2018-08-14	Updated after CAM Champions Review	S. McCarthy

Contents

Purpose

The intent of this document is to define the PAAR Level 1 requirements for the PM Procedure.

Preventive Maintenance (PM) is planned and scheduled maintenance performed at an established interval or frequency.

Preventive Maintenance (PM) is predetermined, regularly scheduled maintenance that is designed to prevent equipment failures. The interval is usually run hours, miles/km traveled or calendar days.

Preventive Maintenance does not require condition based monitoring, but includes condition monitoring techniques like vibration analysis and oil analysis.

Critical equipment requires a cross functional team from maintenance and operations to analyze data from equipment history, personal experience and manufacturer data to determine the technically feasible steps to economically reduce failures. These steps can then be formulated into a PM for input in the CMMS which PM includes resources, job steps, frequency and required materials. Updating the maintenance strategy is a continual improvement process throughout the equipment life cycle.

Advantages of PMs

Planning is the biggest advantage of Preventive Maintenance over less complex strategies. Unplanned, reactive maintenance has many overhead costs that can be avoided during the planning process. The cost of unplanned maintenance include lost production, higher costs for parts and shipping, as well as time lost responding to emergencies and diagnosing faults while equipment is not working. Unplanned maintenance typically costs three to nine times more than planned maintenance[1]. When maintenance is planned, these costs can be reduced. Equipment can be shut down to coincide with production downtime. Prior to the shutdown, any required parts, supplies and personnel can be gathered to minimize both equipment downtime and labour hours. These measures decrease the total cost of the necessary maintenance.

Effectively planned, scheduled and completed PMs will improve system reliability, decrease operational cost and unplanned system downtime and provide a safer workplace for our crews. Also, service records will be maintained and available for future reference to allow Asset Management to make informed decisions on refurbishment or replacement of these assets.

When PMs are planned in advance the labour and material plans do not have to be re-written each time the service is called to create a work order. This both saves planning time and provides a platform to continually improve the PM plans and data.

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[1] The Cost of Unplanned Maintenance includes the costs of extra equipment downtime, extra Maintainer hours required, emergency materials sourcing and air freight. To add to this, unplanned jobs are inherently less safe than planned jobs.

PM Services are pre-approved and pre-scheduled. PM Work Orders do not have to be handled by so many people prior to execution. PM Work Orders by-pass the Gatekeepers and many of them may bypass the Planners once they are created and planned.

Disadvantages

Unlike Reactive Maintenance, Preventive Maintenance always requires maintenance planning. This requires an investment in Planner time and resources not required with less complex maintenance strategies.

It is important that PM routines be both technically feasible (i.e. you have the technology to perform the task and assess the results) and economical (i.e. doing the task is cheaper than the consequences of failure). Commonly, Preventive Maintenance frequency is incorrect. Unless, and until the PM frequencies are optimized, too much or too little Preventive Maintenance will occur. Repair activities generated from PM inspections should be monitored to measure PM efficiency.

In order to measure PM cost and the consequences of failure, both the real cost of a maintenance person-hour and the cost of unavailability must be known. Both of these factors must be kept up-to-date.

Business Process – PM

The Preventive Maintenance programs in JDE E1 generate work orders, checklists and procedures on a predetermined schedule. PM cycle is reset when the order is moved to Complete Status and data entered. Overdue PM's can be tracked by percentage due. PM's over a defined threshold percent greater than 100% due should be considered overdue. PM's completed at a defined threshold percent less than 100% due should be considered to have been completed too early.

Completion of PMs in a timely fashion is a goal that must be supported by all parties, especially Operations and Maintenance groups. Maintenance groups must have appropriate labour resources available and Operations groups must make equipment available. The risk of not completing the work must be balanced against the long and short term needs of the organization. PM late non-conformances may be due to failure to release equipment resulting from aversion to the risk of running without backup or to the risk of transferring load from running to stand-by equipment.[2] It is essential to operate the equipment in the way it is designed, and in accordance with its agreed operating context[3]. One of the more important elements in defining the operating context or equipment is redundancy.

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[2] Revision 2: Aversion to risk of making equipment available for maintenance points to the need to consider (1) more condition monitoring approaches for running equipment; (2) Different maintenance tactics for running and standby equipment; and (3) accepting that if one cannot transfer load reliably between running and standby equipment, then you don't have a standby.

[3] Operational context: The current condition, environment, and culture in which you operate a piece of equipment.

Redundancy affects the design of the appropriate maintenance tactics for the equipment. This means that if the equipment was designed with a standby capability, and the current operating context confirms this, then any type of work involving a shutdown of the equipment may be scheduled at any time. Other operational and environmental considerations may dictate actual completion date. Scheduling PMs may also include consideration of the most effective use of time and resources. Often travel or cancelled outages due to operational needs will hinder a crews ability to complete a PM in a timely manner and may result in added cost and effort.[4]

All PM's set up should have BOM attached, regardless of whether or not the task requires parts. The BOM attached to the model work order contains the routing instructions (Job steps and estimates - "THE PLAN") and the parts requirements, both direct purchased and inventory. PM work orders could be generated at a Status "Waiting to schedule" and if they do not require a reduced load (i.e. a unit outage), purchased materials or outside services they should bypass the planning stage. The routing instructions from the BOM automatically populate the new PM work order. BOMs aid in the warehouse in preparing materials in advance for a scheduled PM in timely manner and ensure that the estimated hours and crews are identified for the weekly schedule.[5]

The lack of availability of long lead time materials, where those materials are required for PMs, can cause significant delays in competing PMs. If this is a concern, and to avoid undue increases in warehouse inventory holdings, the following options should be evaluated in terms of their financial risk:

- The PM Services can be configured to create work orders at a Maintenance Service Percent Due low enough to ensure that materials are committed and received in advance of the need. In this scenario quantities of the materials are configured as stock items but not normally held in inventory but are ordered through inventory replenishment when demand is created. This may be appropriate when the usage frequency is a multiple of the replenishment duration.
- The items may be made into stock items. This may be appropriate when the frequency of demand for the material is not much greater than the time to replenish inventory. Stores management may adopt strategies to reduce the replenishment time, such as vendor pricing supply agreements.[6]

If while performing a PM task, it is necessary to perform repair maintenance, the Technician should write a separate work request in all cases. He should make the correction if it takes less than ½ hour; above that, others must be informed and make the decision regarding how to handle the defect. This limit is necessary because without it, the PM Technician can spend too much time correcting and not

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[4] Revision 2: This paragraph added
[5] Revision 2: Revised sentence on the usefulness of PM BOMs
[6] Revision 2: Added this paragraph on materials planning and integration with Stores processes.

enough time performing PM activities. If a Corrective Work Order is not created, we will have inaccurate failure history and costs of PM.

PM work orders should include work procedures with details, like tolerances and methods. Without detail, PM depends on the Maintenance Technician's memory and personal skills. His/her approach may or may not be correct. Even if it is correct, it could get lost if the person leaves or is reassigned

A PM schedule can be created for any piece of equipment for which you require recurring maintenance tasks. On each PM schedule, indicate each service type that should be associated with that equipment. Also specify the rules governing how and when each service type is performed.

Service types can be used:

- For regularly scheduled maintenance
- For unscheduled maintenance tasks (such as cleanings on an as-needed basis or repairs at the point of equipment failure.
- To signal warranty service
- For other planning events not necessarily associated with Preventive maintenance tasks (such as license renewals and re-certifications)
- For investigations Orders from Condition Alerts

PM Work Orders may be generated by several methods.

- Generating by Batch Process, both manual and by nightly scheduled event
- Generate Planned Unscheduled Events - Manual
- Generate by Pre-firing or Overriding the Scheduled Event - Manual
- Condition based alerts – both manual or automatic

It is common to set and forget PM routines. The system should be set up to generate most of the PM's for a site at night so that in the morning the jobs will be ready. The ability to create orders at any time is possible but should only be available to a high level user of the PM system. PMs may also be set up to generate on certain days of the week or month in order to make it easier for scheduling.

There are certain types of PM's that can be assigned for manual generation or 'on request' generation. Within E1 these tasks would be considered Planned Unscheduled Events. In this situation, the model job plan is created but is not set up on an interval (there is no PM Trigger or frequency).

There is an ability to override the schedule event and generate scheduled PM on request. This is a necessary requirement, but should only be used by JDE Users with a good working knowledge of the PM system.

PMs are pre-approved model work plans that have been assessed and accepted as required tasks to maintain the integrity of the equipment to which they have been assigned. A continuous improvement process needs to be in place.

It is important to advance the status of PM Work Orders to 70 as soon as they are completed, and especially so for single cycle PMs. All completed documentation including WO "Actual Work Performed" and check sheets must be completed in a timely fashion.

PM Schedule, task, and check sheet continual improvement should be part of daily activities. Formal reviews of maintenance tactics, using a methodology such as Reliability Centered Maintenance (RCM), should be performed regularly or when the operating context of the assets changes.

All PMs should be reviewed to determine what portions of Preventive Maintenance can be completed on-line as well as outside of the traditional maintenance season window. This can result is short outage times (higher availability) and better utilization of crews and equipment[7].

Continuous Improvement
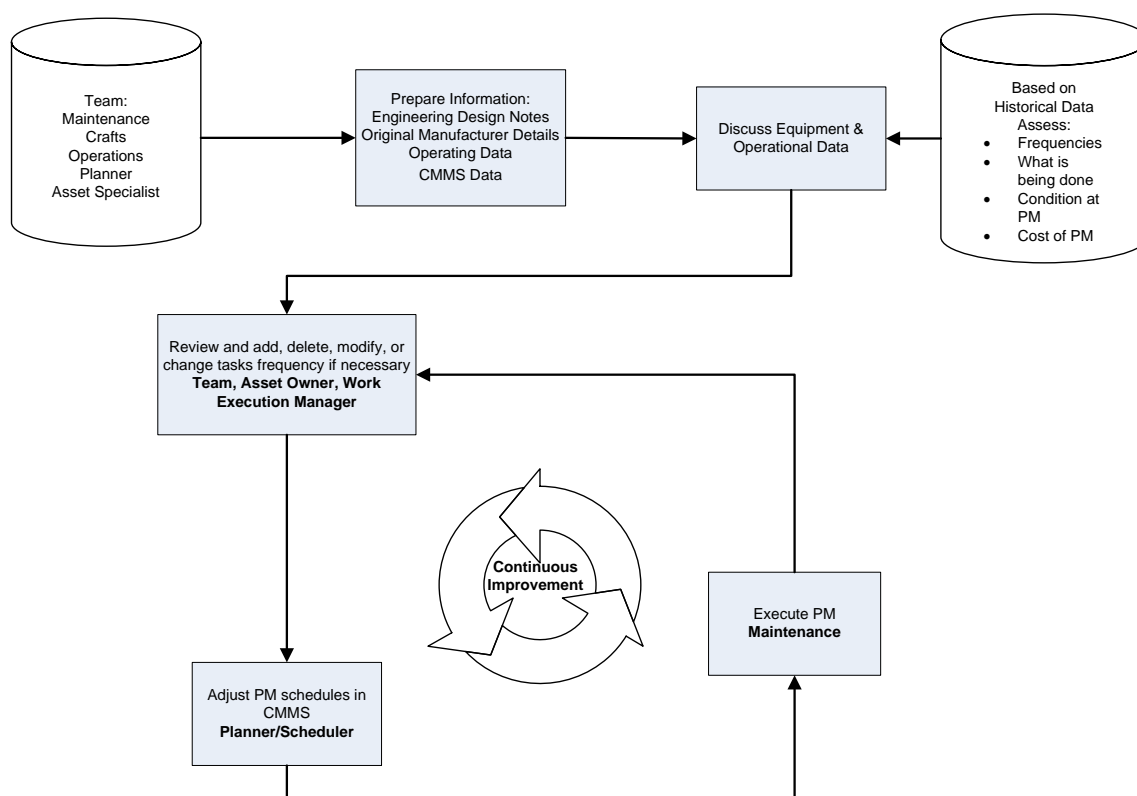
PM Metrics

- Does the plant/area have a documented PM / PdM procedure in the standard Nalcor format and aligned with the Nalcor standard in sufficient detail to provide guidance on PM and PdM management requirements, including roles and responsibilities. The procedure is in force and has been effectively communicated.
- There is a plant/area guideline in place for selecting appropriate PM, PdM, CbM, and Operator basic care tasks, including a focus on critical equipment, an understanding and quantification of the cost of maintenance and the consequences of equipment failure.
- There is a plant/area guideline in place defining approval for new tasks that recur at a defined frequency (days and meter based PMs).
- There is a plant/area guideline in place defining the requirements and approvals necessary to defer or cancel tasks that recur at a defined frequency (days and meter based PMs), and especially those tasks associated with Critical Equipment.
- PM Compliance, as measured from PM Backlog.
- Number of Cancelled PM Services
- Corrective work orders created as a result of PM Inspections.
- Survey of completed PM WO's requiring check sheets with completed check sheet data attached, where the data is useful in future work or for asset history.[8]
- % PM Jobs with standard Labour plans and standard Labour & Material Plans
- Number of PM Check Sheets sourced from binders, and not attached to PM Model WOs[9]

Approvals

	(name)	(signature)	(yyyy/mm/dd)
	(name)	(signature)	(yyyy/mm/dd)

Appendix I – Definitions and Business Rules

1. A Work Order is not necessarily a PM Work Order because it is generated from the PM Module in the CMMS. Technically, any Work Order type may be generated from the PM module.

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[8] Revision 2: Added check sheet availability through JDE as a metric as a result of AM Champions review. Note that there may be cases where the attachments are on the asset record instead of on the WO. If so, supplemental data should be used, since the asset supplemental data is also available on equipment records.

