OFGEM

INFORMATION AND INCENTIVES PROJECT REVIEW OF PES MEASUREMENT SYSTEMS

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1. EXECUTIVE SUMMARY

1.1 Approach to the Review

During May 2000 PB Power conducted a review of the fault management and performance reporting systems employed by each of the 14 distribution businesses in England, Wales and Scotland. The approach employed by PB Power was to issue a questionnaire for completion by each distribution business followed by a visit to each company to review the information submitted with the questionnaire. During the visits a "walk through" was undertaken of the HV and LV fault reporting processes to obtain a first-hand understanding of the nature, accuracy and consistency of data flows.

The accuracy and consistency of fault management and reporting data has been assessed according to "Reliability Assessment" and "Accuracy Assessment" grades that have been devised to reflect the range and nature of manual and automatic processes used to capture and record data. The detailed results of the assessment have been set out in tables included in Section 5 and in the Appendices to this report.

1.2 Summary of Findings

1.2.1 Performance Reporting

The achievements that some companies have made in relation to fault management and performance reporting are recognised by PB Power. However the initial findings indicate that there is significant inconsistency and inaccuracy that tends to arise from three main sources:

a. **Information Systems (IS)**: The automatic and manual processes that companies use to collate information on faults (eg, the automatic linkage between different software applications and the manual processes for collating fault and customer number information from site engineers);

b. **NaFIRS Definitions**: Inconsistencies in the way in which the definitions set out in NaFIRS are applied and interpreted, (eg, differences in how a restoration of supply is defined). These definitions underpin information that is submitted to Ofgem on the number and duration of interruptions to supply; and

c. **Customer to Network Connectivity**: The extent to which customer location information is linked to the physical network so that, in the event of an interruption, the companies can identify which customers are off supply and for how long. Most companies link actual customer locational information to the network at the HV/LV substation. However some companies employ an average number of customers derived from the size of the HV/LV substation reconciled with the total number of customers. This leads to inaccuracies in identifying and reporting the effects of interruptions to individual customers.

In addition to the above sources of inaccuracy and inconsistency it is also apparent that:

i. the level of accuracy in reporting reduces from higher voltage levels to lower voltage levels;

ii. there is limited formal audit or scrutiny of the reported output measures; and

iii. there is limited documentation in some distribution businesses of the processes that staff must follow for collating information on output measures for reporting purposes.

Table 1.1 below shows the estimates of the magnitude of potential inaccuracy in the reporting of output measures to Ofgem that stem from the three areas identified above. It should be noted that the level of inaccuracy differs across distribution businesses and the overall inaccuracy may not be cumulative.

Table 1.1 – Accuracy in Reporting Output Measures

Area	Potential percentage inaccuracy
Information Systems (IS), including: • Linkage between IS and NaFIRS • Information from site engineers	5% - 10%
Inconsistencies in NaFIRS reporting, including: • Interpretation of definitions • Application of definitions	5% - 15%
Lack of customer to network connectivity	5% - 15%

1.2.2 Performance Reporting Improvements

Improvements to increase the accuracy and consistency of information are recommended as follows:

1.2.2.1 Short term improvements (by April 2001)

a. the introduction of consistent definitions for the application of the NaFIRS scheme, for example on the definition of "supply interruption" and "supply restoration"; and

b. the introduction of formal written procedures for the collation of data and improved internal audit/checking procedures.

1.2.2.2 Medium term improvements (by April 2002)

a. the introduction of "customer to network connectivity" to the outgoing LV circuit from the HV/LV transformer; and

b. the introduction of improved and more integrated information systems, eg reducing the amount of manual involvement in the transposition of data from written records to reports that are submitted to Ofgem under the requirements of Licence Condition 9 (Condition 7 in Scotland).

1.2.2.3 Longer term improvements (April 2005 and beyond):

a. consideration of introducing full connectivity of customers to the network right down to the lowest level, i.e. single LV phase. This would provide very accurate information and facilitate accurate automatic payments on Guaranteed Standard (GS) 2.

1.2.2.4 Cost of Improvements

The estimated costs of the improvements set out above are as follows:

a. The costs of the short term improvements are estimated to be less than £0.5 million in total to the industry as a whole.

b. The medium term improvements will vary significantly across companies depending on the nature of their existing systems and the resources already committed to their development or replacement.

c. The estimated cost of establishing "customer to network connectivity" down to customers on LV outgoing circuits for those companies who do not do it at present is estimated to be in the order of £0.3 million.

The cost of improving fault management and performance reporting systems will obviously vary on a case by case basis depending on companies progress in implementing improvements in this area.

1.2.3 Monitoring Medium-term Performance

The approach that distribution businesses take towards monitoring the medium term performance of network assets has also been reviewed by PB Power. It has been found that the approach towards asset management is continually developing and that in general companies are prioritising investment based on a range of factors, such as output focused indicators (for example fault rates), and equipment condition based analysis. Some companies also use decision making tools to assess individual schemes or programmes of work. The use of age profiling is usually only carried out as a backstop to the decision making process and is not the prime driver of investment strategy.

In general the companies asset management schemes are reasonably well documented but they are not accredited. The accreditation of schemes is not considered to be an appropriate means of monitoring medium term performance since it is intrusive and may stifle innovation. Trends in network reliability (faults per 100 km) disaggregated by voltage (and urban/rural network at HV and LV) is considered to provide a useful indicator of medium term performance.

1.2.4 Measuring Transient (short-term) Interruptions

The progress that distribution businesses have made in meeting the commitment made under the distribution price control to measure short-term interruptions to supply has also reviewed by PB Power. Most companies have introduced some form of measurement system for short-term interruptions although the extent to which companies will be able to measure customer effects accurately from April 2001 differs significantly across companies. Two companies have no firm plans to introduce measurement systems for short-term interruptions.

It is recommended that the definition of a transient (short-term) interruption should be broadened to cover all interruptions up to three minutes duration (rather than one minute as is the case now). This would bring the definition in line with that used in European Standards. Increasing the threshold for the definition of short-term interruptions may also provide incentives on companies to invest in more sophisticated automated devices that could result in improvements to performance. At present the definition of one minute does not have this affect because some network automation devices take more than one minute to operate.

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APPENDICES

LIST OF ABBREVIATIONS

CAIDI	Customer Average Interruption Duration Index
CLI	Call Line Identification
CML	Customer Minutes Lost
DTN	Data Transfer Network
EA	Electricity Association
EHV	Extra High Voltage (66kV, 132kV)
FMS	Fault Management System
GS	Guaranteed Standard
HV	High Voltage (11kV or 22kV)
IIP	Information and Incentives Project
IVR	Interactive Voice Response
LV	Low Voltage (415V)
MAIFI	Momentary Average Interruption Frequency Index
MPAN	Metering Point Administration Number
MPAS	Metering Point Administration System
NaFIRS	National Fault and Interruption Reporting Scheme
NMS	Network Management System
OS	Overall Standard
PES	Public Electricity Supplier
POD	Power Outage Device
SAIDI	System Average Incidence Duration Index
SAIFI	System Average Incidence Frequency Index
SCADA	Supervisory Control and Data Acquisition

2. INTRODUCTION

In the Ofgem distribution price control final proposals December 1999 [1] provision was made for introducing new measures, incentives and penalties associated with network performance during the price control period commencing April 2000. Ofgem also tightened the existing Guaranteed Standards and Overall Standards of Performance. (GS and OS Standards) in respect of restoration of supply (24 hours to 18 Hours), including making provision for automatic penalty payments from 2002. Ofgem also indicated that it would introduce additional standards relating to telephone response to supply interruptions and also for worst served customers. Ofgem also intends to undertake a review of Quality of Supply Reports in conjunction with Electricity Consumers Committees (ECCs).

Ofgem recognised that there are some weaknesses associated with the existing framework of price regulation and in the information currently provided by distribution businesses and initiated an Information and Incentives Project (IIP) under an open letter to Chief Executives of the Distribution businesses [2]. The IIP project includes four main workstreams: Defining output measures; Developing incentive regimes; Monitoring delivery between price controls; and Reviewing incentives in relation to cost inputs and outputs. Ofgem has also had a series of meetings with distribution businesses.

In March 2000 Ofgem published an update on the IIP and the arrangements for a public workshop in May 2000 [3]. Ofgem outlined it's initial proposals for defining output measures and monitoring delivery between reviews in June 2000 [4].

Technical consultants were invited to tender to assist Ofgem in certain aspects of the project [5].

The IIP project is being project managed by Ofgem and staff from PB Power have been retained to review existing output measures of the distribution businesses.

[1] Ofgem: Reviews of Public Electricity Suppliers 1998 to 2000 - Distribution Price Control Review December 1999.

[2] Ofgem: Letter to the Chief Executives of the PES Distribution businesses Information and Incentives Project December 1999.

[3] Ofgem: Information and Incentives Project: defining output measures and incentive regimes for PES distribution businesses Update - March 2000

[4] Ofgem: Information and incentives project. Output measures and monitoring delivery between reviews. Initial proposals - June 2000

[5] Ofgem: Terms of reference Information and Incentives project.

