

Typical Operation and Maintenance Schedule

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This functional requirements document is in line with the organisation's 1-11-OP01 Substation Maintenance Policy

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1. Definitions

In this document the following words and expressions will have the following meanings:

Item	Meaning
FMT	Fault Management Team
HV or high voltage	Nominal voltage exceeding 1000 volts alternating current or exceeding 1500 volts direct current
LV or low voltage	Nominal voltage exceeding 50 volts alternating current or 120 volts direct current, but not exceeding 1000 volts alternating current or 1500 volts direct current.
MAIT	Mobile Asset Inspection Tool – an electronic data collection tool provided by ElectraNet (this provides field data collection and data transfer to SAP)
MSP	Maintenance Service Provider
P-F	Potential Failure – Functional Failure
P-F Interval	Potential Failure – Functional Failure interval
RCM	Reliability Centred Maintenance
SAP	SAP is the Asset Management System used by ElectraNet – providing the asset register, routine maintenance program/scheduling, defect management, work orders and financial reporting
SMSC	System Monitoring and Switching Centre

2. ElectraNet Asset Management Overview

The following information is provided in order to assist understanding of the overall asset management approach taken by ElectraNet.

ElectraNet provides a whole of asset life approach for management of all transmission assets in order to minimise lifecycle cost and meet safety and reliability performance. This section describes the overall approach to asset management and its specific application to transmission substation assets.

2.1 Managing the Asset Life Cycle

A combination of routine and defect maintenance responses are used to manage the asset lifecycle:

- a) Routine and Condition Based Maintenance plans have been developed based on manufacturer’s recommendations and RCM analysis – ideally the routine maintenance plan would maintain all assets at the point just prior to potential failure.
- b) Defect Maintenance is ideally responding to assets within the P-F Interval and to gain information that may allow cost effective improvement to routine or condition based maintenance.
- c) Refurbishment Projects are planned where the most cost effective manner of dealing with deterioration of a group of assets is to perform additional one off refurbishment.
- d) Condition Monitoring is used to track the rate of deterioration and provide the basis for asset condition assessment.

SAP is the asset management system used by ElectraNet to collect, manage and analyse all asset maintenance, defects and response. The figure below shows the relationship of the asset life cycle to maintenance response and SAP data collection.

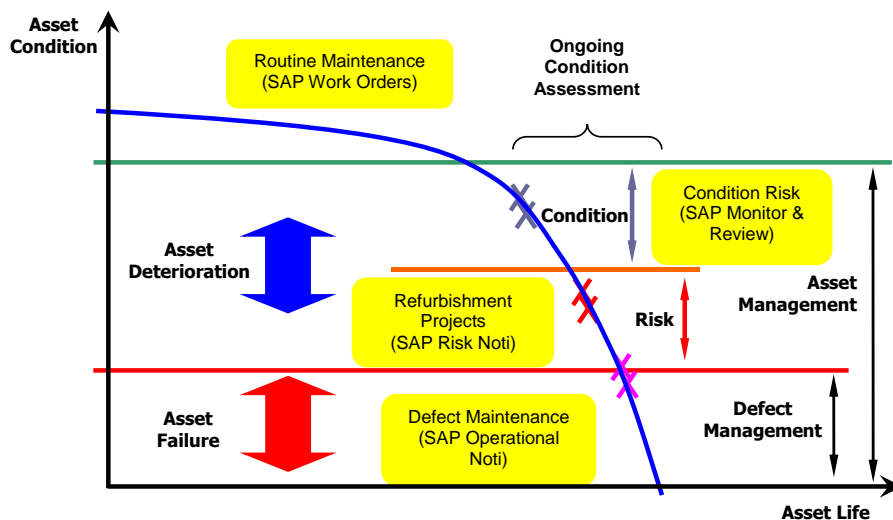


Figure 2-1 Managing the Asset Life Cycle

2.2 Transmission Assets

Transmission assets are classified as:

- a) Primary Plant (all substation HV, LV and civil assets);
- b) Secondary Systems (all control and protection equipment);
- c) Transmission Lines (all transmission line assets); and
- d) Telecommunications (all telecommunication assets).