[9] Revision 2: Added check sheets attached to the model work orders as a result of AM Champions review

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Business Process - Model Work

Swimlane	Content
Long Term Asset Planner	Start → MW 1.00 Identify Need for a Maintenance PM or Standard Job → MW 1.01 Maintenance Engineering to review overall PM program for affected equipment. → (New Model WO Needed) MW 1.02 Identify New Model WO Description & Equipment → MW 1.04 If Maintenance Routes to be used, specify Equipment included. ; (Revise Existing Model WO) MW 1.03 Specify Changes to Model WO Description → MW 1.04
Supervisor, Short Term Work Planning & Scheduling	New BOM Header → MW 2.00 Assemble the Information Necessary to create a BOM Header and make request. → MW 2.01 Create new BOM Header with Number and Description specified, in the correct B/P(s) → MW 2.02 Create or Revise Model Work Order at Status "M" with BOM Number. → MW 2.03 Revise Parts plan in BOM as required → MW 2.04 Revise Labor plan in BOM as required → MW 2.05 Add or update description or standards on WO → MW 2.06 Revise WO Codes as required → MW 2.07 Continue to PM Set Up Sub-Process → End ; Existing BOM Header → MW 2.02

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Role	Step ID	Step Title	Step Description
	MW 1.00	Identify Need tor a Maintenance PM or Standard Job	Identifying the need to create or change Model work orders can happen through: • New Assets/Equipment bought or installed • OEM Identified – new requirements and updates. • Historical Equipment failure Assessment. • Work Order Planners/Scheduler assessment – through Continuous Improvement
Long Term Asset Planning	MW 1.01	Maintenance Engineering to review overall PM program for affected equipment.	Normally there are two reasons for an Equipment PM review. • New Assets are being added through system change or Capital Projects • Equipment identified for assessment or review due to increasing failures, breakdown by several equipment measurements • Increasing Failures to certain Equipment Types • Changes to Regulatory requirements
	MW 1.02	Identify New Model WO Description & Equipment	Where new PM or duties have been added or expanded to include these equipment.
	MW 1.03	Specify Changes to Model WO Description	Where expected results and not matching Manufactures Recommendations.
	MW 1.04	If Maintenance Routes to be used, specify Equipment included.	If standard BOM's are used for types of services or commonly used routes

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Short Term Planner	MW 2.00	Assemble the Information Necessary to create a BOM Header and make request.	Where new BOM are required follow BOM standard Process
	MW 2.01	Create new BOM Header with Number and Description specified, in the correct B/P(s)	Where new BOM are required follow BOM standard Process
	MW 2.02	Create or Revise Model Work Order at Status "M" with BOM Number.	Add or change BOM number to existing Model work order or create model from new.
	MW 2.03	Revise Parts plan in BOM as required	Easily accessed through Model Work Order
	MW 2.04	Revise Labor plan in BOM as required	Easily accessed through Model Work Order
	MW 2.05	Add or update description or standards on WO	
	MW 2.06	Revise WO Codes as required	Make sure all appropriate items have been added to the parts list
	MW 2.07	Continue to PM Set Up Sub-Process	Preventive Maintenance Routes

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Business Process - Preventive Maintenance Routines

Asset Owner

PR 1.02
Approval for Recurring Cost and Equipment Downtime & Frequency

PR 1.06
Initiate routine collection of meter data.

PR 1.05
Initiate routine collection of equipment condition data. Involve others as required.

Meter Based PM

Long Term Asset Planner

Continue from Model WO Process

PR 1.00
Confirm or Adjust Model Work Order Description, Coding, and documents

PR 1.01
Unscheduled Corrective or Condition Based PM or Scheduled PM?

PR 2.01
Identify impact on Long Term Asset Plan

PR 1.03
Specify Scheduling Method. Specify frequency & %Due for creating PM WO. Identify Associations to other PMs where needed.

PR 1.04
Specify how condition based data analysis will be performed, and who is responsible..

Condition Based Monitoring

Scheduled PM

Days Based PM

Unscheduled PM

Supervisor, Short Term Work Planning & Scheduling

PR 2.00
Reviews to identify any impact on Short Term Asset Plan

PR 1.07
Create Equipment PM Schedule

PR 1.08
Set up PM Master with Model WO & Estimated Occurrences

PR 1.09
Identify Maintenance Service to be used

PR 1.10
Request New Service if appropriate one not available

PR 1.11
Set up Maintenance Loops where required (Scheduled PMs Only)

PR 1.12
Set up Associations to other Scheduled PM Services Where Required

PR 1.13
Set PM to initiate by Scheduled Date or Last Completed date or meter.

Continue to PM Management Process

Role	Step ID	Step Title	Step Description
Long Term Asset Planning	PR 1.00	Confirm or Adjust Model Work Order Description, Coding, and documents	
	PR 1.01	Unscheduled Corrective or Condition Based PM or Scheduled PM?	
Asset Owner	PR 1.02	Approval for Recurring Cost and Equipment Downtime & Frequency	For PM that can have large monetary value or requires system down or interruption, these types can affect both Budget and have production impact both the Short and Long term Asset Planning groups should be contacted. – Step 2.00
	PR 1.03	Specify Scheduling Method. Specify frequency & %Due for creating PM WO. Identify Associations to other PMs where needed.	Where data collection is required for Equipment Conditions even though these can be feeding into a condition monitoring, the acts of collection of these data are not considered a Predictive Activity. It is the result and there assessment that can generate the PDM Work Order. Capturing Meters is strictly a PM route activity. If Meter reading – move to PR 1.06
Long Term Asset Planner	PR 1.04	Specify how condition based data analysis will be performed, and who is responsible…	As stated, the Who, What and With (device, or method) questions need to be answered before setting both the model work order as well cycle times in which to take these measurements.

Role	Step ID	Step Title	Step Description
	PR 1.05	Initiate routine collection of equipment condition data. Involve others as required.	Identify both the Responsible parties as well as collection cycle
Asset Owner	PR 1.06	Initiate routine collection of meter data.	Identify both the Responsible parties as well as collection cycle
	PR 1.07	Create Equipment PM Schedule	
	PR 1.08	Set up PM Master with Model WO & Estimated Occurrences	
Supervisor, Short Term Work Planning & Scheduling	PR 1.09	Identify Maintenance Service to be used	It is important to note that depending on the type of PM Service types • Calendar • Meter • Condition It is important to select the correct service type
	PR 1.10	Request New Service if one not available	All New Service types will have to be set up in the Maintenance rules correctly before using. Forward to Planner for set up verification.
	PR 1.11	Set up Maintenance Loops where required (Scheduled	

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Role	Step ID	Step Title	Step Description
		PMs Only)	
	PR 1.12	Set up Associations to other Scheduled PM Services Where Required	
	PR 1.13	Set PM to initiate by Scheduled Date or Last Completed date or meter.	
Supervisor, Short Term Work Planning & Scheduling	PR 2.00	Reviews to identify any impact on Short Term Asset Plan	Identify how these new PM requirements, affect both budget, and its production impact.
Long Term Asset Planner	PR 2.01	Identify impact on Long Term Asset Plan	Identify how these new PM requirements, affect both budget, and its production impact.

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Business Process - Preventive Maintenance Work Order

Preventative Maintenance Work Order Creation Process – To Be

WO SCHEDULER

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Role	Step ID	Step Title	Step Description
	PM 1.00	Confirm Meter Readings Are Up-To-Date In The CMMS System	It is important that where sites are using Meter triggered PM's that there is a coordination that these readings are completed before the batch run of the PM generation program
	PM 1.01	Update % Due of all open PM Services No PM Status Change or WO Creation	This first Batch run is to keep the PM system Current with % due and does not update or create work orders. This will be set up to run automatically during off hours
WO Scheduler Statistical update and PM Assessment	PM 1.02	Project PMs For 5 Weeks	Once updated the WO Scheduler can run the PM Projections out for a minimum of 5 weeks. This will give the Scheduler the ability to see the upcoming events, as well as the material demands the system is forecasting. – go to step PM 2.05
	PM 1.03	Report On Overdue & Cancelled PM Services (Inquiry)	This standard report can assist with the Health of the PM system and give insight for what PM's may require attention or create a requirement for change of PM.
	PM 1.04	PM Program Review & Update Sub Process	This continuous PM Improvement need to be managed by a combination of personnel • Asset Specialists • Work Execution Managers • Operations and/or Asset Owners The time frame for this is site dependent, and should be triggered from the Prior health that the Overdue/Cancelled report will give you
	PM 1.05	PM Schedule	Update PM Schedule to the approved changes required. – See PM Routes
	PM 2.09 Weekly Schedule Sub Process	Seasonal PMs Weekly Run - Create WO	Site specialist or Schedulers should be responsible for the Batch running of this process.

Role	Step ID	Step Title	Step Description
	PM 2.01	On Line PM Service Weekly Run - Create WO	Site specialist or Schedulers should be responsible for the Batch running of this process.
	PM 2.02	Plant condition Specific PM Weekly Run - Create WO	Site specialist or Schedulers should be responsible for the Batch running of this process.
	PM 2.03	Weekly PM Daily Run - Create WO	This will be set up to run automatically during off hours
	PM 2.04	Confirm Material Quantities On Hand (Report) For WOs On Weekly Schedule	Identify the required parts for the generated work orders and their availability.
	PM 2.05	Compare Required Material Quantities To On Hand Quantities (Report) For 30 Day Schedule	Working with Supply Chain – assess the missing parts required for the upcoming and forecasted PM's
	PM 2.06	Identify Which WOs To Change To Status Awaiting Materials	Where Supply Chain cannot satisfy parts requirement and change status to Awaiting Material
	PM 2.07	Material Expediting Sub Process	See Material Expediting
	PM 2.08	30 Day Schedule Sub Process	See Scheduling Process
	PM 2.09	Weekly Schedule Sub Process	See Scheduling Process

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Role	Step ID	Step Title	Step Description
	PM 2.10	Weekly Schedule Created	Print Weekly work orders for Execution
	PM 2.11	Work Order Execution Sub Process	See Work Order Execution
	PM 2.12	Identify Work Order Differences or Required Changes	For continuous improvement monitor the Planned vs. Actual

Corporate Business System - ERP Assessment

Business Process Document

Work Order Prioritization

Asset Management

August 10th/2018

Version	Date	Description of Revision	Author
R1	2016-12-20	Updated after process review	S. McCarthy
R2	2018-08-10	Updated after AM Champions Review	S. McCarthy

Contents

Purpose

The Work Order Prioritization Procedure ensures the highest value work is completed in the proper sequence with available resources and ensures that resources are directed to maintenance work based on the work's true urgency, including minimizing maintenance and forced outages and customer service interruptions.

In order to accomplish this, the work must be planned and scheduled in the appropriate sequence. The Work Order Prioritization Procedure must ensure that the relative impacts to Safety, the Environment, and Production are taken into account along with the probability when assessing the priority of any Work Order under consideration.

Appropriate Operations and Maintenance personnel, and Asset Specialists, must have a complete understanding of prioritization and follow the established procedure.

Area and Plant Managers must ensure that the Work Order Prioritization process is in place and followed, and that the appropriate personnel are trained in the procedure.

Business Process - Prioritizing Work Orders

Gate Keeper

The Gate Keeper should be one person or a group whose primary responsibility is to represent the interests of all stakeholder groups while coding and promoting new work (good work) to be assessed by Planning. A Gate Keeper committee would have representatives from Operation, Maintenance and where needed Asset Specialists and Engineering. Whether the Gate Keeper were a single individual or a group, then the needs of all stake holder groups would have to be fairly represented and the member(s) would have detailed technical knowledge of the equipment and its failure modes. This position allows the Short Term Planning and Scheduling personnel to focus actively on planning (at the appropriate time[1]) fully scoped work orders and coordinating the efforts of the entire maintenance crew.

All requests for the use of Maintenance Services shall be made using a Work Order in the CMMS. Should the work scope be defined as "emergency", the work order must be created as soon as possible, and no later than the end of the shift, or overtime call-out event.

The responsibilities for the Gatekeepers should include the following when reviewing work order:

- *Accept/Approve or reject New Work Priority*

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[1] Revision 2: Added text to highlight that Planners should plan jobs in time, but not too early, and in the appropriate order.

- *Eliminate Duplication*
- *Identify requirement against long term plan*
- *Clarify the Description – Clarify the problem, and extent of what the plan should include (repair, replace..)*
- *Add or update coding – failure, reporting ….. required to support ongoing assessments*
- *Accurately identify the Equipment*
- *Confirm and if necessary update the Business Unit or Project (Ops vs. Capital)*
- *Enter the Planned Start Date (rough cut requirement to aid in the organization of planning activities)*
- *Enter the Requested Finish Date (based on plant/customer needs and equipment condition)*
- *Promote to Planning*
- *Approve as Break in [2]Work if appropriate – Emergencies or Break in Work bypass the Planning stage and goes directly to active work.*
- *Identify the level of Planning required (Minimal or full detail)*

Additional related activities for the Gate Keeper role:

- *Receive feedback from planning – where job scope creep occurs or planning process reveals that the work cannot be executed prior to the Planned Complete Date*
- *Receive feedback from Scheduling – when complete dates are going to be missed for a reprioritization.*
- *Provide feedback to Work Order Originators regarding quality and completeness of Work Requests.*

Proactive vs. Reactive Work

Proactive Maintenance is the combination of Operator performed maintenance, preventive maintenance, and condition based monitoring activities conducted to prevent, eliminate, or delay failures; to detect failures, or to reduce the consequences of the event before failure occurs, and also the work activities identified from them. In general, a proactive action is one that is planned, scheduled and executed before a break-down occurs, and includes maintenance prevention activities.

Proactive Maintenance processes include several sub-processes, including identification of critical equipment, failure analysis, basic operator care and Reliability Centered Maintenance (RCM).

All Scheduled jobs are not Proactive, and all Repair jobs are not reactive.

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[2] A Break-In is any work that is performed during the weekly scheduling period that was not on the schedule when it was set in the prior week.

	Identified Failure Mode?	Proactive?	Corrective?	Pre-planning possible?	Is there Advance Warning?
Predictive Mtce.	Y	Y	N	Y	Y
Predict<u>ed</u> Mtce.	Y	Y	Y	Y	Y
Preventive Mtce.	Y	Y	N	Y	Y
Detective Mtce.	Y	Y	N	Y	Y
Detect<u>ed</u> Mtce.	Y	Y	Y	Y	N
No Scheduled Mtce.	Y	N	Y	Y	N
Emergency / Urgent	Y	N	Y	?	N

Figure 1 - Proactive vs. Reactive Tasks. Jobs with no advance warning are reactive[3].