3. WORKPLAN AND OBJECTIVES

The initial PB Power workplan agreed with Ofgem is attached as Appendix B and the objectives are summarised as follows:

a. to obtain an understanding and report on the processes, information systems and data flows associated with performance data;

b. identify the scope of data collected;

c. identify the outputs provided for Ofgem and company use;

d. to estimate the probable accuracy of the data;

e. to review the accuracy and consistency of data provided within and between companies; and

f. to identify future plans to improve the scope and accuracy of data to meet proposed Ofgem standards of performance and incentives and estimate likely costs.

3.1 Network Performance Information Reviewed

The information which has been considered under this review is as follows:

d. PES licence condition 9 data provided to a fixed template.
This data is used as the basis of the annual Ofgem report on Distribution and Transmission Network Performance [6]. The data on which this report is based is available for all companies in spreadsheet format on the Ofgem website. http://www.Ofgem.gov.uk. (The review includes distribution data for England and Wales and also 132 kV transmission network performance for Scotland where 132 kV network is treated as transmission.)

e. GS and OS Standards of Performance data used for reporting and defined by Ofgem and reported under the annual Ofgem report on Customer Services [7]

f. Quality of Supply Reports data, to the general guidance of Ofgem and tailored to suit local needs in consultation with Electricity Consumers Committees (ECCs).

g. Company network performance data used internally by the company to monitor network performance. For most companies such data is collected and presented under the Electricity Association National Fault and Interruption Reporting Scheme (NaFIRS) [8].

(Note not all companies report exactly in line with NaFIRS. However all except Eastern provide a subset of company data to NaFIRS for inclusion in the annual Electricity Association summary NaFIRS report [9].)

[6] Ofgem: Report on Distribution and Transmission System Performance 1998/99 – January 2000

[7] Ofgem: Report on Customer Services 1998/99.

[8] Electricity Association Engineering Recommendation G43/2 July 1990. Instructions for Reporting to the National Fault and Interruption Reporting Scheme.

h. Customer Service data is also available in some companies from Customer Service Systems and Fault Management Systems which enable companies to identify performance for individual customers and/or groups of customers in order to make automatic payments and produce measures for worst served customers and in some cases telephone response data.

3.2 Methodology

The review of existing measures was conducted during May 2000 and involved the following:

a. a questionnaire completed by distribution companies;

b. review of published and company data associated with network performance identified above;

c. review of written procedures relating to acquisition of data and operation of information systems;

d. review of audit reports; and

e. review of the questionnaire and other documentation and processes related to network performance reporting during a company visit of up to two days held during April/May 2000.

[9] Electricity Association National Fault and Interruption Reporting Scheme National System and Equipment Performance. 1998/99

4. INCIDENT MANAGEMENT AND FAULT REPORTING PROCESSES

4.1 Introduction

Electricity distribution networks are subject to occasional interruptions in service mainly due to the operation of automatic circuit breakers and fuses to isolate faulty equipment following overload or a short circuit associated with damage or equipment failure. The numbers of customers interrupted can vary from one to a few tens of customers for faults on the low voltage (LV) system, to several hundred customers for incidents on the high voltage (HV) systems operating up to 22 kV, and several thousand customers for faults on the infrastructure (EHV) networks operating at 33 kV and above. In addition multiple incident situations can arise at all voltage levels during adverse weather.

There are four dependent processes involved in incident management which need to be co-ordinated and require the sharing of information. Network Control, Incident management and despatch, Field repair and restoration and customer telephone call taking. The office based processes have become more centralised and are supported by information systems described below which are complementary and in some cases either integrated or interface to support the overall process. The office based activities can also be operated at different locations. Call taking for example may have a few distribution call takers based in a Network Management Centre with contract over-spill arrangements to other service providers. A flow chart of the main activities is included in Figure 4.1.

4.2 Network Control

Operations on the EHV and HV networks are recorded and closely controlled and co-ordinated for safety and security reasons in distribution control centres. Faults on the EHV and HV systems are mainly automatically detected by remote monitoring Supervisory Control and Data Acquisition Systems (SCADA) and more recently by Power Outage Devices (PODs), which detect loss of supply in selected customer premises. Historically distribution control centres have been based on manual systems of recording operations in switching logs with reference to manually dressed wall diagrams. All distribution companies in Great Britain are now (or soon will be) using computer based Network Management Systems (NMS) to control the network. These generally are also able to track numbers of customers off supply as the network configuration changes in real time, by reference to fault management systems (FMS) described below. Some distribution businesses also actively control the low voltage network.

4.3 Fault and Incident Management

Fault Management Systems (FMS) are used by incident managers/dispatchers to identify faults from customer calls, despatch resources and to manage the activity in real time. Some HV incidents and most LV incidents are not immediately reported or automatically detected and the circuit affected is identified in FMS by associating customer no supply calls with their connection to the network. Incident dispatchers identify the likely nature of the incident and despatch resources to restore supplies and repair damage. Dispatchers also receive information from site and the Control Centre on the progress being made in restoring supplies and this information is shared with the call takers to provide information to customers, either directly or via voice messaging systems. Increasingly dispatchers also manage the incident and escalate action to ensure that Ofgem's Overall and Guaranteed service standards are met. Many companies set their own internal service level targets that exceed the Ofgem standards.

The effectiveness of the overall process of fault identification and provision of information to customers depends, amongst other factors, on the level of connectivity between customers and the network in the FMS system. Companies associate customers at different points on the network, HV/LV transformer, LV circuit or

LV node. No company associates customers down to a specified phase of a three phase or two phase circuit. Inaccuracies are also derived from inadequate records.

4.4 No Supply Calls

Interruptions in supply can lead to a large number of customer calls in a short period of time and call handling arrangements are required to enable customers to phone in with information about no supply and damage and obtain information about the incident and expected restoration times. Call volumes are extremely peaky and unpredictable and on rare occasions of severe weather may continue for several days.

Call volumes can be managed by setting up automatic messages targeted to customers by call line identification (CLI), by linking BT exchanges with network and customers or postcodes/parishes. Interactive Voice Response (IVR) is most effective when messages are set up quickly following a fault, updated frequently and are targeted at appropriate sized groups of customers. State of the art IVR systems allow messages to be automatically set up from SCADA data, with several hundred message areas and computer assisted compilation and control of messages. It is also possible to set up messages on the telecom service providers exchange to avoid being constrained by the number of incoming lines on company exchanges.

Companies currently have a range of the facilities described above and many are in the process of reviewing their customer call arrangements.

4.5 Network Performance Reporting (NaFIRS)

NMS and FMS information systems provide historical data which can be used to provide network performance indicators for network management and to meet certain obligations to report performance and meet service levels e.g. Guaranteed and Overall Standards of Performance (GS and OS standards) and reports on network performance under Condition 9 of the PES licence. Many of these indicators have been produced through the National Fault and Interruption Reporting Scheme (NaFIRS) co-ordinated by the Electricity Association (EA) or minor variants of NaFIRS for those companies not reporting to the EA. Computer systems, including those companies not reporting to NaFIRS, are all based on NaFIRS requirements, either mainframe or bespoke systems or more recently a PC or server based system using a Microsoft Access database. In general these systems are not automatically linked with NMS and FMS systems. Links would improve accuracy, particularly for incident capture.

4.6 Network Performance Data Accuracy Issues

The basic input data required for performance monitoring includes:

a. incident capture

b. interruption start time and restoration stages

c. number of customers involved at each stage

d. incident cause

Fixed data such as total numbers of customers, length of network and numbers of items of plant is also required to produce standardised data.

The main output performance indicators are as follows, with international equivalent:

Availability - average customer minutes lost per connected customer per year
(System Average Incidence Duration Index - SAIDI)

Security - average number of customer interruptions per 100 connected customers
(System Average Incidence Frequency Index – SAIFI)

Duration of customer interruption
(Customer Average Interruption Duration Index - CAIDI)

Response – Percentage of customers restored in a given time period e.g. one hour, three hours (OS Standard) and 18 hours (GS and OS Standard)

Transients (short term interruptions less than one minute)
(Momentary Average Interruption Frequency Index – MAIFI)
(European Standard EN50160 specifies interruptions less than three minutes duration)

Reliability - faults per 100 km of network or per 1000 units of specified equipment

All companies report to the NaFIRS format, with minor variations. In addition to the indicators set out above, NaFIRS can also be used to provide disaggregated data by voltage, geography, overhead/underground and other reports.

NaFIRS has been operating since the 1960s. NaFIRS does allow some options for reporting, particularly at low voltage and there are many ambiguities. NaFIRS, as presently implemented by the distribution companies does not provide the accuracy required for comparative analysis for incentive payments and would not meet requirements for information relating to particular customers or groups of customers. Most of the inconsistencies and inaccuracies associated with NaFIRS arise from different interpretations and data input inaccuracies or omissions as follows:

a. Incidents not captured;

b Incident time not identified correctly – most companies use the time the company first becomes aware of the incident, others use the time off reported by the customer;

c. Number of customers off supply and restored at each restoration stage not accurately identified. There are various levels of accuracy:

   i. Full dynamic connectivity model within NMS/FMS which automatically identifies numbers of customers off supply in NMS/FMS as supplies are restored;

   ii. Full static connectivity model within NMS/FMS which identifies numbers of customers off supply as supplies are restored by manual identification of transformers off supply, manual or automatic;

   iii. Customers affected based on average number of customers per transformer or type of transformer, which may or may not be reconciled with total customer numbers. In these cases customer calls may be associated within FMS by parish or postcode;

   iv. Customers affected based on demand or connected transformer capacity which may or may not be reconciled with the total number of customers.