Asset lifecycle characteristics and associated maintenance strategy for each of the main asset types are described in the below table:

Table 2-1: Asset Management Lifecycle Summary

Asset Group	Typical Assets	P-F Interval	Maintenance Strategy	Notes
Substations	Circuit Breakers Isolators Transformers Switchboards Structures Earthing Fences Buildings Earthworks	Short period failure mode components (0-1 year) (e.g. heaters, lamps, filters)	Undertake routine inspection of short P-F components	Ground level in-service inspection
		Medium period failure modes (1-20 years) (e.g. hot joints, lubrication, seals)	Scheduled routine preventative maintenance, on-line transformer oil monitoring, thermographic survey	Short duration outage of circuit breaker & transformer assets.
		Long period failure modes (>20 years) (e.g. corrosion, component wear)	Condition monitoring only based on inspection data	Asset refurbishment or replacement projects
Secondary Systems	DC Systems, Protection Relays, Bay Controllers	Random failure modes (note: battery banks, controllers and relays are self-monitoring)	Undertake routine inspection of condition – links wiring & panels Undertake in-service end to end trip testing	Ground level in-service inspection Scheduled in-service trip testing

Asset Group	Typical Assets	P-F Interval	Maintenance Strategy	Notes
Transmission Lines	Structures Line Hardware Insulators Earths	<p>Short period failure mode components (0-1 year) (e.g. Insulator flashover, damaged insulators)</p> <p>Medium period failure modes (1-20 years) (e.g. line hardware)</p> <p>Long period failure modes (>20 years) (e.g. corrosion, component wear)</p>	<p>Undertake routine inspection of short P-F components</p> <p>No scheduled maintenance - failure modes are outside 20 year interval</p> <p>No scheduled maintenance - failure modes are outside 20 year interval</p>	<p>Ground level in-service inspection</p> <p>Design line to enable live line change-out of insulators</p> <p>Asset refurbishment or replacement projects</p>
Telecoms	IP Hardware Line Drivers Power supplies	Random failure modes (note: equipment is self-monitoring)	Undertake routine inspection of condition – links wiring & panels	Ground level in-service inspection

3. ElectraNet Works Management Overview

The following information is provided in order to assist understanding of the overall works management approach taken by ElectraNet.

3.1 Maintenance Service Provision Management Structure

Maintenance of all ElectraNet assets is outsourced to maintenance service providers with:

- Maintenance service provision managed by the ElectraNet Maintenance Delivery team; and
- SAP used as the works management system to schedule work and by the MSP to manage all works.

Figure 3-1 below shows the maintenance service provision management structure and the relationship to the MSP.