The question of whether a Corrective job is reactive is usually resolved as follows:

- *If it is an emergency, then the corrective job is Reactive.*
- *If the equipment is in a functionally failed state, then the corrective job is Reactive.*
- *Regardless of whether the defined maintenance tactic is "run-to-failure", if the equipment is in a functionally failed state, then the corrective job is Reactive.*
- *If the equipment has not failed functionally at the point when the repair is actually performed, then the corrective job is Proactive.*

The vision for a Proactive culture includes the following achievements:

- *Accurate Backlog of Work*
- *No Emergency Work*
- *High Schedule Compliance*
- *Paperless Environment*
- *Reasonable Overtime*
- *Partnership between Production and Maintenance*
- *Operator Care Program (Operator Routine Duties)*
- *Exceed Environmental And Safety Regulations*
- *Increase Equipment Availability And Reliability*
- *Decrease Maintenance Costs per Unit of Production (or replacement asset value)*
- *Integrate with Operations & Engineering*

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[3] Revision 2: Changed Figure bottom left hand cell from "Emergency/Reactive" to "Emergency/Urgent"

Minimum Requirements for Work Order Prioritization

- *Develop a Work Order Prioritization matrix to balance risk [probability (urgency) and consequence[4] (importance)] for <u>reactive</u> maintenance.*
  - *Consequences shall include those for Safety, the Environment, Cost and Production Loss / Customer Service Interruption.*
  - *Suggested formats are included in the appendices*
  - *Threshold levels for Consequence (Importance) should be defined locally.*
- *Develop a method for prioritization of Project (Improvement) Work involving changes to equipment and/or process on the basis of avoided cost.*
- *Prioritize Proactive Corrective Work Orders based on assessed equipment condition.*
- *Prioritize Preventive & Predictive Maintenance tasks to get them completed within <mark>ten percent</mark> either way of their defined frequency.*
- *Threshold values for Safety, the Environment, and Production Loss / Customer Service Interruption shall be defined clearly enough to be used as a guide to support the process.*
- *The Work Order Priority resolved from the Work Order Prioritization matrix shall result in an assigned Work Order Requested Finish date.*
  - *The Requested Finish Date for Proactive Maintenance shall take the timeframes of the <mark>P-F [5] curve</mark> into account.*
  - *There should be no Work Orders in backlog with Requested Finish Dates in the past.*
  - *The Work Order "Requested Finish Date" represents an agreement between Operations or other stakeholder and the Maintenance group that the work will be completed by that date.*
    - *The Work Order Requested Finish Date may be adjusted as often as required because of new conditions (i.e. not deteriorating as quickly as expected; backup equipment condition deteriorating) or an improved understanding of the failure mode.*
    - *"Requested Finish" dates for corrective work orders[6] will not be set based on availability of equipment or resources.*
    - *Changes to the Work Order "Requested Finish Date" can only be done by the Gate Keeper.*
  - *The Work Order "Planned Start Date" is <u>Not</u> used for Work Order Prioritization, but for Scheduling.*
    - *The "Planned Start Date" should be an appropriate number of days before the "Complete By" Date.*

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[4] For reactive maintenance, the consequences are those that will occur if the breakdown is not repaired. Consequence should not be used alone, but only with probability.

[5] The P-F Curve as used here refers to the time from the discovery of the Potential Failure (P) to the expected time of the Functional Failure (F). The Functional Failure is defined as the point at which the equipment no longer does what Nalcor wants it to do. (i.e. if a pump needs to transfer 30 USGPM from a reservoir to a tank, when it can only move 29 USGPM it has functionally failed; it is not design capacity but desired capacity).

[6] Revision 2: Corrective Work Order Requested Finish Dates should not consider resource availability. The Planned Start Date is used for scheduling.

- - *The "Planned Start Date" reflects equipment and resource availability, not priority.*
  - *The "rough cut" Planned Start Date is to be used by the Planners to schedule their activities.*
  - *The Planned Start Date may be adjusted by the Planners to reflect materials, equipment, or resource availability, as long as it remains a sufficient number of days prior to the Requested Finish Date.*
- *The Work Order Prioritization process shall occur only after any emergency risk mitigation activities are completed and reviewed (i.e. hang a tarpaulin, then prioritize the roof repair).*
- *The Work Order Prioritization matrix is approved by Plant or Area Manager(s).*
- *Immediate Health, Environment, and Safety problems and Major Production Losses should receive the highest priority, and result in schedule break-ins.*
- *Controlled Health, Environment, and Safety problems and Minor Production Losses should receive a lesser priority, but may result in a schedule break-in.*
- *Equipment criticality should be taken into account, but not by itself. The failure mode, system design, and the condition of backup equipment should also be considered. No formula can automatically take these factors into account to assign a work order priority.*
- *Consideration should be given as to how to prioritize shutdown jobs that might be scheduled earlier as Opportunity Maintenance[7].*
- *Consideration should be given as to how Customer Service Work Orders should be prioritized.*
- *Preventive Maintenance, Predictive Maintenance, and Corrective Maintenance should be performed as scheduled unless break-in work prevents the work being done.*
- *The Plant or Area Manager should ensure that the appropriate personnel are trained on the Work Order Prioritization process.*

Metrics that shall be used as KPI's for the Prioritization function

- *Percent Break-In Work*
- *Percent Proactive Work*
- *Percent Emergency Work*

Validation of the Prioritization Process

- *Confirm that the Prioritization matrix exists and is available for use.*
- *Confirm that Gate Keepers daily review and prioritize new work orders and re-assess work orders whose Requested Finish Dates are approaching.*
- *An assessment should be made of the level of awareness of the Work Order Prioritization procedure through interviews with first and second line Maintenance and Operations Supervision and observation of gate keepers.*
- *Work Orders should be sampled to assess the level of adherence.*

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[7] Opportunity Maintenance usually refers to work that required a shut down or de-rated plant or system condition not usually available, which work is performed when other circumstances, like a forced outage, make the performance of the work possible ahead of a Scheduled Outage.

- *Training records should be reviewed.*
- *The amount of reactive work should decline over time to a more acceptable level.*
- *There should be a local process, approved by area management, defining in what ways this process is implemented across the local area, including scope and personnel or position assignments.[8]*

Approvals

	(name)	(signature)	(yyyy/mm/dd)
	(name)	(signature)	(yyyy/mm/dd)

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[8] Revision 2: Added this bullet.

Appendix I – Definitions and Business Rules

Business Process

Work Order Prioritization

The following sample business process provides only the first level of detail Information on the groups or individual positions, their associated *tasks (steps) in the process and high level descriptions for each step.*

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Role	Step ID	Step Title	Step Description
ORIGINATOR	WOP-01	Safety Hazard Assessment	Safety Hazard Assessment: If a Safety Hazard exists, and the condition can be controlled, then do so. If the mitigation is beyond the control of the Originator or their supervisor, and Maintenance help is needed, then enter an Emergency Work Request.
	WOP-02	Environmental Hazard Assessment	Environmental Hazard Assessment: If an Environmental Hazard exists, and the condition can be controlled, then do so. If the mitigation is beyond the control of the Originator or their supervisor, and Maintenance help is needed, then enter an Emergency Work Request. If immediate cleanup is needed, then enter an Emergency Work Request. Follow rules of Environmental policy.
	WOP-03	Major Production Loss or Customer Outage Assessment	Major Production Loss or Customer Outage Assessment: If there is a Major Production Loss or a Customer Outage beyond the established thresholds, and Maintenance help is needed, then enter an Emergency Work Request.
	WOP-04	Moderate Production Loss Assessment	Moderate Production Loss: If there is a Moderate Production Loss beyond the established thresholds, and Maintenance help is needed, then enter a Priority 2 Work Request.
	WOP-05	Environmental or Safety related Improvement Assessment	Requests for Environmental or Safety related Improvement should be Priority 3.
	WOP-06	None of the above	If the work order is not related to safety, the environment, production loss or customer outage, then it is a Priority 4.
Gate Keeper	WOP-07.1 & 07.2	Are there other problems revealed?	WOP-07.1 Were other or multiple potential failures not as a result of the original event revealed as a result of this failure? If so, then create the Work Orders, and if necessary get a project approved and so code the Work Orders.
	WOP-08	Check All New Work Orders Prioritize AFTER Mitigation.	WOP-08.1 Review all work orders created since last meeting. Prioritize using site or area specific matrix. Make sure the type, priority, and coding is correct. Assign Requested Finish Dates.

Role	Step ID	Step Title	Step Description
			Assign Rough Cut Planned Start Date as an aid to the Planner in selecting which jobs to plan first. (The Planner may adjust the Planned Start Date after going through the Planning sub-process.)
	WOP-09	Make sure the Requested Finish Dates aren't in the past	If the Work is not being done as per the Requested Finish Date, then the work order must be reviewed and re-assessed for risk. It may be found that the equipment is in better or worse condition than expected, or that the mitigation chosen is more or less robust then anticipated.
	WOP-10	Feedback to Work Order Originators	Feedback to the Work Order Originators suggestions to improve their use of the Work Order Prioritization process.

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Appendix 2 – Hydro Legacy Routine Work Prioritization Guide

Evaluation Factors:

1) **Importance = (a)*(b)*(c)*(d)*(e)*(f)**

(a) The work is: Reject if (a) = 0	Other	Corporate Mission Support	Justifiable	Necessary	Essential
	0	1	2	3	5

(b) The loss type is:	None	Facilities / Equip.	Production	Delivery	Safety & Health or Environment
	1	2	3	4	5

(c) Equipment Criticality:	Other	Standby Unit in Critical System	Critical to Plant or Station	Critical to Entire System	Critical Safety Protective Device
	1	2	3	4	5

(d) Loss can be mitigated by:	Available Redundant Equipment	Available Backup Option	Nothing
	1	3	5

(e) Loss probability is:	Low	Medium	High
	1	3	5

(f) Loss Potential is:	Minimal	Moderate	Substantial
	1	3	5

Total = (a)*(b)*(c)*(d)*(e)*(f)	**Low**	**Medium**	**High**
	< = 72	**73 – 1619**	**> 1619**

2) **Urgency:**
How long can the work be delayed before the above loss is incurred?

		Low	**Medium**	**High**
	N/A	**> 1 month**	**<= 1 month and > 1 week**	**<= 1 week**

3) **Priority Matrix:**

Priority Action Timeframe

- Immediately
- 1-7 Days with Target Start
- 8 Days – 4 Weeks with Target Start
- Schedule as Required with Target Start

Figure 2 - Reference Hydro "Routine Work Prioritization, Rev. 5, 2004-11-10

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Evaluation Factors:

The following provides some guidelines when assessing the range of each evaluation factor. Both importance and urgency can evolve due to changes in circumstances and these can ultimately impact the priority.

1. *Importance*
    a. "The work is?" This factor covers the work category.
        i. Other: The work is not required and should be rejected if it doesn't fit into the following work categories.
        ii. Corporate Mission Support: At a bare minimum, our work should support our corporate mission by aligning to our goals and objectives. For example, enhancing our public image through provisions of materials and labour for municipal celebrations.
        iii. Justifiable: This refers to work that will provide a benefit to the company that outweighs its cost. These benefits may be financial or non-financial (E.g. Improved customer service index)
        iv. Necessary: This refers to work required to maintain facilities and operations in adequate condition to meet anticipated activity levels. For example, a derated unit at Holyrood may be required at full load within a week because of system load projections. More examples of necessary work would be JD Edwards is down (during normal service hours), the AS400 production machine is down, or the Corporate LAN is down.
        v. Essential: Work that is required to meet government regulations, legal requirements, or minimum environmental/safety standards. For example, work to address a class "A" safety hazard or work covered under the wood pole agreement with Aliant would be considered essential.
    b. "The loss types" are as follows:
        i. None if there is no loss associated with not performing the work.
        ii. Facilities/Equip. if there is a potential or existing loss of support facilities or equipment not directly related to the production or delivery of electrical energy. For example, line depots, regional offices, Hydro Place, servers, office equipment could be covered under this loss type.
        iii. Production if there is a potential or existing loss to equipment or systems related to the production of electrical energy such as hydraulic or thermal generating equipment, dams, control structures, etc. This type focuses on unit unavailability without having major customer delivery implications.
        iv. Delivery if there are potential or existing customer outages resulting from equipment or systems involved in the production, transmission or distribution of electrical energy. The focus here is on external customer outages due to generation unavailability, transmission line or distribution feeder outages.
        v. Safety & Health or Environment if the loss has or will have an impact on employee or public safety and health such as rotten wood poles, defective distribution disconnects, line road crossings, etc. or on the environment such as a potential contaminant release.
    c. "Equipment Criticality" asks for an indication of how critical the equipment is to the company's operations.
        i. Other is used to capture all equipment/systems that are less critical than those in the following groups.

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        ii. Standby Unit in Critical System would cover equipment like backup chargers in terminal stations, ring bus breakers in terminal stations, backup 230 kV line protection, parallel lines, etc.

        iii. Critical to Plant or Station covers equipment/systems that are critical to a plant's or station's function such as line breakers, power transformers, RTUs, radial lines, etc.

        iv. Critical to Entire System covers equipment/systems that are critical to the an entire system's function, whereby system is defined as the main power grid (interconnected island or Labrador) or any isolated diesel system,

        v. Critical Safety Protective Device covers equipment/systems that are in place to provide safety protection in the event of equipment failure such as pressure relief valves, surge tanks, fire alarm/protection systems, etc.

   d. "Loss can be mitigated by" covers the kind of mitigation that could offset the impact of the loss.

        i. Available Redundant Equipment covers equipment/system that is a direct replacement for the equipment experiencing the loss. For example, this would include a parallel battery bank charger, a parallel line or transformer, a spare diesel unit, backup line protection, etc.

        ii. Available Backup Option covers options that are not direct replacements but provide the same function. These options would usually come at some extra cost. For example, mobile substations/diesel units/ transformers, temporary bypasses, alternate feeds, etc.

        iii. Nothing covers the case where there are no options for mitigating the loss.

   e. "Loss Probability" provides an indication of how probable the loss event may occur. This will require judgment based on equipment history and present condition and may also be influenced by external factors such as weather forecasts, load projections, system conditions, season, etc.

   f. "Loss Potential": An assessment of the loss extent that could be suffered to people (loss of life, injury, etc.), environment (spills, exposures, hazards, etc.) and/or plant/asset/equipment/systems if the job is not completed soon. This is not a probability assessment but an indication of how much damage could occur. This again will require judgment based on system knowledge and external factors. For example, if delaying a job could result in no injury, low plant/asset/equipment loss and significant environmental loss, then the loss potential would be substantial due to the environmental factor. Another example could be a computer virus, which affects a few people but has the potential to affect every user. This case would have a substantial loss potential. The loss potential extent should also be evaluated in terms of its cost. For example, minimal loss potential could be a cost of less than $1,000. Moderate loss potential could be a cost of $1,000 to $10,000 and substantial could be greater than $10,000. These limits would have to be agreed upon before implementing this methodology. Another consideration is the loss's impact on the system. For example, if the loss is limited to local systems such as a local server, security system, air conditioning unit, vehicle, etc. or parts of systems such as a distribution feeder, a terminal station, a generating unit in a multi-generator plant, etc., then it may be considered a moderate loss. However, if the loss affects or will affect an entire system such as the Island grid, an isolated diesel system, an interconnected distribution system, the ECC control system, all PC users on the corporate network (E.g. Software virus), etc., then that should be considered a substantial loss. Staff productivity needs to be considered here in the case of losses associated with facilities or equipment like servers, buildings, printers, etc. The loss potential could range from one person (i.e. minimal) to all users (i.e. substantial).

2. *Urgency*

   a. This factor takes into account the timing requirements of the work. This is again a judgment call that takes into account risks. One needs to consider the above loss potential(s), along with its probability, to

determine how long the work can be delayed before incurring the loss(es). Influencing factors could be weather or season, unit outage coordination, load projections, coordination with other higher priority work, or work type (E.g. Preventive maintenance, Corrective Maintenance, etc.). For example, an impending lightning or sleet storm may necessitate that work be carried out within the next 2 days or a planned unit outage may be coordinated with previously unidentified work to take advantage of the outage. In any case, the urgency chosen needs to be justified based on some risk assessment. The user will indicate N/A (i.e. not applicable) for work that doesn't have any losses associated with it.