Companies have reported step changes in CMLs of between 10% and 30% by changing the basis of reporting customer numbers.

About 30% of CMLs and Interruptions per 100 customers arise on HV incidents during restoration stages. The reporting of restoration stages can therefore have a significant impact on reported performance. Some

NaFIRS computer systems and data entry pro formas restrict the number of stages that can be reported. Some companies also only input main restoration stages. In addition re-interruptions may arise during fault finding and restoration. Some versions of NaFIRS have a facility for suppressing re-interruptions which not only reduces the apparent number of interruptions (by up to 15%) but also impacts on interruption duration and therefore on 3 hour and 18 hour GS and OS standards.

Fault causes are inconsistently reported, partly due to different custom and practice and also because some pro formas do not include all cause codes.

Other errors can occur due to misunderstanding of reporting requirements by users, transcription and system errors. NaFIRS includes automatic plausibility and error checking to eliminate some of these errors.

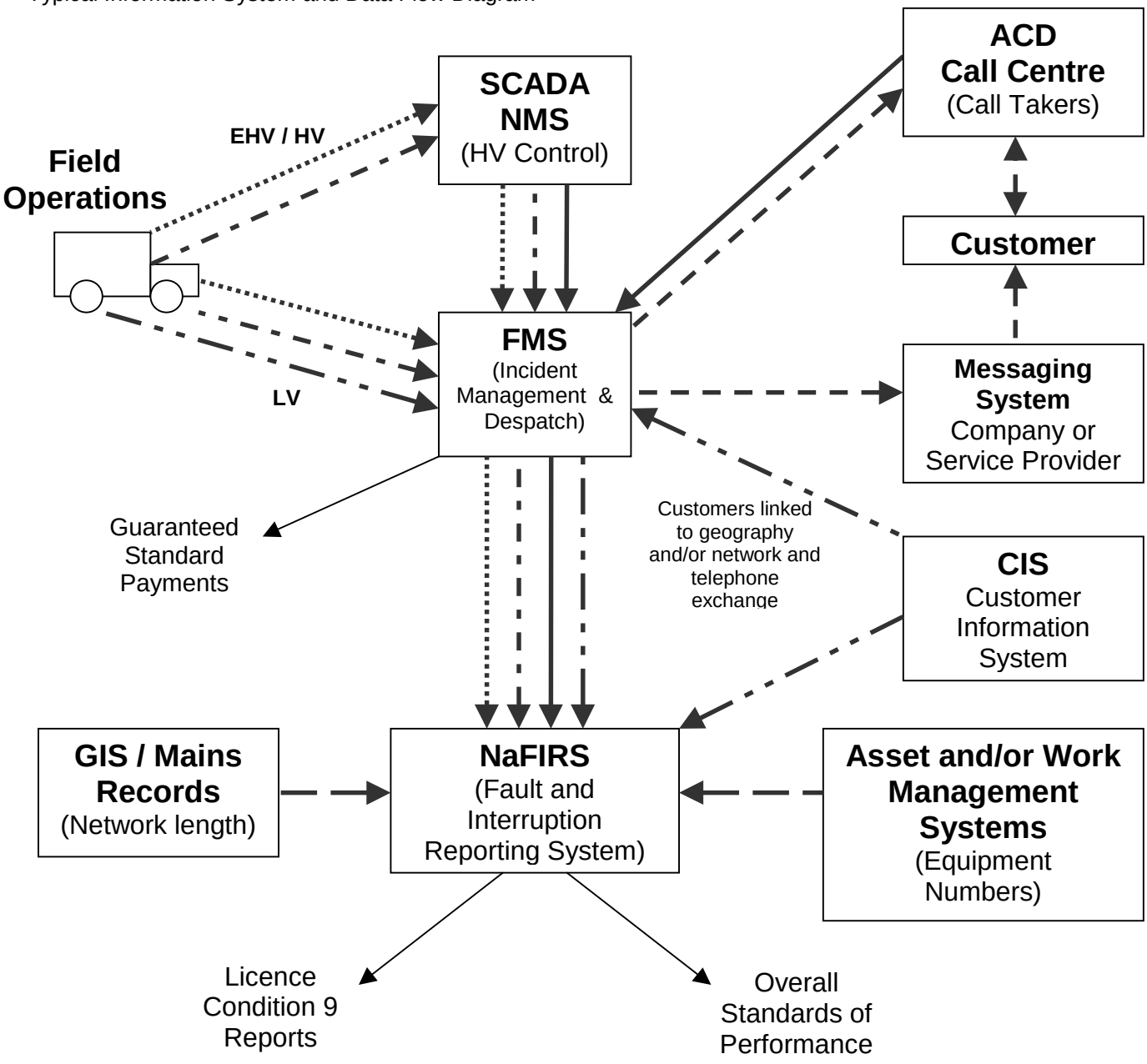
NaFIRS currently does not have facility for recording transient interruptions, although this was once a feature of NaFIRS. A number of issues would need to be resolved. Companies currently measure number of transient mainly on source circuit breakers but some also measure interruptions on downstream reclosers and PODs. Numbers of transients along a circuit may be coincident and the present measures do not relate transients to customers. However a transient measurement system could be incorporated in NaFIRS.

Companies currently measure performance relating to worst served customers within NaFIRS by circuit monitoring which can be used to rank circuits on a number of measures e.g. number of incidents, number of customer interruptions per 100 customers, number of customer minutes lost per customer. NaFIRS currently has no facility for monitoring the number of interruptions experienced by groups of customers or individual customers.

It may be possible to incorporate such reporting requirements for transients and worst served customers into NaFIRS to ensure that the base data is from a consistent source and that reporting methods are consistent across companies.

Figure 4.1 - Incident Management and Network Performance Monitoring

Typical Information System and Data Flow Diagram



Customer numbers

Incident Capture

restoration times

Fault Cause

Customer information

Circuit length and Equipment numbers

Outputs

Diagram shows main systems and data flows. Systems may be manual or computer based and in some cases integrated.
Data flows may be manual or automatic and may include intermediate paper based forms.
Processes may take place at several locations.

5. FINDINGS, ISSUES IDENTIFIED AND CONCLUSIONS

A review of the measurement systems employed by each of the 14 distribution companies in England, Wales and Scotland is given in Appendix A. The findings, issues identified and the conclusions are set out below.

5.1 Information Systems

5.1.1 NMS

All companies have implemented or are in the process of implementing computer based network management systems (NMS) to replace wall diagrams and manual switching logs. Three companies with older systems are moving to a second generation of NMS. Three companies are currently using wall diagrams and manual logs until NMS is fully implemented. The more modern NMS systems have dynamic links with the FMS system in order to maintain the customer connectivity model during operations and abnormal feeding arrangements. However this is not essential to maintain accurate reporting as the number of transformers off at any one time can be monitored manually to provide accurate real time information for customer service and for reporting.

NMS systems or manual control logs are the main source of data for HV incident reporting into NaFIRS and historically have a high level of accuracy. Data is normally transcribed manually from NMS systems to NaFIRS as NMS systems are not automatically linked to NaFIRS, although some companies are considering this option.

5.1.2 Fault Management Systems (FMS)

Fault Management Systems (FMS) or Troublecall are required as a means of co-ordinating information and actions between call centre agents, network management (control) and incident management and resource despatch. The outputs are used for incident and performance reporting and also as a basis for providing reliable real time information to customers.

The key function is to assist in the management of fault and pre-arranged outages:

a. to plan pre-arranged outages;

b. to capture no supply and network status and damage reports from customers and the public;

c. to provide information to customers, (sometimes via associated IVR and messaging systems);

d. to aid despatch of resources and expedite repair through management escalation including GS/OS standards;

e. to record feedback from the field including expected restoration times;

f. to record the progress of the incident restoration times and customer numbers;

g. to aid the management of incidents including emergency situations; and

h. to provide information for incident and performance reporting including GS and OS standards.

FMS systems tend to be bespoke systems and are generally used slightly differently at HV and LV as incidents are managed by different staff.

Most FMS systems hold a connectivity model linking customers to the network or geography and the refinement of this model dictates the extent to which customer calls can be associated in order to identify the section of network and sometimes individual customers affected. Links can be at the levels indicated below.

1. postcodes and parishes linked to network – no customer link;
2. customers linked to HV/LV transformer;
3. customers linked to LV outgoing circuit; and
4. customers linked to a node on the LV circuit but not phase.

Most systems with a customer link also link to HV circuits or protected zones and customer numbers can thereby be aggregated for incidents at higher voltages e.g. 33 kV and 132 kV.

FMS systems can be alpha numeric or graphic/geographic. Both types may be integrated with NMS systems at some level. Dynamic linking with NMS more readily facilitates identifying customers off supply as the network configuration changes during restoration. However systems with no real time link with NMS can still identify the real time state by manually tracking transformers off supply. No FMS system currently allows for dynamic changes on the LV system, although some are being considered.