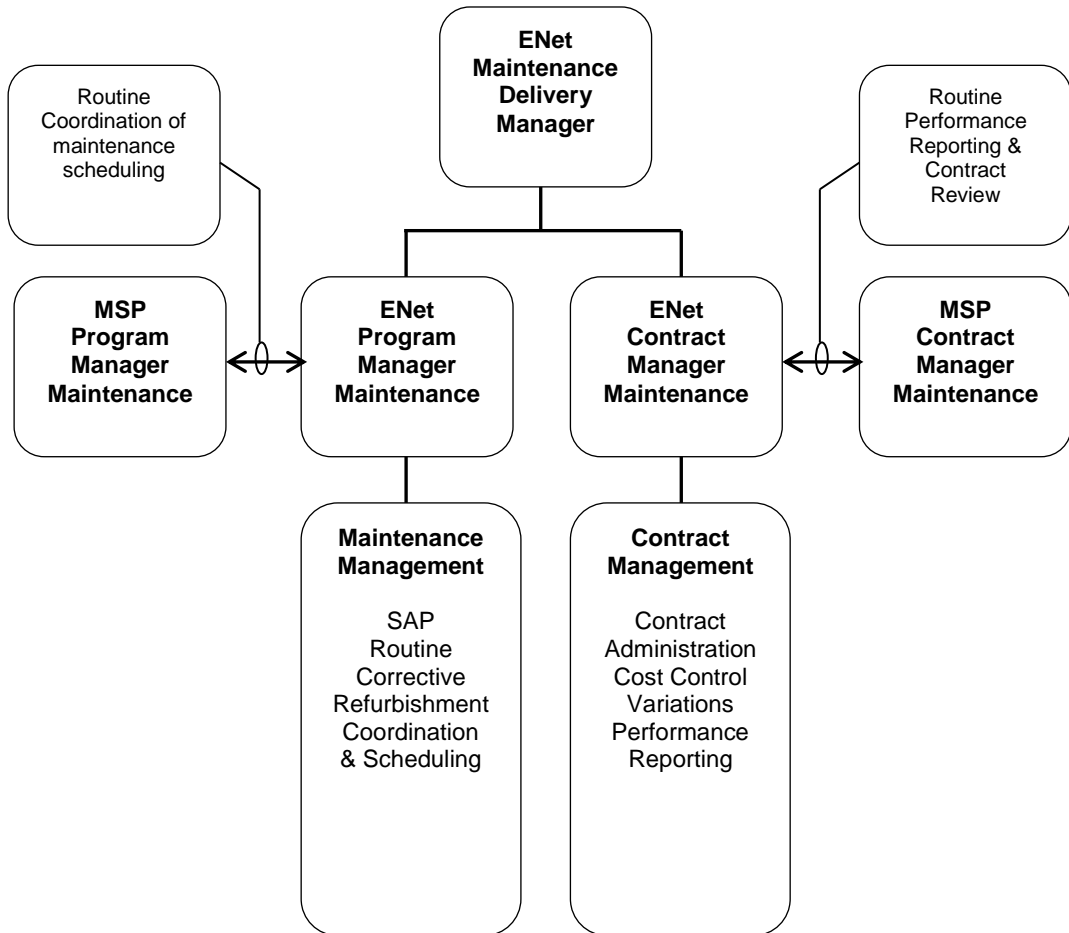


Figure 3-1 Maintenance Service Provision Management Structure

3.2 Routine Maintenance Document Framework

All routine maintenance is based on RCM requirements. Maintenance procedures are provided for each asset type which describes the life cycle routine maintenance plan for that asset and the associated maintenance frequency and data collection requirements.

Associated with each procedure are task lists and checklists that provide more information relating to the specific maintenance tasks to be undertaken and a detailed specification of data collection requirements.

Typical routine maintenance documents and maintenance task frequencies are shown in Appendix A Typical Maintenance Task List & Frequency - Substation.