3. *Priority Action Time Frames*

   a. The following timeframes are merely guidelines for planners when scheduling work. They may be impacted by resource (human and goods & services) availability. The main emphasis is that higher priority work should get completed before lower priority work.

      i. **Priority 1** = Immediately (An injury has occurred or may occur; customer outage is ongoing or pending; necessary production is stopped or about to be stopped; or significant damage to plant/asset/equipment or environment has occurred or may occur. This is urgent reactive work of high importance, with no planning or scheduling within JDE).

      ii. **Priority 2** = 1 Day - 7 Days with target start date (Work must be started as promptly as possible with some planning done prior to it's commencement, as time permits. This is reactive work with some planning and scheduling within JDE.) This work is of an either high urgency and medium importance nature; or medium urgency and high importance nature.

      iii. **Priority 3** = 8 Days - 4 Weeks with target start date (This is important proactive work that is not urgent and must be fully planned and scheduled within JDE.) This work is of an either high urgency and low importance nature; medium urgency and medium importance nature; or low urgency and high importance nature.

      iv. **Priority 4** = Schedule as required with target start date (Any work that is required to be done but is not, at this time, affecting safety, health, environment, production or cost. It may be upgraded to another priority should the work become more urgent due to deteriorating or changing conditions. This is required proactive work of low to medium importance and low urgency or low to medium urgency and low importance that must be fully planned and scheduled within JDE).

Appendix 3 – Alternative WO Prioritization Matrix

Reactive Maintenance Prioritization Matrix
RISK = CONSEQUENCE x PROBABILITY

Consequence: Assess the work at hand against each consequence. Select the most severe.

Classification		No Safety Concern	Minor Safety Concern	First Aid	Recordable Injury	Recordable Injury and Lost Time	Fatality or multiple recordable injuries
Safety Impact		No Safety Concern	Minor Safety Concern	First Aid	Recordable Injury	Recordable Injury and Lost Time	Fatality or multiple recordable injuries
Environmental Impact		No Environmental Concern	Any or low impact spill of non-hydrocarbon liquid	Hydrocarbon (HC) spill to land or containment < x liters. Chemical spill < x kg. Recordable spill.	Hydrocarbon (HC) spill to water < x liters. HC spill to land or containment between x & y liters. Reportable spill.	Hydrocarbon (HC) spill to water > x liters. HC spill to land of containment between y & z liters. Government Agency mobilizes.	Major fire. Severe environmental damage.
Equipment Failure Consequences		No equipment or Production concern.	Loss of production efficiency < x. Production Loss < x MW. Transmission impact < x. Distribution impact < x.	Production efficiency loss > x. Production Loss between x & y MW. Transmission impact between x & y. Distribution	Fire < $ x damage. Production Loss > x MW. Transmission impact > y. Distribution impact > y.	Fire between $ x & $ y damage. Unit Shutdown. Transmission impact ?? Distribution Impact ??	Fire > $ y damage. Plant Shutdown. Transmission impact ?? Distribution Impact ??
Operational Flexibility		No Operational concern	Alternate operational modes possible. Installed Spare equipment installed.	Alternate operational modes. Spare equipment installed.	Marginal alternate modes for operation. Spare installed equipment.	Limited or restricted operation possible. Spare installed equipment.	Limited or restricted operation possible. No spare installed equipment.
Production or Asset Loss on Non-Routine /Projects		No Damage or Asset Loss	Minimal Damage or Asset Loss < $ x	Minimal Damage or Asset Loss between $ x & $ y	Some damage, asset loss, or efficiency reduction. Cost between $ y & $ z.	Some asset loss, damage, or downtime. Cost between $ z & $ z1.	Significant asset loss, damage, and/or downtime. Cost > $ z1.
	Annualized Cost		< $ x	< $ x	< $ x	< $ x	Matrix
	Severity -->	**0**	**1**	**2**	**3**	**4**	**5**

Probability: The consequence can reasonably be expected to occur

Reactive Maintenance Scale

Review Requirements to Decide how or whether to progress this work

	Probability Description	Severity 0	1	2	3	4	5
A	Occurring NOW or likely to occur in 1 - 2 days		3-1	2	1	1	1
B	2 days to 2 weeks. Unlikely within 2 days.		3-2	3-1	2	1	1
C	2 weeks to 3 months. Unlikely within 2 weeks.		4-1	3-2	3-1	2	1
D	3 months to 6 months. Unlikely within 3 months.		4-2	4-1	3-2	3-1	2
E	Likely to occur > 6 months. Unlikely within 6 months.		4-2	4-2	4-1	3-2	3-1

Figure 3 - Sample Prioritization Matrix. Refer to attached file for complete document.

Priority & Codes

Priority	Definition	Target Date	Schedule Breaker?
1	Emergency	Begin Immediately	Yes
2	Urgent (High Priority)	Complete in 1 -7 days	Possibly
3-1	Routine	Complete in 14 Days	No
3-2	Routine	Complete in 30 Days	No
4-1	Routine	Complete in 90 Days	No
4-2	Routine	Complete in 365 Days	No

Generic AM Reactive WO Prioritization Matrix

Figure 4 - The matrix result shall result in a Requested Finish Date[9]

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[9] Revision 2: Generic Matrix revised to use "Target Date, and to specify that while an Emergency should be started immediately, it will not necessarily be completed in one day.

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Corporate Business System - ERP Assessment

Business Process Document

Scheduling - Asset Management

August 14th/2018
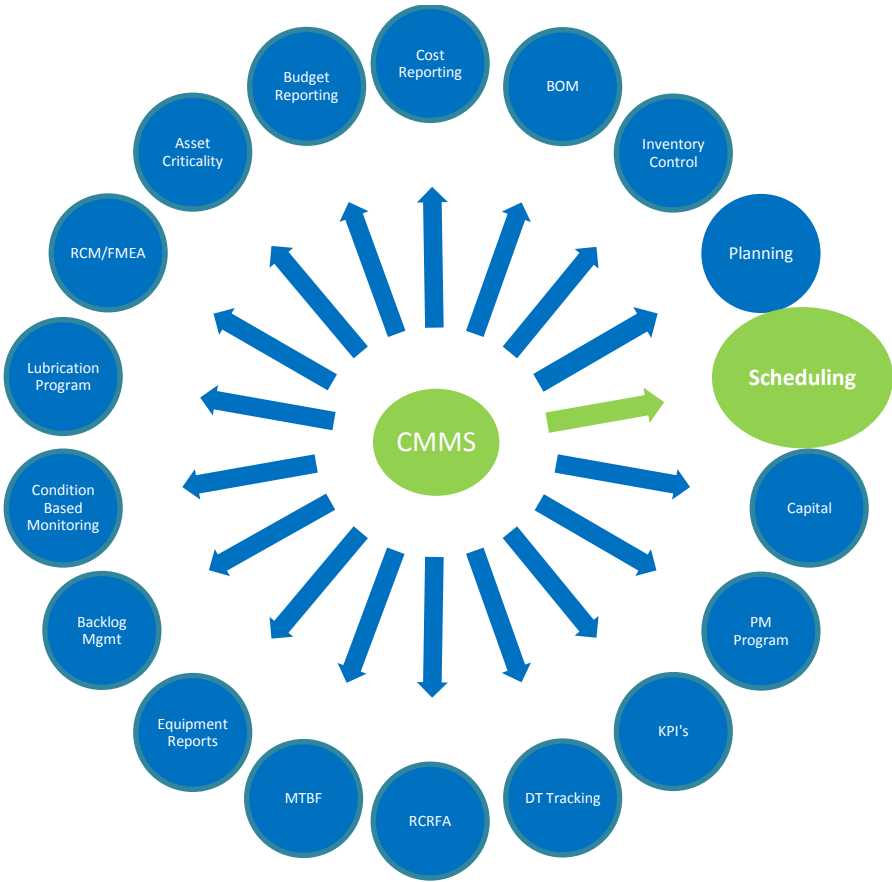
Version	Date	Description of Revision	Author
R1	Aug 20, 2015	Added Metrics section	S. McCarthy
R2	2016-12-20	Updated after process review	S. McCarthy
R3	2018-08-14	Updated after AM Champions Review	S. McCarthy

Contents

Purpose

The "scheduling function" is the hub from which all planned maintenance activity is coordinated. The Maintenance Scheduler is responsible for scheduling preventive and regular maintenance with minimal interruption to production operations. In this capacity, the Maintenance Scheduler is the principal contact and liaison person between Maintenance and Operations and other supporting departments in relation to determining the timing for execution of planned maintenance work. The Maintenance Scheduler works in coordination with the Maintenance Planner to ensure that Operations balance their need for daily output with their need of equipment reliability through proactive maintenance. The Maintenance Scheduler ensures that all internal customers of Maintenance receive timely, efficient and quality services. The Maintenance Scheduler will adhere to all Safety and Maintenance guidelines, to ensure a safe working environment and increase equipment longevity and improve labor productivity and equipment availability.

- Facilitation of weekly work scheduling meetings with Maintenance, Operations and other supporting departments.
- Attendance at, and if not facilitated by Maintenance first or second line supervision, facilitation of Daily Schedule Update and Coordination meetings with Maintenance, Operations and other supporting departments.
- Schedule and assign the work, integrating both customer (internal and external) and maintenance's needs.
- Develop maintenance shutdown schedules integrating all activities into one comprehensive plan.
- Coordinating maintenance work and projects.
- Creates and manage Maintenance schedules.
  - 5+ Year Long Term Schedule
  - 1 Year Integrated Schedule
  - 90 day rolling Schedule
  - 4 week Rolling Schedule (30 days)
  - Weekly Schedule
  - Shut down Schedule
- Generate metrics to demonstrate performance and guide process[1] improvements.

Scheduling – determining when an activity can be accomplished based on available resources.

Scheduling Includes:

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[1] Replaced the word "drive" with "guide process".

- Assigning jobs to appropriate blocks of time based on external & internal resource availability, priority, material availability, and equipment availability.
- Confirming materials availability for scheduled work.
- Scheduling jobs in areas that require travel or that need the same equipment shut down in the same blocks of time.
- Preparing Gantt Charts for small Maintenance Outages based on Planned Work Order Steps and available resources.
- Approving Break-In Work
- Daily Coordination among Front Line Supervisors, to include the following:
  - Review jobs or work order operations that have hand offs to other Supervisors or groups.
    - Confirm the expected completion of predecessor activities
  - Higher priority jobs (break-ins) being worked
    - Impact on the weekly schedule.
    - Potential impacts on resource requirements from other groups
  - Reschedule jobs on the weekly schedule as needed.
  - During overhauls or other periods of intense activity, the Daily Coordination meeting requirements may become more formal.
- Weekly Schedule Preparation, to include the following:
  - Previous week's results.
    - Anticipated status at end of the current weekly scheduling period
  - Confirmation of available maintenance resources for the upcoming scheduling period.
  - Discuss additional work found.
    - Higher priority jobs (break-ins) being worked.
  - Discuss production work priorities.
  - Publishing a Resource Loaded Schedule for the next weekly scheduling period.
  - Agree on major backlog jobs to be scheduled.
- Weekly Schedule Compliance Review, to include the following:
  - Previous week's results.
    - Review Schedule Compliance statistics.
    - Identify off-schedule situations and reasons.
      - Identify sources of problems and delays.
    - Review corrective action taken.
    - Review Break-In Work.
  - Issues/lessons learned and feedback from actuals.
- Periodically purging the backlog.

Business Process - Scheduling Work Orders

The purpose of Scheduling is to sequence the work tasks in a manner that allows the safest and most efficient execution of tasks, and needs to include considerations for simultaneous operations, minimizing production outages, coordination between work disciplines, etc.

Schedules are developed in conjunction with the appropriate Operations, Engineering and Maintenance personnel.

- Work on assets by all groups must be integrated
- Examples of work that must be integrated into a single Maintenance Planning & Scheduling system:
    - Asset Integrity or Condition Assessment inspections by external consultants.
    - TRO working in a Plant's Terminal Station where a plant or unit outage is required.
    - Network Services working in a Terminal Station.

Type of Schedules where Schedulers are involved, in order of increasing levels of detail:

- 5+ Year Long Term Maintenance Schedule
    - The 5 + Year Schedule, whether by itself or as part of the schedule created and managed by the Long Term Planning group, identifies major projects such as new generation and transmission facilities, minor projects, and events such as outages and major PMs. The 5+ year Maintenance Schedule provides input to the 1 Year Integrated Schedule.
    - Larger or more important repetitive events should be included, such as Unit Overhauls, but the individual PMs that make up the Overhaul tasks do not need to be listed in detail
- 1 Year Integrated Schedule
    - Consists of major events for Maintenance and Capital, Shutdowns, Regulator Inspections, Rebuilds and events that affect production. It is at this time that PM and work orders may be assigned or assessed through forecast. This schedule is fed from the 5 year plan, PM Projections and Work Order backlog.
    - Provides input to the budgeting efforts for the upcoming year.
    - Resources should be loaded in the annual schedule to the levels defined and documented in either corporate or local procedures, corporately defined levels taking precedence[2].
- 90 day rolling Schedule
    - The Rolling 90 Day schedule is an update of the Annual schedule for major non-routine work activities, with detailed focus on the next 90 days. This scheduled is usually tracked, managed and updated monthly.
- 4 week Rolling Schedule (30 days)

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[2] Revision 3: Added resource loading target for annual work plan.

- Includes the activities from the 90 day schedule, and also the PM, PdM, and other maintenance activities known from the CMMS. The data for the Rolling 4 Week schedule comes from the CMMS system.
- Work Order Start Dates should be assigned within the 4 week window.
- Activities can be exported to Project Management Software at a detail level of one activity per work order or at an Operation Step level if desired.
- Schedule loading by craft for each week is calculated and reported. Materials, external services, & special tools for the work are actively confirmed for delivery by scheduled date.
  - Weekly Schedule
    - The weekly schedule is for the next 7 day period (i.e. Monday through Sunday) and is locked down when approved (before the Schedule Period begins). Tasks assigned should usually be able to be accomplished within the week-long schedule period.
  - Shut down or Overhaul Schedule – May or may not be managed by the same group
    - These are typically major events that affect Operations, and often requires the management of work order tasks at a higher level of detail (i.e. shift-by-shift) than is done for weekly schedules.
    - Activities can be exported to a project management software where needed.

Backlog Review

An accurate backlog is necessary to be able to continually evaluate maintenance resource requirements and to successfully perform planning and scheduling activities. Duplicate work orders and jobs that have become irrelevant or impractical must be purged from the backlog, since they over-state resource requirements and distract from real priorities.

The Gatekeeper(s) have a role to play in the identification and removal of duplicate work orders, and in ensuring that work is not approved for Planning unless it is likely to be executed. The Planner(s) have a role to play in that any duplicate work that comes to their attention should be noted as such and returned to the Gatekeeper(s). In addition, to maintain an accurate backlog of work, periodic work order backlog reviews and purges must be performed.

The purpose of conducting recurring backlog reviews is to ensure that:

- Invalid work orders are removed.
- Valid work orders have their information, equipment number, coding and status updated where appropriate.
- Duplicate work orders are eliminated.
- Incomplete work orders reflect the current status of completion.
- Common problems with work order management are identified, and actions assigned to eliminate or mitigate the basic causes.