5.1.3 Customer information Systems

Companies are at various stages of separating distribution and supply business Customer Information Systems. Some continue to use the Supply business information systems, including under a contract where companies are now in separate ownership. Others are developing customer information systems for distribution only based on a historic copy of the supply customer database and updates either from the Data Transfer Network (DTN) or direct from the supply data base and new connections data. Others are basing the distribution customer database on the Metering Point Registration System (MPAS data) with updates as above. At least three companies do not identify individual customers but use overall customer numbers to derive average numbers of customers per transformer. In these cases customer no supply calls and CLI messages are associated coarsely by postcode or parish and/or BT telephone exchange.

Companies dependent on DTN updates do not now automatically obtain customer names and data is reported to be frequently inaccurate or inconsistent with existing records.

Distribution companies are attempting to redefine “a customer” in line with the MPAS system definitions e.g. MPAN numbers, excluding unmetered street lighting connections but including unmetered supplies to more critical installations such as telecom sites and cathodic protection installations. The status of installations also needs to be taken into account i.e. energised, de-energised or disconnected. In view of the changes being made on customer information systems there is likely to be inconsistency and inaccuracies between companies and over time. A definition is required for "a customer" which takes into account the above changes.

5.2 Customer numbers affected by incidents.

The linking of customers to the network is key to obtaining a correct count of customer numbers associated with individual incidents. Two companies have no association of customers with network and rely on using average numbers of customers per transformer (different classes are identified) for customer count and associate incidents by geographic area only e.g. post code or parish.

Where customers are linked to network the accuracy can be constrained by the accuracy of the mains records for example, records of phase connections are not always available or reliable. However, methods do exist of obtaining such information such as equipment that can identify the phase connection from sources of electric light (i.e. non-intrusive).

In general companies which link to the HV/LV transformer and/or LV network have an accurate count of customers involved for individual HV faults. Companies with no customer to network link do not have an accurate count of customers associated with individual incidents but may have reasonably accurate average performance figures, provided the number of customers reconciles with the total company number of customers. However one company demonstrated variances of ± 6% on HV and LV possibly due to the unequal disposition of faults towards the older more densely populated areas and statistically faults are likely to occur on the longer circuits with more customers.

It is not straightforward to identify the number of customers for LV faults because of the difficulties of identifying connections and phases. LV restorations can also involve a number of strategies including isolating the affected part of the network and restoring the rest in stages including use of mobile generators and temporary connections. Adjustments also need to be made for single or two phase faults. Some companies adopt an averaging approach as for HV. One company which has connectivity to HV/LV transformer level for HV incidents, uses average numbers of customers per LV circuit for LV incidents which it claims is likely to be more reliable for average reporting than information form site or records. Others rely on reports from site by telephone/radio in real time (also used for customer information) and/or reports on time sheets or work records. Some do both which may lead to inaccuracies due to inconsistency. Site estimates depend on the availability and quality of mains records on site by fax, aperture cards, CDs, paper records or telephone enquiries to dispatchers. Even with site records it is not always possible to identify the number of customers in flats or whether supplies are metered or sub metered. Some systems are more accurate than others but none are 100% accurate in recording the number of interruptions affecting individual customers due to LV connectivity issues and identifying customers off supply.

5.3 Plant and circuit records

NaFIRS includes plant units and circuit length in order to calculate reliability in faults/ 100 km and equipment unit fault rate. An overall figure of reliability faults per 100 km is included in Condition 9 reports, which is meant to exclude services but some companies do not segregate service and mains faults either by design or default. The reliability index could be disaggregated by voltage to support the monitoring of medium term resilience of the network.

Plant data is normally accurate as most companies have reasonable record of strategic HV plant items for work scheduling and asset management.

Cable and overhead line lengths come from a range of sources. Some are taken from a spreadsheet record based on historic figures which have been checked at privatisation or at each price control, updated from project records. This may not be accurate and is not easily audited. Other companies have fully vectorised geographic or sometimes geo-schematic mains records and diagrams. Not all companies that have full GIS use the GIS system as the basis for NaFIRS fixed data.

5.4 NaFIRS and other Procedures.

All companies claim to follow G43/2 instructions for reporting EHV/HV LV and pre-arranged outages. Some companies have their own IT systems with some variation in categories of equipment and fault causes. Eastern does not report to EA NaFIRS and London and Midlands only report partially to NaFIRS. All companies produce reports in accordance with licence condition 9. Companies have either a mainframe version of NaFIRS or very similar or a PC version developed by Heed Ltd for the Electricity Association. The PC version includes more restoration stages and better facilities for extracting reports, including audit checks.

Some companies provide no additional information to users to guide fault reporting whilst others provide additional procedures and instructions. Some companies have very comprehensive procedures for the whole process of fault and incident management, including guidance on response, escalation actions and audit and monitoring procedures. It was found that advanced IT systems did not necessarily correlate with good incident reporting procedures.

In general companies are moving to centralised network operation and control, including LV control in a few companies. This tends to improve the accuracy and consistency of performance reporting statistics used in NaFIRS and condition 9. However incident causes reporting is variable. Some companies also consider that the field teams should have responsibility for performance and associated reporting and they may have an involvement in either or HV and LV reporting which can lead to improved or lowered accuracy depending on controls, incentives and culture.

5.5 EHV and HV Incident Reporting

Most companies co-ordinate all EHV and HV fault reporting in the HV control centre / network management centre environment and achieve a reasonable accuracy within the limits of counting customers above and some inconsistencies in reporting restoration stages identified below. There is an anomaly in NaFIRS which counts transients on the 132 kV system with sustained interruptions at lower voltages. Transient interruptions of less than one minute are not recorded within NaFIRS for EHV and HV incidents but they are recorded in NaFIRS for 132kV incidents. At 132kV these generally do not cause a loss in supply but when they do the interruption affects a large number of customers for a short period and these short term interruptions are included in the index of number of interruptions per 100 customers. This anomaly needs to be removed from NaFIRS by excluding the 132kV short term interruptions for this analysis.

5.6 HV Incident and Interruption Count

Most companies have extended remote control to devices on the 11/6.6 kV network although automatic control is often not integrated with NMS and the SCADA facilities. HV incidents are therefore captured from a number of sources: 11kV Remote Control, SCADA, PODs (Power Outage Devices) and by association of customers within FMS.

However all incidents are formally recorded in manual or electronic HV Control logs and can be reconciled with the source. Restoration times can also be reconciled with the information held in FMS for customer information, including time the incident was first reported.

No company has a direct link between the NMS system and NaFIRS for HV fault and incident reporting. Intermediate manual forms used for collating NaFIRS information are mainly centrally processed but sometimes the forms must be sent to depots to obtain fault cause and equipment details. Routine audit of

number of incidents is variable but the number of incidents can be post audited and reconciled against NMS logs and daily/monthly/annual reports. It is considered that less than 1% of HV incidents are not reported.

There are some anomalies in interruption reporting due to the way restoration stages are counted. Various versions of NaFIRS are used, Mainframe, PC NaFIRS (Access) and bespoke NaFIRS systems operated by at least three companies. These systems allow different numbers of restoration stages to be reported, the remaining restoration stages being aggregated. There are also different policies on reporting repeated interruptions during the same incident. Companies generally report major restorations. One company defines this on the basis that customers should have been restored for five minutes before it is classed as a restoration, subsequent interruptions during fault sectionalising are counted as new interruptions. A second company uses ten minutes as the criteria. However some companies discount all re-interruptions on the same incident and PC NaFIRS makes provision for this using an optional tick box. Some companies with other versions of NaFIRS also take this line.

The reporting of restoration stages can have a significant impact on number of interruptions per 100 customers index, interruption duration and worst served customers. Whereas numbers of incidents are consistently and reasonably accurately recorded, interruptions are not consistently recorded and the difference can be up to 15% according to one company.

5.7 EHV/HV Customer minutes lost and durations

Most HV incidents are identified by automatic means which times the incident start. Where this is not the case for faults beyond unmonitored protected points, the time is generally taken as the time the company is made aware of the fault. Some companies however record the time off supply as reported by the customer and this can add to interruption duration.

Policy and practice on recording restoration stages, described above, can lead to differences and these may be significant as the majority of HV CMLs occur during restoration. Reporting short duration restorations and re-interruptions can reduce overall CMLs and outage duration times. These may be offset by increased interruptions unless these are discounted as indicated above.

Some of the above differences may appear trivial. However the majority of customer minutes lost occur during the restoration stages of HV incidents, approximately one third of all CMLs. Different practices can have a significant affect on reported performance. It is also for this reason that companies have concentrated on improvement in restoration times, by operational measures or network automation. This can give a dramatic improvement of CMLs without tackling the underlying number of interruptions experienced by customers. The process is also subject to diminishing returns.

5.8 LV Incident Reporting

There are significant differences in the policy and practice of reporting LV incidents. Most companies indicate that they comply with NaFIRS, but NaFIRS appears to allow different approaches to services, cut out fuses failures and unmetered supplies. Company policies are not always fully understood by staff or complied with. Condition 9 requires a split of mains and services figures but the Condition 9 reliability figure is based on mains faults only. However some companies do not segregate mains and service faults. Clearer definitions and less ambiguous and more consistent practice is required.

There are also different practices on reporting of restoration stages as for HV. There are different practices in reporting in relation to temporary disconnection of supplies for the connection of a mobile generator. Some report such disconnections, others do not. A consistent approach is required.