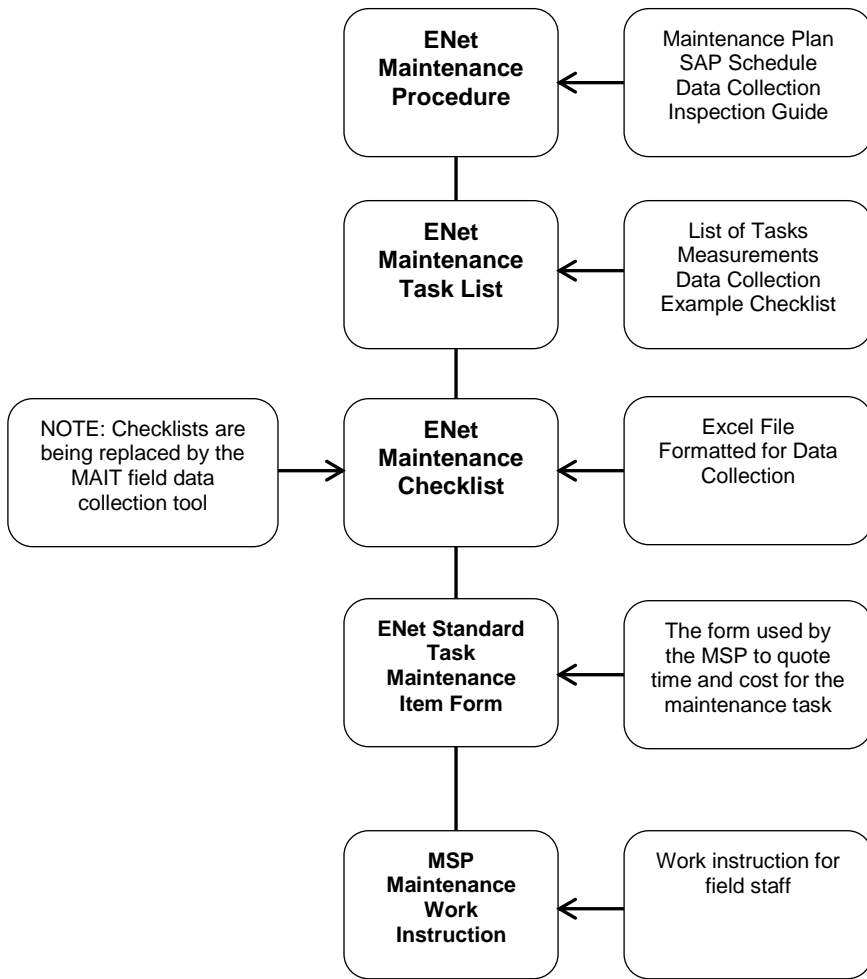


Figure 3-2 Maintenance Documentation Framework

3.3 Routine Maintenance Management

All routine maintenance is managed in SAP. Work orders for routine maintenance tasks are automatically generated by SAP and are allocated to the MSP for action. For the purpose of scheduling, each task has a due date and associated maintenance plan float time period within which the work must be completed.