Initially, a number of joint meetings will probably be needed to review all backlog work orders, one-by-one. While this is tedious, it should be a one-time event if appropriate work order management

processes are implemented to keep the backlog clean. After this first effort, the meeting frequency can be reduced and the scope of review changed to cover discrete sections of the backlog. All backlog should have been reviewed annually.

Scheduling Process Metrics

The following metrics refer to weekly regular maintenance scheduling, and except where specifically noted, not to Shutdown (Outage) planning. Reports should be submitted to the Work Execution Manager so that appropriate action can be taken to address any gaps.

- All Work Orders in the Weekly Schedule are fully planned in the CMMS.
- All Work Orders with Planned Start Dates less than 30 Days out are fully planned in the CMMS.
- Schedule Loading by trade
    - Next week – target 100% resource loading for Maintenance trades, not for equipment resources (i.e. special tools or resource-limited equipment).
        - Based on resource loaded schedule produced by Scheduler divided by adjusted resource availability for upcoming week.
    - Two weeks out – target? (< 100%)
        - Based on planned work orders involving Maintenance trades where the WO planned start date is in the two week out period.
    - Three weeks out – target? (< 2 weeks out target)
    - Four weeks out – target? (< 3 weeks out target)
    - Five weeks out – target? (< 4 weeks out target)
- Overdue Work Orders
    - Number of Work Orders at status < In Progress with Planned Start Date in the past.
    - Overdue backlog by trade for Work Orders at status < In Progress with Planned Start Date in the past.
- Maintenance Planned Backlog by trade
- Unplanned Maintenance backlog
- Schedule Compliance
- Percent PM Compliance
- Percent Reactive Work
- Percent Proactive Work
- Repair Work Generated from PM's as a Percentage of all Proactive Work.
- Creation of weekly schedule compliance reports, and quarterly schedule compliance summary reports.
- Confirm that Work Order Backlog review meetings:
    - Are attended by at least a Maintenance and Operations representative;
    - Are held at least quarterly and minutes are kept identifying the participants, the work order groups reviewed and the results.
    - Review all of the work order backlog groups at least once in an annual period.

Scheduling Process Audit Requirements – Level 1

Scheduling determines when work should be performed based on priorities, the availability of the equipment for work, and the availability of personnel, materials and parts, outside services, and transportation.

- Work Orders are scheduled to be performed before the Requested Finish Date as assigned by the gate keepers.
- A Weekly Schedule procedure exists that includes:
  - A swim lane flow diagram detailing for the plant or area the responsibilities by position.
  - A requirement for a Weekly Scheduling Meeting with Agenda defined and requirements for keeping minutes defined.
  - A requirement for one or a group of Daily Scheduling Coordination Meeting(s).
- Targets are set for work order backlog by trade, in weeks based on expected resource availability.
- Schedule Compliance is measured, issues documented, and recurring issues followed up and action documented.
- Work Orders are scheduled in the Weekly Schedule at least at a Work Order Level.
- Existence of Break-In approval procedure
  - Confirmation of the knowledge and use of the Break-In approval procedure by Operations and Maintenance and Project and Administrative personnel.
- Creation of quarterly Schedule Compliance review reports
  - Confirmation of evidence of feedback through front line management of unforeseen events that resulted in delays in execution of the work.
  - Show evidence that such feedback was used in some concrete way to improve Scheduling effectiveness.
- Agenda for weekly scheduling meeting with appropriate participants and agenda items.
- Confirmed appropriate use of Work Order Planned Start Date
- Existence of Annual Schedule at appropriate level of detail.
- Show the results of weekly 30 Day Schedule material quantity reviews, and evidence of corrective action taken in the event of shortages.
- Show evidence that Capital Project Work is not creating demand in the MRO Warehouse, and thereby artificially inflating inventory value and invalidating MRO Purchasing history as an input to decisions on stocking level.
- Show that all Major Shutdown Work Orders for Maintenance are fully planned in the CMMS when the shutdown scope is locked down, or 2 months prior to the shutdown, whichever comes first.
- The Plant/Area has a documented Scheduling procedure aligned with the corporate standard procedure in sufficient detail to provide guidance in implementing the procedure, executing the procedure, and training appropriate personnel. The Procedure is approved by Plant/Area

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Management,[3] published and available to view. Personnel involved are familiar with the procedure and its contents.

- o The Scheduling Procedure includes a procedure for Break-In approval and review.
- The Plant/Area has a documented Scheduling Training Plan covering process, standards, and use of the CMMS and associated tools. The Scheduling Training Plan is being followed.
- The CMMS Procedure is adhered to in Scheduling in the use of Work Orders, Work Order status codes, Work Order planned start and Requested Finish Date, etc.
- The Standard Work Order procedure is adhered to in the use of Model Work Orders to record learnings from Schedule Compliance reviews.
- Scheduled Preventive Maintenance jobs are performed when due, with exceptions explained.
- A guideline for documenting resources available for Maintenance work in the coming 5 week period, and especially for the coming weekly schedule period, shall be defined. The guideline will include in what cases and for what reasons any maintenance personnel who are available for work are excluded from the available maintenance resources used to calculate schedule loading.[4]

Scheduling Process Audit Requirements – Level 2

Level 2 is built on the requirements of Level 1.

The intent of this procedure is to ensure that the Scheduling Procedure fully utilizes the Scheduling Tools inherent in the CMMS in the development of the 7 Day and 30 Day Schedules, and to ensure that PM routines are scheduled and executed on time.

- Plan and Schedule all work 30 Days in the future, in the CMMS.
- Schedule Major Jobs at least 12 months in advance.
- Review the Annual Schedule monthly and update major outage windows and major project start dates
- Confirm the 90 Day Schedule monthly and reconfirm Maintenance trade resource loading and equipment availability for work.
- Provide familiarization training to selected [5]Operations and Maintenance and Project personnel in the Weekly, 30 Day, and Annual Scheduling procedures
- Confirm Materials for 30 Day Schedule are On Hand and if not, take corrective action.
- Maintenance trade resource levels and information on scheduled time off are available from the CMMS, and used for resource loading calculations.
- Work Orders are scheduled in the Weekly Schedule at an Operation (Routing) step level.

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[3] Revision 3: Added approval for area procedure.

[4] Revision 3: Added documentation of reasons for excluding maintainers from resource availability.

[5] Revision 3: Specified that selected personnel to be familiarized with how work is scheduled, This is in order to promote early notification of the need for maintenance assistance.

Approvals

	(name)	(signature)	(yyyy/mm/dd)
	(name)	(signature)	(yyyy/mm/dd)

Appendix I – Definitions and Business Rules

<< Add any agree upon business rules or definition associated to the business processes.>>

Business Process

Work Order Scheduling

The following sample business process provides only the first level of detail Information on the groups or individual positions, their associated tasks (steps) in the process and high level descriptions for each step. This is an overview of the 30 day and 1 week schedule.

WS 1.0 – 30 Day and Weekly Maintenance Schedule

Swimlanes:
- Short Term Scheduler - 30 Day Scheduling
- Short Term Scheduler - Weekly Scheduling
- Maintenance Supervisor - Weekly Scheduling

Process steps:
- WS 1.01 90 Day Rolling Schedule
- Start
- WS 1.02 Create or Validate Work Order with Dates
- WS 1.00 Backlog Assessment for Outstanding Work Priority/Dates
- WS 1.03 PM Forecast
- WS 1.04 Carry Over Work
- WS 1.05 Next Week Schedule Formulation
- WS 1.06 2nd Week Out 60 to 80 % Loaded
- WS 1.07 3rd Weeks Out 40 to 60 % Loaded
- WS 1.08 Weekly Scheduling Meeting
- WS 1.09 Approved and Published Schedule
- WS 1.10 Baseline Next Period
- WS 2.00 Current Week Distribute to Supervisor(s)
- WS 2.01 Be Informed of Break in Jobs
- WS 2.02 Daily Scheduling Meeting Approve Changes
- WS 2.03 Adjust for Schedule interruption and Close Week
- WS 2.04 Schedule Compliance KPI
- WS 3.00 Assign Crew Member to Tasks
- WS 3.01 Distribute Work Order to Crew
- WS 3.02 Work Execution Sub-process
- WS 3.03 Complete and Close Work Orders and Tasks
- End

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Role	Step ID	Step Title	Step Description
	WS 1.00	Backlog Assessment	The first step a Scheduler must do is to poll the Annual Work Plan and the Work Order backlog ready for scheduling. Though there are several other inputs that must be considered, should be the primary source for the formulation of the Next Period Scheduling requirements. A Scheduler main work effort is with the coordination with Maintenance and Operations, and agreement of the work to be accomplished in an upcoming or future period. The Scheduler is to validate and load the crew's capacity load, be it one or many trade disciplines. Normally the Schedulers will use Planned Start Date as to meet the Required Planned Complete dates, as well as critically to define which job should be selected to load. Schedulers should not be loading any trade group higher than the agreed upon capacity. If target dates cannot be met there may be an escalation to Supervisor, Superintendent, or Gate Keeper Committee to reevaluate the following • Requested Finish Date • Overtime Considerations • Contracting Out Schedulers should always be forward looking and normally will have Jobs or tasks spread over several periods. Including Current Week a minimum of a following three periods should be in some state of Scheduling and coordination with Operations and a full 30 days from current is good.
Short Term Scheduler - 30 Day Scheduling	WS 1.01	90 Day Rolling Schedule	The 90 Day Rolling Schedule is a portion of the agreed upon Yearly Plan. These requirements may or may not already be a Work Order. Schedulers may need to coordinate with the Planner or Long term Planner for the creation of these in a work order and task requirement
	WS 1.02	Create or Validate Work Order	Work Order Create and Date validation may require feedback to the Planner group where dates are aged out.

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Role	Step ID	Step Title	Step Description
	WS 1.03	PM Forecast	Schedulers should be forward looking and should consider upcoming impact from the PM system and how and who this will affect. I may be a decision to manually create these PM early as to assign them to a Scheduling Period. (this assumes that PM's are fully Scoped jobs)
	WS 1.04	Carry Over Work	Carry Over Work is a term for job tasks that were not completed, that had been scheduled. Carry Over Work does not necessarily fit into the week following, and will have to consider the condition of the equipment, especially relevant when equipment shut required.
	WS 1.05	Next Week Schedule	Next Week Schedule – Should be the list of jobs or tasks that will be completed "Next Week". At this time it is only a bulk load of hours by trade disciplines. There may be hard dates due to equipment shut requirements and coordination with Operations is required. It is up to the Scheduler to coordinate these dates with Maintenance, Operations and possibly the Asset Specialist and Short Term Planning. Scheduler should be focused on bulk loading and not on Resource loading. It is also at this time that the Scheduler should be verifying with Warehouse the parts availabilities and adjust or expedited if required.
	WS 1.06	2 Weeks Out	Similar to any future period – is a labour load of planned work orders. These future periods should not be to the level loading of the Next or Current Week period. Targets for level loading should lose around 10 to 20% per period. (This does not apply for Shut Down Periods) or 80% loaded
	WS 1.07	3 Weeks Out	Similar to any future period – is a labour load of planned work orders. These future periods should not be to the level loading of the Next or Current Week period. Targets for level loading should lose around 10 to 20% per period. (This does not apply for Shut Down Periods) or 60% loaded
	WS 1.08	Weekly Scheduling Meeting	The weekly meeting should be a natural extension to the daily meeting. The main difference may be the complement of personnel; this may require coordination with all related Schedulers (e.g. Shut Down) and Operational personnel. It is from this meeting

Role	Step ID	Step Title	Step Description
			the Approved schedule should be finalized for the "Next Period". "Current Period" tasks should be assessed for completion, or forecast completion or rescheduled.
	WS 1.09	Approve and Publish Schedule	Once the changes have been made this should be posted and communicated as the approved Schedule.
	WS 1.10	Baseline the Schedule	This baseline or frozen Schedule should be "banked" and used for as one of the measurement or assessment KPI of both Planning and Scheduling. This will be used for a Key assessment once the "banked" scheduled period has been completed and then compared to the actual.
	WS 2.00	Distribute to Supervisor(s)	Once the weekly scheduled is approved, the scheduler should create the job packages and ready for distribution. The scheduler will distribute the job packages to the Supervisors and forward the parts requirement to inventory for "Bag and Tag" and even for delivery. Different sites may have different requirements due to remoteness of site. **It is also at this time that any requirement for interface or updates to feed into a Project tool for the Weekly Schedule may take place**
Short Term Scheduler – Weekly Scheduling	WS 2.01	Be Informed of Break in Jobs	Break in Jobs are task that have not been scheduled but due to Operations, Environment, or SWOP are required. True emergencies will always be an after the fact plan, some will be already actively being worked on while others may be brought to the Gate Keeper (Work Order Review) Meeting for approval. The Short Term Scheduler must be Informed of Break-In Jobs, but is responsible to adjust neither the daily schedules nor the in-execution weekly schedule as a result of the break-ins. **There should be a defined Break in Approval process to follow**
	WS 2.02	Daily Scheduling Meeting	Daily meeting should track the health of the current Schedule and could include the following: • Previous day's results. • Review jobs completed. • Identify off-schedule situations and reasons.

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Role	Step ID	Step Title	Step Description
			• Review corrective action taken. • Discuss additional work found. • Current day's results. • Higher priority jobs (break-ins) being worked. • Problems and delays. • Anticipated status at end of shift. • Jobs that require unexpected overtime. • Future schedule. • Reschedule jobs as needed. • Discuss production work priorities. • Agree on major backlog jobs to be scheduled. • Issues/lessons learned and feedback from actuals.
	WS 2.03	Adjust Schedule and Close Week	Adjusting of the schedule can happen many times within the Scheduled Period, and coordination with Supervisors is critical as to adjust where required. The last daily scheduling meeting of the period also is the time to verify and validate the required closing of the open task, work orders, or identify which task will have to be Carried Over. It is also at this time the continuous improvement and feedback to the Planning group should take place. Identify where the plans worked well and where they were deficient. This communication or feedback can be instrumental in updating PM, Standard Jobs or even be the cause for reassessing the PM requirements for your assets.
	WS 2.04	Schedule Compliance KPI	Once the weekly Schedule has been closed, the closed actual can be measured against the Frozen or "Banked" Schedule for creating the Weekly Scheduling KPI.