Information on LV incidents is input through a variety of routes. Several companies automatically set up a NaFIRS report from the FMS system. This type of link appears to be essential in order that all LV incidents are reliably recorded. Restoration times and causes can then continue to be input by the most accurate and meaningful route, including work records and by phone. It is noted however that progress on all incidents need to be reported to the incident management centre in real time to provide a substantive and accurate response to customers It appears to be sensible for this to be reported from site in real time, except where dispatchers are busy with multiple fault situations.

The accuracy of LV information is variable and this is likely to continue to be the case when dealing with a large number of incidents with time pressures and communication bottlenecks and the uncertainty of the number of customers linked to the network. A code of practice approach may help to reduce inconsistencies and improve accuracy. Some of the options in NaFIRS may also need to be reduced for consistent Condition 9 reporting.

5.9 Fault Causes

There is little consistency in reporting fault cause and it is noted that the percentages in the main classes reported by companies varies significantly. In some cases companies do not include the whole range of fault causes on the work record pro formas used to collect data from site. Improvements would need to be made if disaggregation was to be required on the basis of fault cause. The drift in accuracy of reporting is inconsistent in what companies are telling us about condition monitoring and failure mode analysis. One company uses a different definition for the category “unknown”, using cause not found which may lead to inconsistencies.

5.10 Pre-arranged Interruptions

There are differences in issuing notices to customers for pre-arranged outages. Most companies do not issue notices for work on a single service either agreed with the customer beforehand or on an ad hoc basis e.g. service renewal. Most companies record actual times which are generally notified via FMS to keep the call centre updated in real time. Companies either post or hand deliver notices depending to some extent on their confidence in customer to network link and/or mains records.

5.11 Worst served Customers

Most companies indicate that they are able to target worst served customers by a mix of indicators and that the number of interruptions experienced by individual customers is not the only, or even the best, measure. Other measures include number of interruptions on an HV circuit or protected zone, CMLs on a rogue circuit, customer complaints, exponentially weighted trend data. Those who do use number of repeated interruptions to target investment often average the figure over various time periods from one to five years.

One company who has monitored the percentage of customers off supply n times (n = 6, n = 10) over the past few years indicates that it is a useful measure and they were able to improve performance from 120,000 off supply 6 or more times per year to 20,000 (about 1% of customers). At the new low level often no causal link is found, particularly between incidents aggregated across different voltage levels and over a single year.

In order to monitor number of interruptions affecting groups of customers aggregated across voltage levels it will be necessary to develop a connectivity model between customers and low voltage circuits and to record the phase affected for low voltage incidents. This would form a reasonable basis for a OS standard and GS standard with non automatic payments, i.e. payments based on customer claims, which could be checked against site records of phase connections. Automatic payments would require closer investigation of

individual incidents e.g. by examination of plans, or identifying phase connection of all customers or possibly a combination of both over a period.

Some companies have also raised the question of the effect of single phase faults which could leave certain single phase transformers on supply. This has not been taken into account in the past as these situations will have little effect on overall statistics. In order to identify worst served customers, it would be necessary to record the phase affected for single phase HV fuse operations where the fuse is subsequently successfully replaced, without disconnecting supplies to other phases, in situations where there are single phase transformers downstream of the fuse.

Other companies say that there is no business case for linking customers to LV networks and that inaccuracies would lead to loss of credibility and false payments if GS were based on either automatic or non automatic payments. Some indicate that they can identify worst served customers manually. London for example only perceives a problem on LV networks but the numbers are small (1500 per year) and they indicate that they can be identified manually.

Most companies saw a problem with customer claims against a GS standard. The LV interruptions would be inaccurate, but there would be other anomalies such as auto reclosers and repeated interruptions during one incident which customers would not be able to distinguish from one minute interruptions. (Some companies think the industry should adopt the European standard of three minutes as it would incentivise use of automation at 11 kV which often requires more than one minute to restore supply due to the communications and necessarily slow actuators on certain types of switchgear).

However most companies indicated that they were moving on putting in FMS systems which would provide a customer network link which would allow then to monitor number of interruptions experienced by groups of customers in aggregate.

Companies have different approaches to worst served customers, often immediate action through operational measures is as effective as refurbishment schemes long after the event. One company has provided a schedule indicating the effect of various Opex and Capex measures on CMLs and Interruptions per 100 customers over a relatively short period of three years.

5.12 Telephone response

Most companies intend to change telephone call centre arrangements as distribution businesses separate from supply. Some companies already outsource outside of the sector for over-spill calls, not just in emergency but to provide back up on a daily basis to ensure that the service provider maintains capability. Others are considering the use of sister companies for mutual support.

Most companies can divert calls to messages which are routed using call line identification (CLI). Companies have different capabilities in this area and are able to set up from less than ten to three hundred messages. Some do it at their own exchange level and some at service provider level e.g. BT exchange level. However some companies do not use the service provider for over-spill as calls with information about damage are lost and it may be preferable to take off messages in the early stages of an emergency to gather information. It is understood that more modern systems are able to re-route calls from a service provider messaging service back to the company exchange for damage reports.

The variety of arrangements raises a question about how average response times are measured and compared. It could be based on the calls taken by agents or all calls including those intercepted by messaging at service provider or company level. One method of preventing long queues of customer calls is to use call blocking. Call blocking is the practice of giving a busy tone to callers who it is hoped will hang up

and try again later. This practice can reduce the average response time by limiting the number of calls presented to the call centre but this does not necessarily indicate customer satisfaction. Not many companies use call blocking but one company considers that call blocking is better than long ring out times and uses it sparingly to avoid customer annoyance.

Two companies put messages on very quickly and gauge substantive response by the percentage of callers that listen to the appropriate part of the message - the companies report that around 90% appear satisfied on this criteria.

Companies are already achieving close to proposed Ofgem telephone response targets for normal conditions - some say 20 seconds is the industry standard not 15 seconds. Others say it will be difficult to achieve in abnormal conditions and it would provide a perverse incentive to use messages and not agents at just the time they need to glean information from customers and the public. Some companies use a dedicated and highly disciplined damage line for this purpose, but it would need to be publicised as extensively as the normal Supply Fault Incident Centre (SFIC) number and could be abused.

5.13 Medium term network performance

Incentives for improvement of network performance in the short term may tend to lead to improvements for worst served customers and in average performance at the expense of medium term performance of the network. Short term improvements can be achieved by targeting relatively small investments into network automation and specific problem areas of the network. Operational measures also have an immediate impact, for example, tree cutting programmes, improved response to supply interruptions, use of live working and mobile generators. These capital investment and operational initiatives have had a significant impact on network performance and represent most of the steady improvement in performance since privatisation. In practice any neglect of the long-term condition of the network will have an impact on short term performance measures and there is no current evidence that companies have achieved these improvements at the expense of network performance.

However companies do have differing views on the levels of investment required to underpin performance. This may be expected to some extent as network assets begin to come close to the end of their technical lives and companies have different approaches to risk and asset life extension.

5.13.1 Investment and Asset Management Techniques

Companies generally have a systematic approach to this non load related investment and take account of the following:

a. Obligations to ensure the safety of the public and employees, which is closely related to condition but can also be linked to obsolescence.

b. Environmental obligations e.g. visual amenity and anti-pollution measures linked to oil insulation and noise.

c. Obligations to maintain the condition and performance of the network which are generally expressed in the Electricity Supply Regulations and which is the basis for the capital investment assumptions in the distribution price control review.

d. Improvements in average performance of the network, linked to the price control review and in accordance with company targets published in the quality of supply reports, and in future related to incentives.

e. Improvements in the performance experienced by worst served customers linked to the price control review and in accordance with company targets published in the quality of supply reports, and in future related to incentives.

f. Co-ordination of non-load related investment with increase and decrease of demand (and capacity of embedded generation) and new connections.

g. Financial and performance risks in the short, medium and long term. All companies model asset replacement programmes against theoretical asset retirement profiles to avoid future cliff faces in the investment programme.

Companies are also developing asset management practices to ensure optimum design, and whole life performance and cost, including modern maintenance practices and life extension where cost effective.

In developing investment programmes companies are using more sophisticated techniques to assess the condition of assets and model the effect of various investment strategies, including the use of IT for data capture, performance modelling, prioritisation and decision making. There is a delicate balance of investment against these drivers, which are interdependent. Over time priorities will change as many of the drivers are subject to the laws of diminishing returns. The drivers will also vary between companies as they respond to the particular needs of their network and customers. Companies also have different starting points.

This process of asset management is reasonably well documented in company responses to the price control review business plan questionnaire. It has been suggested by some companies that the process should be subject to accreditation as a means of underpinning medium term performance of the network. However one company has attempted this and accreditation does not appear to be appropriate for what is a relatively immature non-routine activity. Accreditation may stifle innovation. Best practice would need to be established as a benchmark and this is not clearly definable at present.

5.13.2 Investment Inputs

One difficulty in assessing asset management practices is that there is currently little information available from companies on inputs. Inputs are currently divulged in monetary terms and there is now a divergence in the information provided by companies. Before privatisation companies reported non load related investment on the basis of investment in asset types. Companies now report expenditure against a mix of assets and drivers so that inter-company comparisons are not easily made on an asset by asset basis. In addition where companies do report investment by asset class they do not systematically provide information on the quantity of assets installed or replaced. Best practice unit costs are assumed in developing investment models for the price control review. In practice assets are not necessarily replaced like for like and much of the capital investment is associated with improvements or life extension.