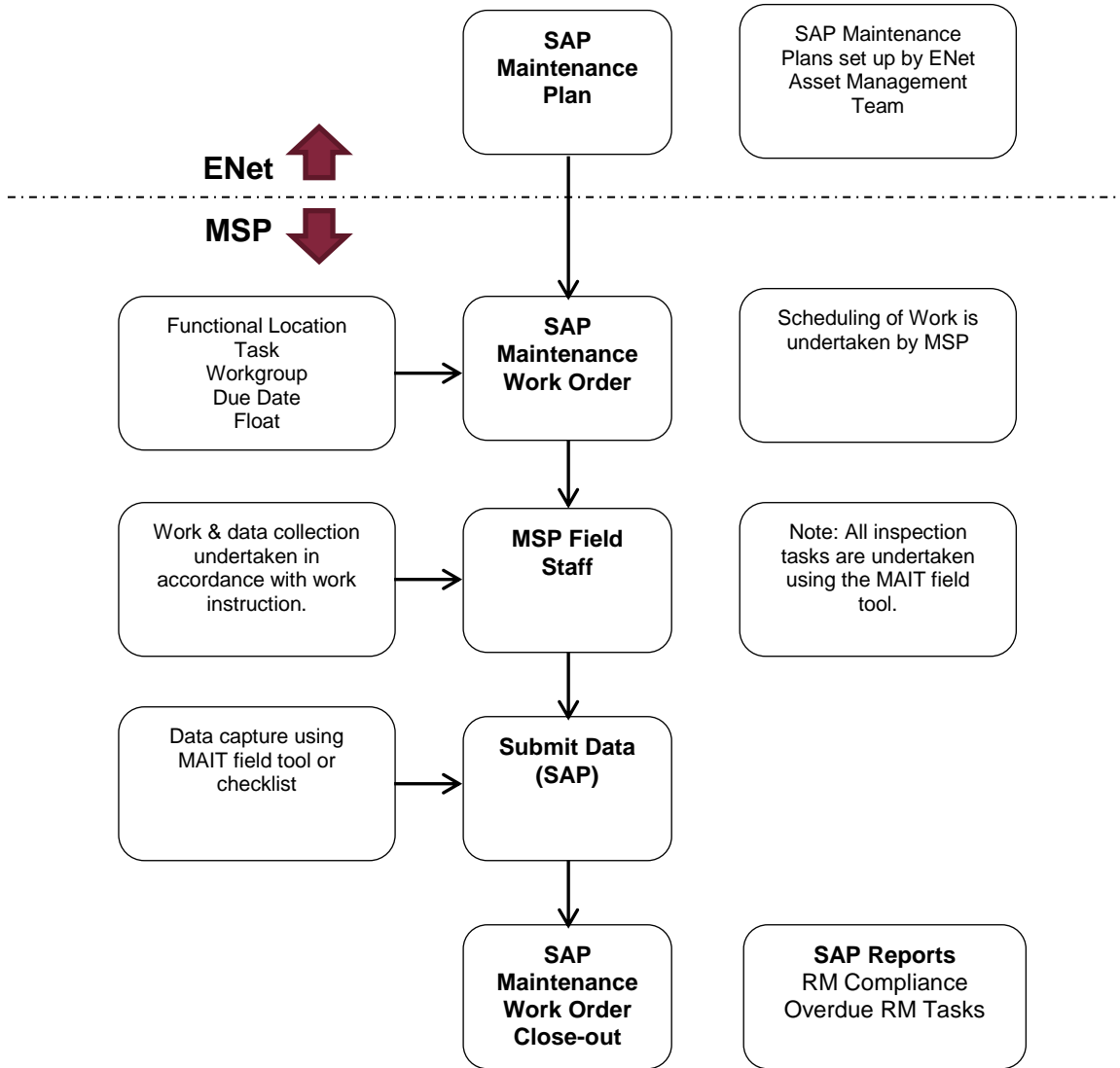


Figure 3-3 Routine Maintenance Management Process

3.4 Defect Management

All asset defects are managed in SAP. Defects are registered as SAP Notifications and are coded with response times and associated risk ratings. The MSP is required to attend to all defects within the required response times.

This process is also followed for 1st call and emergency response defects.

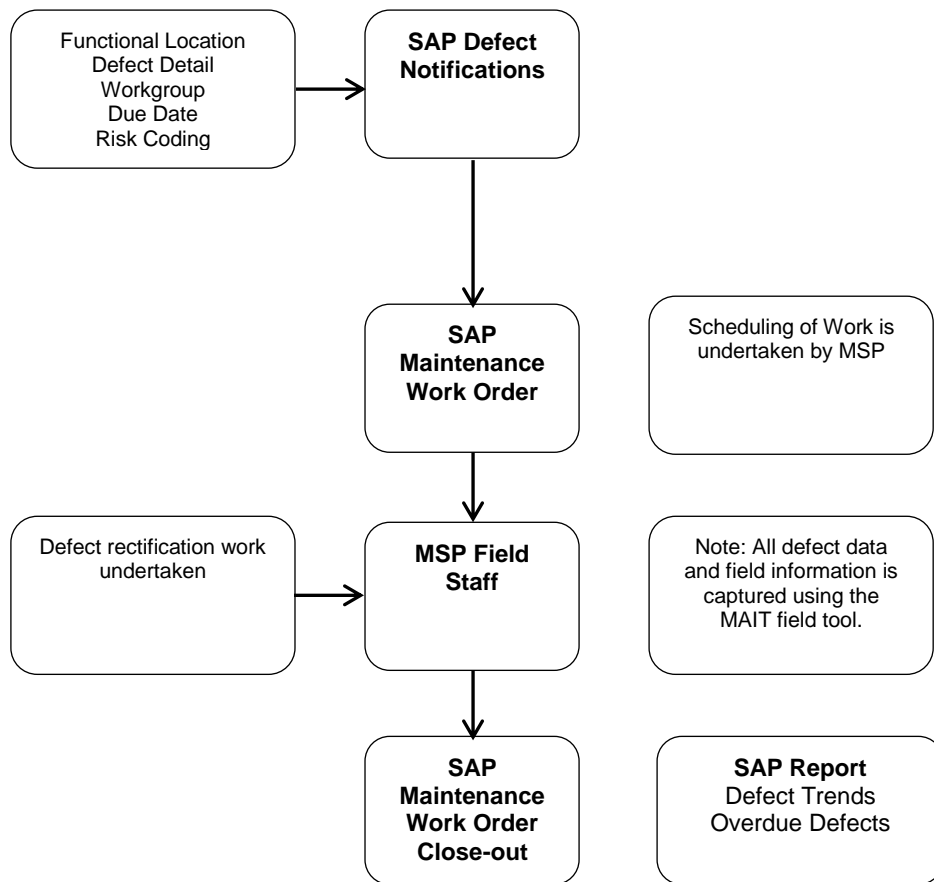


Figure 3-4 SAP Defect Management Process

3.5 Inventory Management

ElectraNet will purchase HV plant items for emergency spare equipment. Control of inventory will be managed through ENet SAP inventory management.