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	WS 3.00	Assign Crew Member to Tasks	Though it is critical that the scheduler control the bulk loading of Task to Crew Capacity, and to identify hard dates (where coordination with Operations is Required), it is just as critical that the Crew Supervisors manage who from their crew should be assigned the jobs or task. They also have an impact on the daily smoothing of work with the schedule period.
Maintenance Supervisor – Weekly Schedule	WS 3.01	Distribute Work Orders to Crew	It is the Supervisors responsibility to go over the distributed work orders with the assigned trades' personnel. Morning Meetings, Tailgate Meetings should be one of the main ways to communicate as well as daily work order being posted.
	WS 3.02	Work Execution Sub-process	The work execution sub-process is covered elsewhere. For the purpose of the weekly scheduling process, it is important to note that the Maintenance Supervisor is responsible for managing break-ins to the current weekly scheduling period, and not the Scheduler or Planner.
	WS 3.03	Complete and Close Work Orders and Tasks	It is critical that the crew Supervisor make sure that the Tasks and/or work orders are being identified for Complete and closed. This is a primary measure on the current health of the Schedule period. Without these activities you will not have an accurate daily completion and percent complete of the Scheduled period.

Corporate Business System - ERP Assessment

Business Process Document

WO Management- Asset Management

August 8th/2018
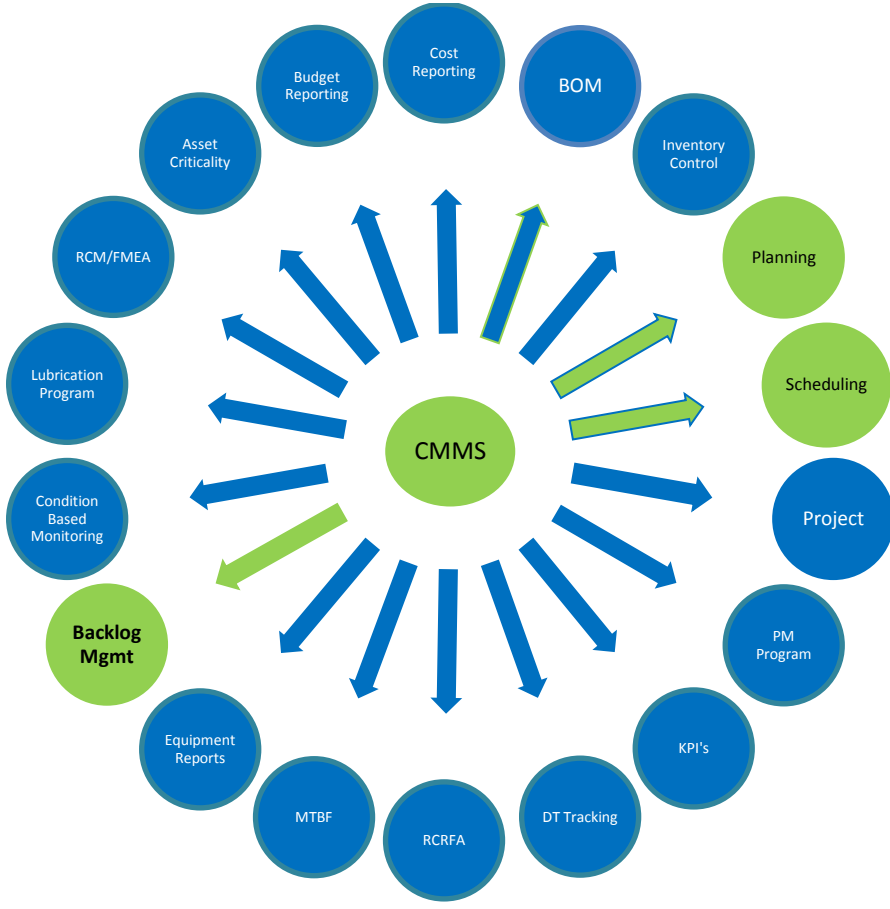
Version	Date	Description of Revision	Author
R1	Nov. 25, 2015	The use of equipment numbers on non-maintenance work orders is discouraged.	S. McCarthy
R2	May 24, 2016	Added RACI Chart	S. McCarthy
R3	2016-12-20	Updated after process review	S. McCarthy
R4	2018-08-08	Updated based on AM Champions' Comments	S. McCarthy

SCOPE:

The scope of this document includes the general requirements for asset management work order management.

Contents

Purpose

Maintenance is defined as the combination of technical and administrative actions—including supervision actions—in order to preserve or maintain an equipment state to perform a required function. - maintaining means making sure that an asset continues to perform the functions it was designed for.

In a restricted sense, maintenance activities are limited to returning an asset to its original conditions. In a broader sense, maintenance activities involve changing its original conditions by introducing improvements to prevent failures from occurring or recurring; optimizing cost and increasing both maintenance and asset productivity; ensuring safety and reliability; and protecting the environment.

No maintenance activity can increase the asset's functional capability or its reliability without improvements. Therefore, improvement activities must be considered as part of maintenance, which is under responsibility of Maintenance Engineering. Under normal conditions this would require a Project for improvement to monitor changes to the original design and current rating or throughput of the system.

The work order Procedure is the backbone behind any effective maintenance system. Work orders are used to manage the work flow of maintenance tasks and projects. Work orders are created for preventive (PM), corrective/repair (CM) maintenance and Project Improvements. The progress of work orders is tracked by status. All maintenance work must be performed from a work order. First and foremost, each site must adopt the policy that all non-emergency maintenance work must be performed from an approved work order from the Gate Keepers. This ensures that all work is recorded and can be analyzed. If this rule is not followed, cost, various metrics, and history records will not be accurate or meaningful.

Business Process –Work Orders

An Asset Management Work Order is not merely a cost collection bucket, but rather separate work orders should be created for discrete, fixed scopes of work with a definable start and end point. If the work scope is not known, then the work order can neither be planned nor scheduled.

Work Order Types

- Corrective
  - Corrective Work Orders are to be created whenever an equipment failure is found to have happened or to be in progress.
  - A Work Order is not classified as a "Corrective" work order merely because the cost is being charged to Operating expenses.
  - A Corrective Work Order can be charged to an operating BU, to a Maintenance Project BU, or to a Capital (Job Cost) Project BU.
  - All Work Orders for repairs are "Corrective Work Orders". Corrective Work Orders are used only for repairs. Corrective Work Orders are not used for any requests for changes

to plant, equipment, or process; nor are they used for activities unrelated to repairing functional equipment.[1]

- Improvement
    - o Improvement Work Orders are to be created for any change to plant, facilities, or process.
    - o Improvement Work Orders include Maintenance and Capital projects, but also any requested changes to plant, equipment, or process.[2]
    - o A Work Order is not classified as "Improvement" merely because it is to be capitalized.
    - o An Improvement Work Order can be charged to an operating BU, to a Maintenance Project BU, or to a Capital (Job Cost) Project BU.
    - o Equipment Numbers should not be used on all Improvement Work Orders. Refer to Appendix 1 for a decision diagram on the use of equipment numbers on work orders.
    - o It is critical that changes to equipment and process be reviewed, approved, and managed correctly to avoid unforeseen consequences. Many catastrophic failures have resulted from a combination of several seemingly inconsequential changes.[3]
- Non-Maintenance
    - o Non-Maintenance Work Orders are created for activities that are neither repairs nor are they Improvements or PM related.
    - o Non-Maintenance Work Orders are not to be coded with an equipment number, since the use of virtual equipment in order to track program costs is discouraged.
- Preventive
    - o Preventive Maintenance Work Orders are always system generated work orders.
    - o PM Work Orders are always created against equipment records.
    - o Preventive Maintenance Work Orders are generated based on some schedule of intervening days, hours or some other meter between occurrences, and can also be related to seasonal work.
    - o Because a Work Order is generated from the PM Module in the CMMS, it is not necessarily a PM Work Order; any Work Order type can technically be created from the PM Module.

Maintenance types

- ***Unplanned Reactive Maintenance*** *– Performed after a previously unidentified failure occurs. Allowing equipment to run-to-failure may be less expensive in the short-term in terms of maintenance costs, but the failure may have higher consequences due to safety, environment, or production downtime effects. In order to minimize consequences when a failure happens, you must have the necessary resources (replacement parts, tools and labor) to act quickly. This is often a burden for maintenance.*
- ***Planned Reactive Maintenance*** *– Corrective Maintenance carried out after the identification of the functional failure, when this information is obtained after routine systematic technical*

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[1] Revision 4: This clause moved to this section from Appendix 1
[2] Revision 4: This clause moved to this section from Appendix 1
[3] Revision 4: This clause moved to this section from Appendix 1

inspections or by identification from those personnel or customers next to the assets. Planned Reactive strategies may come from Condition Based Monitoring programs, or from the failures of non-critical equipment.

- **Planned Proactive Corrective Maintenance [4]** - Performed after the failure is identified, but the equipment itself is not yet in a failed condition. Planned Proactive strategies may come from Condition Based Monitoring programs, Operator Routine Duties, or PM Inspections.
- **Time-Based Systematic Preventive Maintenance** – Involves some systematic tasks, such as inspections, refurbishments and part replacements. From the maintenance cost standpoint, it is not the most cost-effective type, because the parts are replaced and the components are refurbished before their end of life. From the production standpoint, it is very appropriate, because it ensures a more reliable working period for the asset.*** Go to PM Sub Process*
- **Condition-Based Systematic Preventive Maintenance (Predictive)** – The conditions of a part or assembly are monitored throughout its life cycle, using special analysis techniques (vibration, oil analysis, thermography, etc.). These activities allow us to diagnose when a part or component is approaching its end of life, so that we can optimize maintenance planning (replacement or refurbishment) and even extend the maintenance interval. These activities are carried out while the asset is in operation. The techniques provide optimal results and optimize the cost in the long run.
- **Asset Improvement or Project Improvement** – Making gradual and continuous improvements in the assets beyond their original specifications. You can make these improvements using the Kaizen concept, which can be understood as ongoing asset/process improvements. This may result in changes in the project and in operation/maintenance standards as needed.

Gate Keepers

There are many steps to be performed by the Gate Keepers to screen and validate Work Requests. To effectively screen work requests, there should be a single point of contact between operations and maintenance. In this process, this is called the "Gatekeeper". The personnel on the Gatekeeper committee should validate several things within the request by asking the following questions.

1. **Is this a duplicate request?** - Has someone already written a request for the same work? Duplicate requests cause confusion within the maintenance department. An approved duplicate request also creates a second record in the history file that can be viewed as two separate occurrences. Duplicate records should always be moved to status (rejected) no matter who finds the duplicate record. Only one work order per event or problem for the same equipment tag should be allowed. The maintenance person who is assigned the work order is responsible to coordinate with any sub groups that he needs to complete the job. Example: If there is an instrument that needs calibration and it requires scaffolding, the supervisor assigned the work order will need to communicate with scaffolding supervisor. He will also be responsible to get scaffolding removed before he can complete the work order.
2. **Is there enough information on the request for maintenance to understand the problem?** – If the problem is not described or if the work order does not have the appropriate information to act on, the Gate Keeper(s) can send this back for more information or reject.

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[4] Revision 4: Added descriptions of Planned Reactive versus Planned Proactive Maintenance

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3. *__Has the correct equipment number been listed?__ - This is important for at least two reasons. First it is important to know the cost of each repair. Costs can be attached to the equipment only when the proper tag number is assigned. Second, and perhaps more important, is that the tag number is used to attach history information that can be later used to prevent repeat failures, etc.*

4. *__Is the Work Order Type Correct?__ – Corrective Work Orders should not be used for Improvements. A repair or a PM charged to a Capital Project does not become an Improvement Work Order.*

5. *__Is the Corrective Work Order categorized correctly to allow assessment of proactive and reactive work percentages?__ – Corrective work orders can be proactive or reactive, mainly depending on the point on the P-F curve at which the failure is discovered.*

6. *__Does the work request include the correct priority?__ – follow Priority sub process*

7. *__Who should be assigned the request?__ - One maintenance supervisor should be responsible to complete the work order. The use of routing instructions should be used by the planner to determine trades involved.*

8. *__Can this work be completed without a facility shutdown?__ – Code Work Request for the equipment condition required to do the work.*

9. *__Does this relate to a current Project or Require an Improvement Project, or does this bundle in with other Operational Project jobs?__ – Where required request the creation of a new project, and reassign to the cost center for that Project and also code the Subsidiary (Cost Code or "Work Breakdown Structure" (WBS)).*

Standard Repair Procedures (AKA Unscheduled PM's[5])Standard Repair procedures are built and added to the CMMS as Model Work Orders with PM Maintenance Services that are configured to create Corrective Work Orders instead of PM Work Orders. The function is referred to as "Unscheduled Maintenance". These services can be created directly from the WO Backlog application when and as needed.

In the Planning process, detailed procedures can be linked to work orders and routing steps (tasks), in their native format (i.e. Word or pdf), or as text. Understand what documents will print with work orders or be available to connected or disconnected mobile applications when deciding the method of providing the documentation.

WO Management Process Assessment – General Requirements

1. The plant or area has a documented procedure in a standard format aligned with the Nalcor procedure in sufficient detail to provide guidance on deployment, execution, and training requirements, including roles and responsibilities. The procedure is rolled out and visible to the organization.

2. A training plan is in place and followed.

3. Nalcor standards are followed in Work Order creation and use of codes, where and how equipment numbers are assigned to work orders, and the use of the Nalcor CMMS system is rigorous.

4. The Work Order review and approval process is established and adhered to in the organization.

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[5] Revision 4: Standard Repair Procedures are also known as "Unscheduled PMs" in JDE E1

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5. All work related to production, generation, and transmission equipment is managed on work orders.

6. Rough Cut Planned Start Dates and Requested WO Finish Dates are entered and managed.

7. Multiple Work Orders for any one failure are not used.

8. Work Orders are coded to the appropriate BU and Project/Cost Code.

9. Action Metrics
   - Percent Work Order Utilization
     - Craft Hours / Available Craft Hours
     - Work Order Costs / Actual Costs
   - Number of open work orders by age.
   - Percent Reactive Work.
   - Percent Proactive Work.
     - Percent Proactive Corrective Work.
     - Percent of Preventive and Predictive Maintenance tasks that result in a Corrective Work Order.
   - Percent Emergency Work.
   - Schedule Compliance
   - Maintenance Overtime.
   - Inventory Fill Rate
   - Percent Planned Work.
   - PM Compliance
   - Craft backlog & trend in weeks.
   - Planning efficiency.

10. Result Metrics
    - Availability or SAIDI
    - Lost Production (MW-Hrs or Customer Hours)
    - Major Rotating Equipment Availability
    - Maintenance Cost as a percentage of plant/Area controllable costs
    - Critical Equipment MTBF
    - Increase in quality and quantity or equipment data records linked to CMMS.

11. Improvement Work Order Metrics
    - Review Improvement Work Orders to determine whether work orders are created several weeks in advance of the need for Maintenance support.
    - Review Improvement Work Orders against Projects to determine to what extent the budgeted Maintainer requirements match the actual requirements.
    - Review the priorities assigned to Improvement Work Orders to determine whether the Prioritization Matrix is being followed.
    - Review Corrective Work Orders executed in the assessment period to identify inappropriate usage of Corrective Work Orders for Improvements.