5.13.3 Design Standards

Information on input costs or asset quantities does not provide a comparison of the quality of investment, which is also dependent on design standards. Network security is underpinned by the licence condition requirement to comply with the P2/5 security standard which covers network redundancy and interconnection. Companies are beginning to question whether this standard is compatible with the levels of performance required by customers and Ofgem and some are designing and improving networks to a higher standard. There is also some inconsistency in the design of overhead lines. Design standards have changed over the past 40 years, with wartime standards based on minimum sized conductors and safety factors being superseded by probabilistic design criteria and insulated components. Companies have

different strategies on overhead line investments. Some have replaced overhead lines with higher strength insulated designs, whilst others have adopted a strategy based mainly on replacement and refurbishment of components.

Different design standards of overhead lines has an effect on the storm performance of the network and some companies argue that they may not see the full benefits of their investment if performance in storm conditions is discounted. It may be argued that good performance in storm conditions, which effectively proof stresses the network, is a good indicator of medium term performance. It may be the only occasion that the network is subject to conditions close to (and sometimes exceeding) design limits. If storm conditions are discounted there would be no incentive to reappraise the design standards and maintain tree clearances for example.

5.13.4 Network Reliability

Normal customer related output measures of performance are not good indicators of medium term performance as they are capable of influence by network automation and operational measures. Several companies have suggested that reliability in terms of faults per 100 km or faults per 1000 units of equipment could be a reasonable indicator of medium term performance. Trends in reliability provide an early warning of deterioration of the network and reasonable inter-company comparisons. However the current reliability index is probably a better indicator of future performance for overhead lines than for underground cables.

Reliability of the network as a whole is currently reported under Ofgem Condition 9 reporting. This overall figure is dominated by the large number of low voltage incidents which are also subject to some variation in reporting. NaFIRS however includes information which would allow disaggregation of reliability information by voltage and by equipment classes. National fault rates per 100 km for 1997/98 were LV 19.3, HV 10.3 and EHV 4.9 and disaggregation by voltage appears to be essential. It may also be possible to derive a figure for urban and rural system reliability by aggregating equipment classes, since NaFIRS also distinguishes between ground mounted and pole mounted equipment. These reliability figures provide a better intercompany comparison and can be used to explain to some extent the different levels of performance for companies with long overhead line networks.

5.13.5 Fault Causes

One problem with adopting reliability measures as a surrogate for condition is that the figure includes all faults including those with unknown cause and also third party damage faults that are not related to condition. Unknown faults include faults where the cause cannot be determined, including situations where the circuit is restored without the need for locating and repairing damage (non damage faults). It may be necessary therefore to monitor fault causes in conjunction with fault rates for monitoring medium term performance. It should also be possible to allocate such faults to urban or rural networks from the nature of the circuit. Third party damage represents about one third of underground cable faults which can potentially distort inter-company comparisons. Companies have also different levels of weather related faults from year to year and inconsistencies in reporting weather faults. For example some companies report all faults during abnormal weather as weather related faults e.g. snow, wind etc, whereas others may report faults as due to trees or age and wear. These significant differences between company practices in reporting fault causes are unlikely to be resolved and it is recommended that reliability indices are not adjusted for fault cause classifications.

5.14 Audit

Audit practices vary between companies with most carrying out audits for GS and OS standards in line with the Ofgem Best Practice guidance. However, the current audits on GS and OS standards do not look at

NaFIRS data which is the source of 3 hour and 18 hour interruption data. Some companies also audit in whole or part the Condition 9/ NaFIRS reporting. Some companies carry out audits as part of a more general systems audit and some incorporate the audit as part of financial auditing. Some companies have reporting procedures accredited and audited to ISO 9002. External audits are either annual or six monthly and non compliance is generally minor. Companies carry out internal audits at various frequencies but few can demonstrate a continuous audit process that ensures that all incidents are being captured which is the main and essential requirement.

5.15 Accuracy and Consistency of Data

It is important that accuracy and consistency is assessed using standard grades, thereby maximising the comparability of the results reported to Ofgem. The grades used to assess regulatory information focus on the reliability of the procedures for generating the information and the accuracy of the data itself. Data accuracy is determined by:

a. the measurement systems used to generate the data;

b. the methods used, if any, to extrapolate or estimate data;

c. compliance with procedures and human and system errors; and

d. consistency over time and between companies.

A two part grade (e.g. B2 - DX) is assigned to each performance indicator, as defined in Table 5.1 and Table 5.2 below.

Table 5.1 - Reliability Assessment

Grade	Conditions
A	All data is based on sound information systems and records, and on documented policies, practices and procedures, including NaFIRS which are: • consistent with best practice to meet company, industry and Ofgem information specifications; and • fully understood and followed by staff. Examples of Grade A data include the following: - Circuit length is based on a recent summation from accurate GIS records and robust distinction between mains and services. In the case of HV circuits, data may be from records of measured lengths. - Incidents automatically captured within NMS/FMS and/or fully audited against NaFIRS data. - Customer to network connectivity at the HV/LV transformer level or better for HV reporting and at the LV circuit level for LV reporting. Customer numbers take account of dynamic changes on the HV network. Part restorations at LV based on site assessment with reference to accurate site plans or by LV connectivity to individual LV sections. Full reconciliation with total customer numbers and regular updating. Single and two phase faults based on pro rata estimates. - Consistently defined and applied criteria for incident time and restoration stages with appropriate granularity.
B	Most data conforms with Grade A. Data which does not has a minor impact on overall data integrity. For example, a minority of data may be based on: • information specifications which are substantially different to those required; or • procedures which are not fully understood by staff; or • minor variations from documented procedures; or • estimation or extrapolation of data which conforms with Grade A; or • reliance on unconfirmed reports.
C	In many cases, but not all, data is based on: • information specifications which are substantially different to those required; or • procedures which are not fully understood by staff; or • estimation or extrapolation of data which conforms with grade A or B; or • reliance on unconfirmed reports Examples of Grade C data include the following: - Circuit length based on historic data updated from project records or cable purchases. Data not recently updated from prime records. - HV system control procedures generally capture HV incidents to level A or B. Grade C LV incident capture not from FMS and without routine checks and audits. Poor distinction between LV mains and services incidents. - Use of average numbers of customer per transformer. This reduces accuracy for average performance and individual circuit monitoring and does not provide accurate information for identifying individual worst served customers or for response to no supply calls. - Poor definitions and policy guidance and control of incident and restoration times. - Fault causes based on pro-formas which are not consistent with NaFIRS. No company guidance on fault cause or consistency of reporting, e.g. third party damage, weather, age and wear and unknown.
D	Other data

Table 5.2 - Accuracy Assessment

Grade	Conditions
1	± 2%
2	± 5%
3	± 10%
4	± 25%
5	± 50%

Table 5.3 summarises the reliability and accuracy of companies data. The first figure indicates the current situation and the second figure indicates where companies might expect to be by April 2002 on current plans. It is also noted that the perceived accuracy of reporting does not necessarily reflect network performance levels or management focus on network performance.

Accuracy has been assessed against the key determinants of accuracy within the NaFIRS reporting system i.e. incident capture, numbers of customers affected, incident time and restoration times. The reporting rules and systems are different for LV and HV incidents and HV and LV accuracy is assessed separately. The table also includes accuracy of fixed data of total customer numbers and unit quantities of lines cables and plant as these are used to derive standardised indices on a per customer or per km basis. In general accuracy is better at HV than LV.

There are three main determinants of accuracy:

a. Information systems and processes and the linkages between systems and how well the systems are documented, audited, understood and applied. In most cases systems are not fully documented or audited but reasonable levels of accuracy are attained, especially for HV incidents where fault reporting is in a highly disciplined network control environment. In general there is less confidence in reporting at low voltage where in some cases individual incidents may be missed altogether and customer numbers and restoration stages depend on site reports and estimates.

b. The accuracy of source data such as customer records and the linkages between customers and the physical network to determine the number of customers affected by incidents. In some cases averages are used and although this gives a consistent level of accuracy on average, it does not provide accurate information for individual circuit monitoring required by the current NaFIRS scheme and will not support monitoring of worst served customers.

c. Inconsistencies in definitions, interpretation and selection of alternatives within NaFIRS, which is currently the dominant factor in overall accuracy of reporting and is to some extent currently outside the control of individual companies. For example companies report differences of 15% in customer interruptions associated with different methods of reporting restoration stages.

Current overall grades of accuracy are based on the cumulative effect of the accuracy of individual elements. However this does not take account of the different interpretations of the reporting requirements of NaFIRS. The last line of the table indicates the effect of these inconsistencies and how they might be reduced in future. In general companies are currently not able to obtain better than 90% overall accuracy for HV reporting and 75% for LV performance reporting taking into account inconsistencies in definitions and

interpretations of NaFIRS reporting requirements. The grading of future accuracy takes into account future Ofgem requirements for identifying individual worst served customers, which requires customer to network connectivity down to outgoing low voltage circuits or better. It will also be necessary to record the phase(s) affected by interruptions to refine the verification of customers affected by such incidents.