3.6 Site Management Framework

The MSP is required to manage all site based work associated with local operation (switching), maintenance, defect maintenance, 1st call response, emergency response and asset refurbishment projects.

The substation is monitored from the ElectraNet SMSC in Adelaide:

- The SMSC operator is responsible for coordinating all network switching;
- The SMSC operator will contact the MSP 1st call response personnel in the event of a system fault; and
- The ElectraNet FMT is able to remotely interrogate and diagnose system faults and will provide technical support to the MSP as required.

The framework for management of site work is set out below.

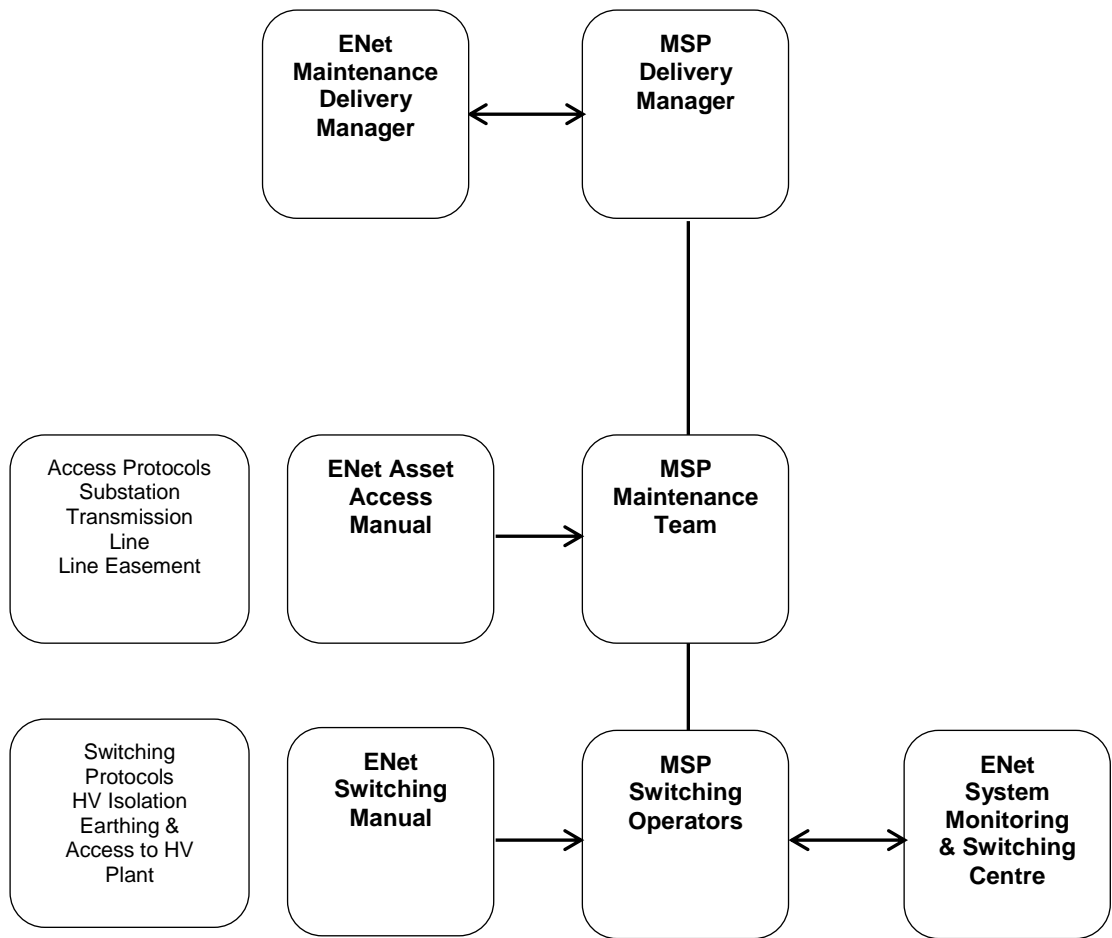


Figure 3-5 Site Management Framework

Appendices

Appendix A Typical Maintenance Task List & Frequency - Substation

Procedure Document	Task	Description	Freq. (Years)
1-11-P14	A_ACSWA	AC SWITCHBOARD MAINTENANCE	2
1-11-P47	A_ACTFA	STATION SUPPLY TF MAINTENANCE	5
1-11-P21	A_AIRCM	AIR CONDITIONING MAINT	0.5
1-11-P15	A_BATBK	BATTERY ANNUAL SITE MAINT	1
1-11-OP01-P013	A_BATDG	BATTERY REPLACE - DIESEL GENERATOR	2
1-11-P15	A_BATRP	BATTERY REPLACE 10Yrs	10
1-11-P58	A_BCHRG	BATTERY CHARGER SITE MAINT	4
1-11-P37	A_BUNDM	BUND MAINTENANCE	1
1-11-P37	A_BUNDP	OIL CONTAINMENT POND MAINTENANCE	7
1-11-P01	A_CBGAS	CB SF6 GAS SAMPLE	12
1-11-P01	A_CBSF6	CB SF6 SERV (NOT CAP BANK)	6
1-11-P07	A_DISCM	MOTOR ISOL SERV	6
1-11-P19	A_EGRD0	10YR EARTH GRID INJECTION TST	10
1-11-P30	A_IN12S	12M RSM FOR SMALL SUBS (SAFETY & ENVIRONMENT INSPECTN)	1