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- Review Maintenance labour costs charged to other than Corrective, Improvement, and PM Work Orders against project or capital accounts to identify improper work order usage.
- Review Improvement Work Orders to determine whether the scope of work is defined in enough detail for planning and scheduling.
- Review Improvement Work Order labour estimates to check whether duration estimates are exceeding stated maximums.
- Compare actual-to-estimated values for Improvement Work Orders to determine whether there exists any problem with estimating work scopes.
- Check the subsidiary codes assigned to Improvement Work Orders to ensure that the work package matches the work scope defined on the work orders' description.
- Review Improvement Work Orders to confirm that the scope of work for "Shutdown", and "On-Line" work are defined on separate work orders.

Approvals

	(name)	(signature)	(yyyy/mm/dd)
	(name)	(signature)	(yyyy/mm/dd)

Appendix I – Definitions and Business Rules[6]

    1.

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[6] Revision 4: Business Rules were removed from this section and included in the work order type definitions.

Decision Diagram for WO Business Unit and Equipment

WORK ORDER EQUIPMENT AND BUSINESS UNIT CODING FOR ACCURATE EQUIPMENT COSTS

Phase

CHANGE OR ADDITION TO EQUIPMENT

REPAIR — START — PREVENTIVE MAINTENANCE

NON-MAINTENANCE

WORK IDENTIFICATION & PRIORITIZATION PROCESS

CREATE CORRECTIVE WO WITH EQUIP.#. BU ON WO ASSIGNED AUTOMATICALLY. DO NOT CHANGE WO TYPE.

CREATE NON-MAINTENANCE WO CHARGED TO BU WITH NO EQUIP.#

PM WO GENERATED FROM CMMS WITH EQUIP.#. DO NOT CHANGE EQUIP.#. BU ON WO ASSIGNED AUTOMATICALLY. DO NOT CHANGE WO TYPE.

DO NOT ADD AN EQUIP.# THE USE OF VIRTUAL EQUIPMENT SET UP FOR COLLECTING NON-MAINTENANCE DEPARTMENTAL COSTS IS DISCOURAGED.

MAINTENANCE PROJECT BU CREATED

MAINTENANCE PROJECT BU CREATED

REPAIR CHARGED TO OPEX BU FROM EQUIP. RECORD.

PM CHARGED TO OPEX BU FROM EQUIP. RECORD.

CHANGE WO BU TO THAT OF MAINTENANCE PROJECT & ADD SUBSIDIARY. CHANGE NEITHER WO TYPE NOR EQUIP.#.

CHANGE WO BU TO THAT OF CAPITAL PROJECT & ADD SUBSIDIARY. CHANGE NEITHER WO TYPE NOR EQUIP.#.

CHANGE WO BU TO THAT OF MAINTENANCE PROJECT & ADD SUBSIDIARY. CHANGE NEITHER WO TYPE NOR EQUIP.#.

CHANGE WO BU TO THAT OF CAPITAL PROJECT & ADD SUBSIDIARY. CHANGE NEITHER WO TYPE NOR EQUIP.#.

CHANGE NEITHER WO TYPE NOR EQUIP.#.

CHANGE NEITHER WO TYPE NOR EQUIP.#.

END REPAIR

END NON-MAINTENANCE

END PREVENTIVE

CHANGE OR ADDITION TO EQUIPMENT

CREATE IMPROVEMENT WO CHARGED TO BU WITH NO EQUIP.#

NEW FUNCTIONAL EQUIPMENT

IS THE PROJECT GOING TO RESULT IN NEW FUNCTIONAL EQUIPMENT? (NOT ASSETS)

CHANGE TO EXISTING FUNCTIONAL EQUIPMENT. DOES NOT MATTER IF NEW FINANCIAL ASSETS ARE BEING CREATED

CREATE IMPROVEMENT WO CHARGED TO BU WITH EQUIP.# FROM EXISTING FUNCTIONAL EQUIP.

UNDER NO CIRCUMSTANCES ADD AN EQUIP.#. PROBABLY CHARGE WO TO CAPITAL PROJECT.

CREATE NEW FINANCIAL ASSET FOR PROJECT.

END CHANGE OR ADDITION TO EQUIP.

CHANGE WO BU TO THAT OF CAPITAL PROJECT & ADD SUBSIDIARY. CHANGE NEITHER WO TYPE NOR EQUIP.#.

Figure 1 - The Use of Equipment Number and BU by Work Order Type

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Work Order Business Processes

Business Process – Corrective Work Order

Corrective Work Order Creation Process – NOT AN EMERGENCY – To Be

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Role	Step ID	Step Title	Step Description
WO Originator	CM1.01	Problem Found	
	CM 1.02	Create Work Request in CMMS	It is important all critical information is given as to allow the Gate Keeper(s) to assess the importance or validity of these Work Requests – Proceed to CM 2.01
	CM 1.03	Provide More Information	If additional information is required the Gate Keeper(s) will return these work requests back to the originator for completeness of the request.
	CM 1.04	Change WO Status to 01	Once corrected change order back to status 01
	CM 1.05	Cancel Work Order	If between the time the order is written and the return back to the Originator the request has been corrected or is no longer required. Add the information to the Request and change the status to Rejected
Gate Keeper(s)	CM 2.01	Approve or Reject Work Request or Request more Information	The Gate Keeper(s) is the approval board for new Work Requests. Main duties consist of • Checking for the completeness of Request – or send back for additional information • Look for duplications or other work that would incorporate the identified correction – where duplications exist normal set would be to reject with reason
	CM 2.02	Change WO Status to 02 – Information Incomplete	If more information is required will send back to originator
	CM 2.03	Cancel Work Order	It is important that work requests are rejected with a reason for originator feedback
	CM 2.05	Request a Project BU if Required	If requests requires modification to the original design, or if major repairs, or like repairs may require that these be added to a Project. If Project does exist – attach proper Project number; if not these jobs may be held till the new Project request is completed or progressed and the transactions' costs backed out when the Project Number has been created. Once the Project is set up – update work order to the correct Project cost center.

Role	Step ID	Step Title	Step Description
	CM 2.07	Update Codes, BU, Priority, Date	The Gate Keeper(s) will then take these work orders and complete the Prioritization and completion and schedule start dated. Any additional parameters that are required for the Planner should be addressed before forwarding – dates, and cost thresholds if required should be noted
	CM 2.08	Change WO Status to 04 Approved for Planning	Promote for planning
	CM 3.01	Wo Planning Sub Process	
	CM 3.02	Is Approval Required	If dates or cost are identified on the work order from the Gate Keeper(s), that the planner estimate is difference, or dates cannot complete to - Change to Status 11 to request the proper approver level
	CM 3.03	Change WO to Waiting for Approval	Change to Status 11
	CM 3.04	Does Work Require a Shutdown	
Maintenance Planner	CM 3.05	Change to Waiting Plant Condition	If yes to CM 3.04 - Change this order to "Waiting Plant Condition" – these jobs should be cross referenced with the short term planning and shut down requirements to verify that these jobs will make the completion date required
	CM 3.06	Is WO Requested Completion Date Still Good	If no to CM 3.04 – Can completion dates be met
	CM 3.07	Update WO Notes and Change to Status 01	If no to CM 3.06 – Update notes and resend back to Status 01 for recycling to Gate Keeper(s).
	CM 3.08	Change WO – Waiting Scheduling	If yes to CM 3.06 – change order to Waiting Scheduling

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Role	Step ID	Step Title	Step Description
	CM 3.09	Maintenance Scheduling Process	

Business Process – Corrective Emergency

Corrective Work Order Creation Process – EMERGENCY – To Be

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Role	Step ID	Step Title	Step Description
Overview			
WO Originator	ER 1.00	Problem Found - Immediate Need For Maintenance Resources Identified.	
	ER 1.01	Create Work Request In CMMS At Status 01 – Work Request Awaiting Review. Assign Preliminary Emergency Priority.	
On Call or Shift Emergency Approval	ER 1.02	During Or Outside Of Normal Office Hours?	• Outside of Normal Hours – proceed to ER 2.00 • During Normal Hours – proceed to ER 4.00
	ER 2.00	Identify Activity To Mitigate Immediate Consequences Of Failure	One of the considerations for deeming an event is an emergency is; are there step required to mitigate this event that makes this not an emergency. Where operational steps can be taken to remove the risks for – safety, environmental, or production issues, is one of determining factor for deciding if "Call In" is required.
	ER 2.01	Call In Needed Maintenance Help	Where risks still exist after Mitigation, call in may be required
Operations	ER 3.00	Prepare for called in resources through additional troubleshooting and/or work protection.	Operations should still act towards quick resolution of this emergency, additional readiness and monitoring of this even should it escalate into a larger problem. Examples would be • Lock out / Tag out, and procedure documents (where shut down is required) • Area clean up or clearing for the repair • Where applicable de-rate current equipment, move load to standby equipment

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Role	Step ID	Step Title	Step Description
	ER 3.01	Change Wo Status To 49* – Emergency Break In	
	ER 4.00	Approve Or Reject Work Orders At Status 49	During normal office hours – these escalated orders still need to be verified with the Gate Keeper(s).
	ER 4.01	Cancel Work Order – Change To Wo Status 91	For Duplications, where work order is not valid, or where assessment does not find an emergency event.
	ER 4.02	Identify Activity To Mitigate Immediate Consequences Of Failure	One of the considerations for deeming an event is an emergency is; are there step required to mitigate this event that makes this not an emergency. Where operational steps can be taken to remove the risks for – safety, environmental, or production issues, is one of determining factor making this a status 49 work order.
	ER 4.03	Change WO Status To 49* – Emergency Break In	
Maintenance Planner	ER 4.04	Break Into Weekly Maintenance Schedule To Perform Mitigation Activities	The jobs that are marked as Emergency will need to go to immediate schedule, or break in work. This will affect the current schedule and therefore scheduler will need to be notified as to adjust the current schedule to offset the time that these new work orders displace.
	ER 4.05	Work Order Execution Sub-Process	
	ER 4.06	Is The Immediate Problem Fixed Permanently?	If complete – proceed to ER 5.00 If more work is required or if initial risks or criticality has been removed – proceed to 6.00

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Role	Step ID	Step Title	Step Description
	ER 5.00	Work Order Execution Sub-Process. Complete And Close	
	ER 5.01	Scheduling Sub-Process – Schedule Compliance Reporting.	At end of current period run Schedule Compliance Report to see impact of displaced work order due to Emergency events
	ER 6.00	Work Order Prioritization Sub-Process	With mitigation or temporary fix in place – resend work order through the priory sub process to manage the new priority it reflects.
	ER 6.01	Update Codes, BU, & Assign Completion Date & Scheduled Start Date, Describe Work Scope	Update any of the pertinent fields due to first mitigation.
	ER 6.02	Change Wo Status To 04 – Approved For Planning	If additional planning to make this a permanent fix is required send these jobs back through >Planning>Scheduling sub processesa
	ER 6.03	Work Order Planning Sub-Process	

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Business Process – Improvement Work Order

Improvement Work Order Creation Process– To Be

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Role	Step ID	Step Title	Step Description
Overview			Improvement jobs can be broken up into two categories, Managed by Maintenance and one for Capital Managers. • Maintenance will look at the upcoming work and bundle these up to create an Improvement project for managing large group or large amount of monetary spending that they want to manage. Example would be large rebuilds • Capital Managers – normally for new or large replacements, and work off of the long term Plan for Asset Replacements or System Upgrades, Our proposal is that for all Improvement jobs that they follow the job cost model and are manage similar.
	PR 1.01	Create Improvement Job for Capital	Forward proper applications/forms for Project job to be created
	PR 1.02	Verify Business Unit and Subsidiary	Make sure that the WBS is reflected in the chart of accounts to support your Project type
	PR 1.03	Fully Scope Work Order Requirements	Fully scope for estimation purposes and for the creation of the detail contracts the work orders required for the WBS
Project Managers	PR 1.04	Maintenance Resources Required	If Maintenance Resources are required forward the appropriate work order to the maintenance Gate Keeper(s) for verification of completion date and Labour loading required. – Proceed to PR 3.01 If not proceed to PR 1.05
	PR 1.05	Managing WO for Project Managers	It will be the responsibility of the Project Managers or their delegate to manage and complete and close the work orders for their project
Short Term Planner	PR 2.01	Create or Identify Improvement Job for Maintenance Operations	Forward proper applications/forms for Project job to be created

Role	Step ID	Step Title	Step Description
	PR 2.02	Verify Business Unit and Subsidiary	Make sure that the WBS is reflected in the chart of accounts to support your Project type
	PR 2.03	Fully Scope Work Order Requirements	Fully define the work order requirements for the creation of the detail work orders required for the project WBS
	CM 2.08	Change WO Status to Approved for Planning	Forward to Gate Keeper(s) for approval for panning
	PR 3.01	Approve for Maintenance Crew or Return to Project Managers	The Gate Keeper(s) will verify the Labour loading and required date. If maintenance crew is not available or if dates cannot be met, these will be back to the Project Managers for external resources and control.
Gate Keeper(s)	PR 3.02	Verify Extent of Job Completeness and Crew Availability	If work order has enough information and will be received to be done by the Maintenance crew they will proceed
	PR 3.03	Update Codes Assign Requested and Schedule Start Dates	
	PR 3.04	Change WO Status to Approved for Planning	
Planner / Scheduler	PR 4.01	Planning Sub-Process. WO Status Verify Scope	Once Planner receive these new work request he/she will put these job through the planning process

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Role	Step ID	Step Title	Step Description
	PR 402	Scope Change?	If scope has been change after the detail planning has been done – send back to Gate Keeper(s).
	PR 4.03	Shutdown Required	If a shutdown is required move to status 35 If a shutdown is not required move to status 44
	PR 4.04	WO Status 44 Waiting Scheduling	
	PR 4.05	WO Status 35 Waiting Plant Condition	
	PR 4.06	Maintenance Scheduling Process	Align these planned jobs with the Scheduling Process
	PR 4.07	Will Complete Date be met?	If dates cannot be met – send back to Gate Keeper(s)

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Business Process – Pre-Planned Repair

Pre-planned Corrective Work Order Process – To Be

Planner or Asset Specialist

START: Unscheduled Corrective Job Set Up in PM System

PP 1.00
CONDITION MONITORING SUB PROCESS

PP 1.01
DEFINED EQUIPMENT FAILURE MODE WHERE AGREED MAINTENANCE TACTIC IS "RUN-TO-FAILURE"

PP 1.02
SELECT APPROPRIATE SERVICE FROM UNSCHEDULED MAINTENANCE ROUTINES AVAILABLE ON EQUIPMENT

PP 1.03
IS APPROPRIATE RECURRING MAINTENANCE ROUTINE AVAILABLE?