Table 5.3 is useful in providing a broad assessment of company positions but the situation is subject to change as companies continue to develop their information systems and internal organisation as restructuring of the sector continues. Company plans will also be influenced by the outcome of the IIP project.

The assessment of future accuracy is based on the assumption that all companies will have put in place documented procedures and more robust scrutiny and audit arrangements as recommended in this report and that definitions and reporting rules within NaFIRS are clarified. Future capability is therefore more dependent on systems characteristics as far as they have been determined.

Some companies have indicated that they are yet to be persuaded about the merits and cost effectiveness of some of the system requirements necessary to meet the future Ofgem requirements and this is reflected in Table 5.3.

Table 5.3 reflects the difficulties of reporting a large number of LV incidents and identifying number of customers affected. It is considered that future accuracy of LV reporting is unlikely to be better than 95% overall. Similarly consistency of fault cause is not likely to be better than 90% for HV and LV faults.

Table 5.3 - Summary and Comparison of Data Accuracy

Scoring e.g. B2 - A1 First column present, second column expected on firm plans

NaFIRS Fixed Data Accuracy

	Eastern	E Mids	London	Manweb	Midlands	Northern	Norweb	Seeboard	Southern	Swalec	Western	Yorkshire	S Power	S Hydro
Total Customer Numbers	B2 - B2	A1 - A1	A1 - A1	A1 - A1	A1 - A1	A1 - A1	A1 - A1	A1 - A1	A1 - A1	A1 - A1	A1 - A1	B2 - A1	A1 - A1	A1 - A1
Circuit length	B2 - B2	B2 - A1	A1 – A1	B2 - A1	A1 - A1	B3 - A1	B2 - B2	B3 - B2	A1 - A1	B2 - B2	A1 - A1	B2 - A1	B2 - A1	B2 - A1
Plant data	A1 - A1	A1 - A1	A1 - A1	A1 - A1	A1 - A1	A1 - A1	A1 - A1	A1 - A1	A1 - A1	A1 - A1	A1 - A1	A1 - A1	A1 - A1	A1 - A1

EHV and HV Reporting Accuracy

	Eastern	E Mids	London	Manweb	Midlands	Northern	Norweb	Seeboard	Southern	Swalec	Western	Yorkshire	S Power	S Hydro
Capture of incidents	A1 - A1	A1 - A1	A1 - A1	A1 - A1	A1 - A1	A1 - A1	A1 - A1	A1 - A1	A1 - A1	B1 - A1	A1 - A1	A1 - A1	A1 - A1	A1 - A1
Customer numbers	C3 - C3	B2 - A1	C3 - C3	B2 - A1	A1 - A1	B2 - A1	C3 - C3	A1 - A1	C2 – C2	A1 - A1	A1 - A1	B2 - A1	B2 - A1	A1 - A1
Incident time and restoration stages	A1 - A1	A1 - A1	A1 - A1	A1 - A1	A1 - A1	A1 - A1	A1 - A1	A1 - A1	A1 - A1	A1 - A1	A1 - A1	A1 - A1	A1 - A1	A1 - A1
Fault Cause	B3 - B3	B3 - B3	B3 - B3	B3 - B3	B3 - B3	B3 - B3	B3 - B3	B3 - B3	B3 - B3	B3 - B3	B3 - B3	B3 - B3	B3 - B3	B3 - B3
Overall company accuracy	B2 – B2	B2 – A1	B2 – B2	B2 – A1	A1 – A1	B2 – A1	B2 – B2	A1 – A1	B2 – B2	B2 – B2	A1 – A1	B2 – A1	B2 – A1	A1 – A1
Overall accuracy including consistency between companies	B3 - B2	B3 – A2	B3 - B2	B3 – A2	B3 – A2	B3 - A1	B3 - B2	B3 – A2	B3 - B2	B3 - B2	B3 - A1	B3 – A2	B3 – A2	B3 – A2

LV Reporting Accuracy

	Eastern	E Mids	London	Manweb	Midlands	Northern	Norweb	Seeboard	Southern	Swalec	Western	Yorkshire	S Power	S Hydro
Capture of incidents	A1 - A1	A1 - A1	B2 - A1	B2 - A1	B2 - A1	A1 - A1	B2 - B2	B2 - A1	B2 - A1	C3 - A1	A1 - A1	A1 - A1	B2 - A1	A1 - A1
Customer numbers	C3 - C3	B2 - B2	C3 - C3	B2 - B2	B2 - B2	B3 – A2	C3 - C3	B2 - B2	C2 – C2	C3 - B2	B2 - B2	B2 - B2	B2 - B2	B2 - B2
Incident time and restoration stages	B2 - A1	B2 - A1	B2 - A1	B2 - B2	A1 - A1	A1 - A1	B2 - B2	B2 - A1	B2 - A1	C3 - A1	A1 - A1	B2 - B2	B2 - B2	B2 - B2
Fault Cause	B3 - B3	B3 - B3	B3 - B3	B3 - B3	B3 - B3	B3 – B3	B3 - B3	B3 - B3	B3 - B3	C3 - B3	B2 – B2	B3 - B3	B3 - B3	B3 - B3
Overall company accuracy	B3 – B3	B2 – B2	B3 – B3	B2 – B2	B2 – B2	B3 – B2	B3 – B3	B2 – B2	B2 – B2	C3 – C3	B2 – B2	B2 – B2	B2 – B2	B2 – B2
Overall accuracy including consistency between companies	B4 - B3	B4 – B3	B4 - B3	B4 - B3	B4 – B3	B4 – B3	B4 - B3	B4 - B3	B4 - B3	C4 - B3	B4 - B3	B4 - B3	B4 - B3	B4 – B3

5.16 Information systems to meet proposed Ofgem requirements

Consideration has been given to company capability to meet the proposed Ofgem reporting and performance standards, including worst served customers, transient short term interruptions, telephone response and medium term network resilience. These requirements cannot be met by the systems that have historically been used for NaFIRS reporting. However there is already a requirement to report transients and worst served customers in Quality of Supply Reports and some companies have already implemented appropriate systems

Table 5.4 below summarises information systems and process characteristics, the first figure reflects the current position and the second figure reflects current plans although in some cases future plans are uncertain as indicated above.

The main issue concerns the requirement for a customer to network connectivity model in order to identify groups and individual worst served customers. The connectivity model improves the overall accuracy of reporting customer numbers affected by incidents at HV and LV. The connectivity model also makes it possible to associate customer calls to a greater level of granularity in order to identify network affected by an incident and to better target automatic messages to customers. This report recommends that in the medium term, customer to network connectivity is required down to at least the outgoing low voltage circuit from HV/LV transformers, with a long term goal of full connectivity including phase connections.

The second issue concerns telephone response and companies operate a wide range of systems which generally have overflow facilities and messaging to meet the unpredictable and peaky distribution of no supply call patterns. Telephone response has consistently been an area of under-performance, especially during severe weather emergencies. Distribution companies also face the challenge of separation from the supply business which has traditionally provided large numbers of call takers to meet the fluctuating call pattern. Technology is now available to significantly increase the capability to provide a substantive response and this report recommends that telephone response should be provided at the telecom service provider level which does not restrict response to the number of incoming lines to a company exchange. Modern Telecom systems will also allow flexible over-spill facilities to be set up between companies and other agencies.

Transients (short term interruptions) are currently measured by the number of incidents measured at various points on the network. It should be possible in future to measure the customer affects of transients within NaFIRS.

Companies have a variety of methods of prioritising investment across the main drivers of: network resilience based on condition, safety and environmental obligations, worst served customers and average performance. The balance between these drivers is critical to companies and varies over time to meet local needs. Care will need to be exercised in setting incentives on two of these measures to ensure that this does not reduce the incentive to invest against other drivers.

Further work is required to model the effect of various potential incentives and to refine output measures, for example the merits of particular types of disaggregation and averaging performance over more than one year.

Table 5.4 - Summary and comparison of systems to meet Proposed Ofgem Standards

	Eastern	E Mids	London	Manweb	Midlands	Northern	Norweb	Seeboard	Southern	Swalec	Western	Yorkshire	S Power	S Hydro
Worst served customers	w2a - w3a	w4b - w4b	w2b - w2b (LV only)	w3b -w3b (HV only)	w5a - w5a	w4a - w4b	w3a -w3b	w3b -w3b (HV only)	w2a - w2a	w3a - w3?	w3a - w3a	w3a - w3a	w3b -w3b (HV only)	w4a - w4a
Transients	s1 - s3	s1 - s1	s3 - s3	No	s1 - s2	s3 - s3	s2 - s3	s1 - s3	s1 - s1	s1 - s2	s1 - s3	s1 – s1	No	s2 - s2
Telephone response	t35 -t35	t16 - t26	t15 - t3?	t16 - t26	t25 - t26/7	t27 - t27	t37 - t37	t27 - t27	t26 - t26	t16 - ?	t15 - t35	t27 - t27	t16 - t26	t27 - t27

WORST SERVED CUSTOMERS

Connectivity

w1 No customer connectivity
w2 Connectivity by post code or geography
w3 Connectivity by HV/LV transformer
w4 Connectivity by LV circuit
w5 Connectivity by LV node
w6 Full connectivity to LV node and phase

Measure

wa Monitors worst performing circuit
wb Monitors worst served customer

TRANSIENTS

s1 Monitors number of transients at source
s2 Monitors number of transients at source, downstream and PODs
s3 Counts overall customer transients

TELEPHONE RESPONSE

t1 Supply call centre
t2 Distribution call centre
t3 Significant outsourcing of call handling including over-spill

Messaging

t4 Non CLI messaging
t5 CLI messaging on company network coarse granularity of less than 25 area messages
t6 CLI messaging on company network with fine granularity 25 or more area messages
t7 Computer assisted flexible CLI messaging on service provider network with option to contact company agent

? No firm plans / Yet to be decided

6. RECOMMENDATIONS

6.1 Short Term by April 2001

6.1.1 Incidents

NaFIRS specifies what are reportable incidents but there are different interpretations between companies. This may be partly due to past changes in reporting service faults and some discretion, especially for low voltage reporting. Where there are options for reporting unmetered and metered service incidents these should be separately identified and all service incidents should be separately reported within FMS and NaFIRS. Condition 9 reports require services and mains figures to be disaggregated and service faults excluded from reliability figures, but these are not consistently identified and reported. By April 2000 the definition of "incident" should be reviewed, preferably under the auspices of NaFIRS. There is also an anomaly that transient interruptions of less than one minute at 132 kV are included in NaFIRS when they are not included at other voltages.