1-11-P30	A_IN1MS	1M RSM FOR SMALL SUBS	0.08
1-11-P06	A_ITSRV	INSTRUMENT TRANSFORMER SERVICE	3
1-11-P37	A_OILSM	OIL SEPARATOR EQUIPMENT MAINTENANCE	1
1-11-P04	A_OLTCD	DIVERTER SWITCH SERV	6
1-11-P04	A_OLTCS	1X3PH SWITCH TAPCHANGER SERV	6
1-11-P20	A_PETHS	PORTABLE EARTHLEAD TESTING (SMALL SUBSTATIONS)	3
1-11-P23	A_SC12S	12M SUBSTATION CLEANING SMALL SITE	1
1-11-P23	A_SCL6S	6M SUBSTATION CLEANING SMALL SITE	0.5
1-11-P39	A_SECUR	SUBSTATION SECURITY SYSTEM MAINTENANCE	1
1-11-P65	A_SELGM	SUBSTATION ELECTRIC GATE MAINTENANCE	1
1-11-P60	A_SFLSU	SUBSTATION FAULT LEVEL CALCULATIONS & SIGN UPDATE	2
1-11-P22	A_SLASH	ENET PROPERTY GRASS SLASHING	0.5
1-11-P24	A_SSM3M	AEROBIC SEWER SYSTEM MAINTENANCE	0.25
1-11-OP01-P008	A_STRMS	SUBSTRUCTURE INSPECTION AND MAINTENANCE - SMALL SUB	5
1-11-P02	A_TFOIL	TRANS/REAC OIL SAMPLE	1
1-11-P02	A_TFSRV	POWER TRANSFORMER SERV	6
1-11-P31	A_THERS	SMALL SUB INFRA-RED SCAN	1
1-11-P03	A_TRFT8	POWER TRANSFORMER - OIL REACTOR HV TESTS - 8YR <16yrs	8
1-11-P28	A_TSTSS	SWITCHING STICK TEST	1
1-11-P16	A_UGSUB	SUB UG CABLE TEST & INSPECT	
1-11-P22	A_WEEDS	PROPERTY & WEEDS SMALL SITES	0.5
1-09-P10	B_CVTVR	CVT MONITORED SECONDARY VOLT READING	1
1-09-OP01-P001	B_DIGAP	PROT SET SERV 275KV-DIGITAL PROTECTION	4
1-09-OP01-P001	B_DIGAT	PROT SET SERV 275KV-DIGITAL TRIPPING	4
1-09-P16	B_TFCCL	TF COOLING CONTROL CHECKS	1
1-10-P13	C_FIRP5	FIRE PROTECTION PORTABLE FIRE EXTINGUISHER REPLACEMENT	5
1-10-P07	C_IBATT	PHONE EQUIP INT BATT REPLACEMENT	4



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