—YES—

—NO—

PP 1.04
IF PRE-PLANNED CORRECTIVE JOB IS NEEDED, USE PROCEDURE FOR CREATING UNSCHEDULED MAINTENANCE SERVICES

PP 1.05
CREATE CORRECTIVE WORK ORDER FOR IMMEDIATE NEED USING REGULAR REPAIR WORK ORDER PROCESS

PP 1.06
GENERATE PRE-PLANNED CORRECTIVE WORK ORDER FOR REPAIR

PP 1.07
UPDATE WO DESCRIPTION WITH FAILURE SPECIFIC DETAILS

End
GO TO WO APPROVAL PROCESS

Role	Step ID	Step Title	Step Description
Overview			At any time there is the ability to create template or model jobs, for the requirements for work that are not metered or calendar event. These can be generated from either the Condition Monitoring or from a list of Planned but Unscheduled events. These jobs can be fully scoped but awaiting a condition that is expected to happen within the life of an equipment. • Vibration • High Heat • Oil Analysis • Total breakdown • System Shutdown These jobs are a simple way to generate a fully planned job, for the condition of equipment, to eases the burden of having to go through an extensive planning stage.
	PP 1.00	Condition Monitoring Sub Process	Assess the results from that condition monitoring system you are using. Possibility for inbounding or feeding or results to condition Monitoring
	PP 1.01	Defined Equipment Failure Mode Where Agreed Maintenance Tactic Is "Run-To-Failure"	This is a strategic step in determining the Maintenance strategy site is working to. It is from this strategy that a site will determine what degree of maintenance they will do.
Planner or Asset Specialist	PP 1.02	Select Appropriate Service From Unscheduled Maintenance Routines Available On Equipment	Once set up, you will be presented with a list of jobs that can be generated for an equipment record.

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Role	Step ID	Step Title	Step Description
	PP 1.03	Is Appropriate Recurring Maintenance Routine Available?	
	PP 1.04	If Pre-Planned Repair Job Is Needed, Use Procedure For Creating Unscheduled Maintenance Services	If the appropriate Model does not exist, assess the requirement if this is a reoccurring event. If required assess the need of creating a model job and assigning this to the equipment.
	PP 1.05	Create Corrective Work Order For Immediate Need Using Regular Corrective Work Order Process	If no job exists – create a standard repair job, track the results to assist with the creation of the model job
	PP 1.06	Generate Pre-Planned Corrective Work Order For Repair	
	PP 1.07	Update Wo Description With Failure Specific Details	Complete the failure assessment on the generated job.

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EXECUTE, COMPLETE & CLOSE PLANNED MAINTENANCE WO PROCESS

EXECUTE, COMPLETE & CLOSE PLANNED MAINTENANCE WO PROCESS – TO BE

Phase

MAINTENANCE SUPERVISOR (MAIN CRAFT)

START – WEEKLY SCHEDULING PROCESS; WOs AT STATUS 44 – WSCH OR 33 - MAT'L AT REMOTE SITE.

EW 1.0 RECONFIRM MATERIALS ON HAND FOR LOCAL WORK OR DELIVERED TO WORK SITE WHERE APPROPRIATE FOR REMOTE WORK.

EW 1.1 RECONFIRM CONTRACT SERVICES AVAILABILITY

EW 1.2 CREATE DAILY WORK LIST FROM WEEKLY SCHEDULE

EW 1.3 ATTEND DAILY PLANNING MEETING WITH SCHEDULER & OPERATIONS

EW 1.4 CONFIRM NEXT DAYS' WORK

EW 1.5 ASSIGN WORK ORDER OPERATIONS TO INDIVIDUAL MAINTAINERS AT LATEST PREVIOUS AFTERNOON

EW 1.6 REQUEST DE-ENERGIZATION & WORK PROTECTION

EW 1.7 RESERVE SPECIAL TOOLS. REQUEST MATERIAL KITTING & DELIVERY FOR LOCAL WORK

EW 1.8 FINAL ASSIGNMENTS OF TRADESPEOPLE TO WORK ORDERS

EW 1.9 EXECUTE WORK

EW 2.0 DEAL WITH PROBLEMS WITH WORK IN PROGRESS

EW 3.0 CONFIRM/EDIT WO COMMENTS. CONFIRM TIME & MATERIAL TRANSACTIONS DONE.

Planning Improvement Suggestions Offered

EW 3.1 CHANGE WO STATUS TO 79 – COMPLETED with Improvement Suggestions

No Planning Improvement Suggestions Offered

EW 3.2 CHANGE WO STATUS TO 80 - COMPLETED

MAINTENANCE TRADESPEOPLE (MAINTAINERS)

DEAL WITH PROBLEMS WITH WORK IN PROGRESS

EW 2.1 UPDATE WORK ORDER DESCRIPTION OF WORK DONE, AND COMMENTS ON PLAN IMPROVEMENTS

EW 2.2 FOR CORRECTIVE WORK ORDERS, UPDATE WORK ORDER FAILURE COMPONENT AND WORK DONE CODES.

(A)

EW 2.3 RELEASE WORK PROTECTION

EW 2.4 RETURN UNUSED MATERIAL TO WAREHOUSE REFERENCING WO#

EW 2.5 ENTER WO TIME IN TIME ENTRY

EW 2.6 REVIEW WO COMPLETION DATA. CONFIRM CODES, TIME, MATERIAL USAGE, & DESCRIPTION OF WORK DONE

(B)

SHORT TERM MAINT. PLANNER

(A)

EW 4.1 CHANGE WO STATUS TO 70 WITH COMMENTS ON MISSING DATA OR TRANSDACTIONS.

INCOMPLETE WO INFO

EW 4.0 CONFIRM THAT WO INFORMATION IS COMPLETE & ACCURATE.

(B)

WO INFORMATION COMPLETE & ACCURATE

EW 4.2 UPDATE OR REQUEST UPDATES TO STANDARDS, STANDARD JOBS, EQUIPMENT DATA, OR PARTS LISTS.

EW 4.3 UPDATE PLANNING INFORMATION FOR A BETTER PLAN NEXT TIME.

EW 4.4 ENSURE WO IS CLOSED (STATUS 90) WITHIN 90 DAYS.

END – ACCURATE WO & EQUIPMENT HISTORY AT WO STATUS 90

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Role	Step ID	Step Title	Step Description
MAINTENANCE SUPERVISOR (MAIN CRAFT)	EW 1.0	RECONFIRM MATERIALS ON HAND FOR LOCAL WORK OR DELIVERED TO WORK SITE WHERE APPROPRIATE FOR REMOTE WORK	Don't waste Maintainers' efficiency by assigning them planned work where the material is not ready or available.
	EW 1.1	RECONFIRM CONTRACT SERVICES AVAILABILITY	If the contract service is being run by the Maintenance Front Line Supervisor or Work Execution Manager, then ensuring the presence of the contractor when needed is under Work Execution's control. Coordinate with the person responsible for the contract to ensure efficient execution.
	EW 1.2	CREATE DAILY WORK LIST FROM WEEKLY SCHEDULE	The Weekly Schedule is prepared by the Scheduler, and represents a best guess of the sequence of work. While there are probably some "anchor jobs" on the schedule that cannot be moved around without major consequences, the Maintenance Supervisor is responsible to prepare the daily work lists, assign Maintainers to various jobs, and coordinate with other maintenance supervisors and Operations as required for the efficient and timely execution of the schedule.
	EW 1.3	ATTEND DAILY PLANNING MEETING WITH SCHEDULER & OPERATIONS	This meeting can be formal or informal. The intent of this activity is to ensure coordination for efficient use of resources and release of equipment for maintenance.
	EW 1.4	CONFIRM NEXT DAYS' WORK	Since the weekly schedule does not represent the final word on what jobs will be done each day, the outcome of the daily coordination meetings is the list of work to be performed the next day.
	EW 1.5	ASSIGN WORK ORDER OPERATIONS TO INDIVIDUAL MAINTAINERS AT LATEST PREVIOUS AFTERNOON	Work Orders should be assigned to individual Maintainers the previous day, to avoid start delays and encourage preparation.
	EW 1.6	REQUEST DE-ENERGIZATION & WORK PROTECTION	Requests for equipment isolation and testing should be prepared for the confirmed work for the following day, in order to get equipment isolated and de-energized on night shift and avoid delays awaiting permits.
	EW 1.7	RESERVE SPECIAL TOOLS. REQUEST MATERIAL KITTING & DELIVERY FOR LOCAL WORK	Storekeepers need some time to kit and deliver (bag and tag) work order material. There needs to be sufficient time allowed after confirming the next days' work schedule to let the Storekeepers perform this task. Do not have material delivered too many days in advance to avoid losses and clutter.
	EW 1.8	FINAL ASSIGNMENTS OF TRADESPEOPLE TO WORK ORDERS	Maintainer assignments may change depending on what break in work appears and unforeseen leave.
	EW 1.9	EXECUTE WORK	
	EW 3.0	CONFIRM/EDIT WO	In order to achieve accurate maintenance history and costs, the

Role	Step ID	Step Title	Step Description
		COMMENTS. CONFIRM TIME & MATERIAL TRANSACTIONS DONE.	transactions and comments entered against the work order must represent what was done. The necessary fields on the work order, such as Failure Codes, should be filled completely.
	EW 3.1	CHANGE WO STATUS TO 79 – COMPLETED with Improvement Suggestions	If there was new information researched (i.e. parts, clearances, torques) or if there are other improvements to the job plan desired for the next time, they should be entered on the work order. This new status is a trigger for the Planner to review the Work Order and make the appropriate improvements to standard jobs and equipment data.
	EW 3.2	CHANGE WO STATUS TO 80 - COMPLETED	Changing the status to 80 assigns a Completion Date to the work order and if the job is a PM, resets the PM Schedule.
	EW 2.0	DEAL WITH PROBLEMS WITH WORK IN PROGRESS	In the execution of the work, best practice is that the Maintenance Supervisor and Maintainers deal with any issues that come up and inter-trade coordination rather than involving the Planner. The exception to this practice is when the work cannot be accomplished at all.
MAINTENANCE TRADESPEOPLE (MAINTAINERS)	EW 2.0	DEAL WITH PROBLEMS WITH WORK IN PROGRESS	See EW 2.0 under Maintenance Supervisor group
	EW 2.1	UPDATE WORK ORDER DESCRIPTION OF WORK DONE, AND COMMENTS ON PLAN IMPROVEMENTS	It is important to get feedback directly from the Maintainers on what was done and the problems encountered in the performance of the work. This improves the accuracy and usefulness of the work order history. The comments "Work Done" and "Completed" are usually inadequate. The description of work done should match the transactions entered against the work order.
	EW 2.2	FOR CORRECTIVE WORK ORDERS, UPDATE WORK ORDER FAILURE COMPONENT AND WORK DONE CODES.	The Failure Codes need to be updated by the Maintainer and later confirmed by the Maintenance Supervisor (Refer to EW 3.0).
	EW 2.3	RELEASE WORK PROTECTION	
	EW 2.4	RETURN UNUSED MATERIAL TO WAREHOUSE REFERENCING WO#	Unused stock items need to be returned to the warehouse with instructions to return the quantities to the correct work orders. Unused direct purchased material should be returned to Salvage Stores for investment recovery. Avoid clutter and unofficial inventories.
	EW 2.5	ENTER WO TIME IN TIME ENTRY	The time spent performing the work needs to be recorded against the work order. Work Order time is only that spent working on the work order. Time entry against individual work order routing steps for planned jobs is encouraged in PAAR Level 1 and required in PAAR Level 2.
	EW 2.6	REVIEW WO COMPLETION DATA. CONFIRM CODES, TIME, MATERIAL USAGE, &	The Maintainer is the first line of quality control to ensure that work is documented accurately.

Role	Step ID	Step Title	Step Description
		DESCRIPTION OF WORK DONE	
SHORT TERM MAINT. PLANNER	EW 4.0	CONFIRM THAT WO INFORMATION IS COMPLETE & ACCURATE.	
	EW 4.1	CHANGE WO STATUS TO 70 WITH COMMENTS ON MISSING DATA OR TRANSDACTIONS.	Status 70 is "Completed – Awaiting Information" is used when Work Order Information is deemed to be incomplete. The responsibility to correct that condition rests with the Maintenance Supervisor.
	EW 4.2	UPDATE OR REQUEST UPDATES TO STANDARDS, STANDARD JOBS, EQUIPMENT DATA, OR PARTS LISTS.	If work order information is complete and accurate, and there are learnings that should be captured for next time, the Planner is responsible to make or request those changes.
	EW 4.3	UPDATE PLANNING INFORMATION FOR A BETTER PLAN NEXT TIME.	The Planner updates the JDE Standard Jobs and Equipment data to improve the knowledge in the system of how to perform the work.
	EW 4.4	ENSURE WO IS CLOSED (STATUS 90) WITHIN 90 DAYS	A report will run automatically to close work orders 90 days after completion. The Planner will check periodically to ensure that this is getting done.

RACI Chart for Work Order Activities

Tasks	Equipment Operator	Long Term Asset Planner	Maintenance Technician	Maintenance Supervisor		Maintenance Short Term Planner	Gate Keeper(s)	Asset Owner	Work Execution Manager	Asset pec-ialist/ Plant Engineer
Create Work Order	R		R						A	
Review WO Codes & Accounting Accuracy							R		A	
Review & Approve WO Scope							R		A	
Assign Requested Completion Date				C			R	C	A	C
Assign Rough Cut Requested Start Date		C					R		A	
Assign Requested Start Date		C				R			A	
Input Problem Code	R		R					A		
Input preliminary Component Code						R			A	C

Tasks	Equipment Operator	Long Term Asset Planner	Maintenance Technician	Maintenance Supervisor	Stores	Maintenance Short Term Planner	Gate Keeper(s)	Asset Owner	Work Execution Manager	Asset Specialist/ Plant Engineer
Input or confirm Component Code			R	A						
Input "Work Done" Code and text description			R	A						
Plan Labour						R			A	
Plan Materials & Services						R			A	
Create Purchase Requisitions for Planned Material						R			A	
Arrange for Inventory Material to be On Hand at Warehouse					R				A	
Receive & Store Purchased Material					R				A	

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Tasks	Equipment Operator	Long Term Asset Planner	Maintenance Technician	Maintenance Supervisor	Stores	Maintenance Short Term Planner	Gate Keeper(s)	Asset Owner	Work Execution Manager	Asset Specialist/ Plant Engineer
Coordinate with Contractors for Services mobilization				R					A	
Feedback Data & Plan Improvements to Planner				R					R	
Complete Work Order			R						A	
Initial WO QA check				R					A	
Update Equipment Data & Standard Job Plans						R			A	
WO QA Check						R			A	
WO Close Out				C		R			A	
Analyze Failures or Failure trends		I		C				C	A	R
Maintenance Strategy Adjustments		R	I	C				A	C	C

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Tasks	Equipment Operator	Long Term Asset Planner	Maintenance Technician	Maintenance Supervisor	Stores	Maintenance Short Term Planner	Gate Keeper(s)	Asset Owner	Work Execution Manager	Asset Specialist/ Plant Engineer
Implement new Maintenance Strategies		C	I	I		R		A	I	C

Responsible: The "Doer"

Accountable: The person responsible for ensuring it gets done.

Consulted: Opinions requested

Informed: Told about it after the fact.

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