6.1.2 Transients (Short Term Interruptions)

Some companies have suggested that transient interruptions of less than one minute should be redefined in line with EN50160 to interruptions less than three minutes. This will incentivise the use of automatic control systems for restoration of supplies at HV, which may not be possible within the existing one minute period due to the time taken for actuators to operate on switches and time delays in communications and logic systems. There also appears to be an anomaly that transient interruptions include both interruptions associated with automatic switching schemes, which are design features, and other short term interruptions e.g. associated with embargoed switchgear. There should be some incentive to limit deliberate short term interruptions, especially if a three minute rule is adopted, and these transients should only be excluded if associated with automatic design features within a three minute period. This could apply from April 2001 and is not expected to introduce a step change in the incident count for companies who have been reporting correctly.

It is recommended that transients are defined as three minute interruptions but restricted to automatic switching operations only, i.e. all operational switching would be reported under NaFIRS as sustained interruptions. It is also recommended that by April 2001 all companies should have developed the capability to record the redefined transient interruptions and by April 2002 to be able to measure and record in NaFIRS the number of short term interruptions per customer taking into account operations of downstream reclosers.

6.1.3 Incident time, restorations and re-interruptions

There are various arrangements for reporting "time of incident" and restoration stages in NaFIRS sometimes linked to the provision of limited numbers of stages in computer systems and on pro-formas. Many companies discount re-interruptions during a single incident and some companies discount restorations and re-interruptions occurring within a five minute time period. It is recommended that, by April 2001, the instructions for reporting incident time and restorations stages are standardised, preferably incorporating clearer rules within NaFIRS. It would appear to be reasonable not to recount re-interruptions during fault sectionalising within certain time limits.

6.1.4 Worst served Customers

In defining incidents, transients and restoration stages above it will need to be recognised that these definitions may impact on the definition of interruption for worst served customer performance measures and the above suggestion on treatment of re-interruptions appears to give a reasonable balance, although this may not be fully understood by customers and may lead to contention in GS payments.

Companies will be required to report fully to Ofgem on worst served customers from April 2002. In the meantime companies should use the best information available to report on worst served customers in terms of number and proportion of customers experiencing more than a certain number of interruptions, preferably aggregated across voltage levels.

Consideration also needs to be given as to whether future GS payments should be based on the number of interruptions in a fixed reporting year or over any rolling 12 month period. Measurement systems should be capable of identifying either.

6.1.5 Customer numbers

Distribution businesses will in future no longer be able to use supply business customer information systems and definitions of customer will need to be based on information available to Distribution businesses via the Metering Point Administration System MPAS, Data Transfer Network (DTN) and new connections. Definitions of customer in the context of network performance reporting needs to be standardised, preferably jointly by companies and incorporated in NaFIRS instructions by April 2001.

Companies adopt a variety of methods of counting customer numbers, both overall for fixed NaFIRS data and in relation to reporting individual incidents. Many companies are implementing new customer information systems in the medium term. In the meantime all companies should ensure that the method currently being used for counting customer numbers reconciles with a verifiable total number of customers. This will improve accuracy of reporting of average network performance indicators. However where companies are using average data for customers on transformers the accuracy of reporting for individual incidents will not be improved until new systems with customer connectivity are implemented.

6.1.6 Fixed NaFIRS network data

Fixed data used to provide standardised reports in NaFIRS and for Condition 9 reporting consists of customers and total circuit length and equipment numbers. The data is taken from a variety of sources and by April 2001 and the data should be taken from the most accurate source and audited. It is understood that September figures are used to give a midpoint figure for the year for maximum accuracy.

6.1.7 Documented Procedures

All companies report network performance in line with NaFIRS and Engineering Recommendation G42/3. The PC version of NaFIRS (Access) also has useful guides for system administrators and user. Only one company mentioned the additional guidance provided in EA document TR17 and not all companies have detailed instructions and data flow diagrams which explain the overall process of fault reporting including responsibilities checks and audit arrangements. Companies should be required, by April 2001 to produce such documentation as the basis for routine checks and audits on process and accuracy. It is noted that companies do have such documentation for GS and OS standards although the level of detail varies and few include a detailed account and audit of the flows associated with the base network performance data used for network related GS and OS standards.

6.1.8 Medium Term Network Performance

Medium term performance is underpinned by asset management and investment processes. On balance accreditation of these systems would appear to be too intrusive. The price control review should continue to be the appropriate mechanism to review asset management and investment techniques. However companies should be required to provide consistent information in quality of supply reports at a level of detail which will promote transparency and best practice.

Review of asset management processes as part of the price control review is limited by not having consistent reporting and classification of investment and by having too little information on assets installed and replaced. The template for the reporting capital investment should be standardised for use at the price control review and for annual reporting of investment in the quality of supply reports, or a special annual investment report.

Companies should be required to report network reliability (faults per 100 km) as part of Condition 9 reporting, disaggregated by voltage (and urban/rural network at HV and LV). Trends in these reliability figures will provide a useful indicator of medium term performance. They will also provide a good indicator to Ofgem about the long term condition of the network and global investment needs at the price control reviews.

6.1.9 Routine Checks

Companies are implementing improvements to information systems associated with network control and network management which in the medium term may set up fault reports automatically. In the meantime, by April 2001, companies should be required to introduce arrangements to fully 100% check that all relevant incidents identified from all sources result in a NaFIRS report. Sample checks should also be introduced on at least a monthly basis to check the accuracy of reporting.

More formal audit arrangements should be introduced by April 2001 to at least the same standard as the audit arrangements in place for GS and OS standards of performance. This may require the development of an Ofgem Best Practices Code for network performance reporting similar to that produced for GS and OS standards.

6.2 Medium Term by April 2002

6.2.1 NMS and FMS Customer connectivity

By April 2002 NMS and FMS systems should have minimum capability to utilise the connectivity features identified above for associating customer calls to network incidents and for providing measures of worst served customers. The systems should have the capability to dynamically model the customer connectivity as the HV system configuration changes in real time.

Companies are currently developing customer information systems in line with the requirement for business separation and taking into account the distribution definition to be agreed. It is recommended that these be fully in place by April 2002.

Customers should be individually identified and associated with an outgoing low voltage circuit from an HV/LV transformer, (this does not mean associating customers to the network using algorithms or other estimation methods). This will bring all companies up to best practice and will:

a. improve the level of accuracy of reporting of individual incidents;

b. provide a basis for performance measures for worst served customers;

c. give better resolution for identifying incident by association of customer calls within FMS systems; and

d. provide better information for customers enquiring about no supply incidents.

6.2.2 Worst served customers

By April 2002 measures of worst served customers should be defined in terms of both number and proportion of customer experiencing "n" interruptions where "n" is a variable number, again considering the merits of averaging over a period of two to five years for the overall standard. This will require companies to record the phase affected by HV and LV incidents. These measures should be aggregated across voltages. It is recognised that in the case of LV interruptions there may be some uncertainty about interruptions to individual customers. The introduction of a guaranteed standard with automatic payments may incentivise the companies to introduce systems to improve the accuracy of recording for individual customer interruptions. This may be made easier by the capture of phase information for HV and LV faults and retrospective analysis as part of a long term data capture of phase connections.

6.2.3 Procedures and Audit

It is recommended that there should be a requirement for companies to have procedures in place that ensure that all incident data is captured and recorded accurately. Arrangements should include facilities to automatically raise and classify incidents within NaFIRS. Regular audits should be carried out to ensure that the procedures in place are resulting in accurate recording of incident data.

6.2.4 Transients (Short Term Interruptions)

From April 2002 companies should report transients, preferably within NaFIRS, recording the number of incidents and the customer affects, “Customer Transient Interruptions”.

6.2.5 Disaggregation

Studies are required to understand the benefits of disaggregation on network type to facilitate inter-company comparisons. It is recommended that a project is defined to carry out this research and that companies be required to co-operate with the project by providing NaFIRS and other historic data. A suggested method of disaggregation is to classify circuits according to network type, e.g.

Urban

- Overhead/Underground Primary Network
- Underground 11kV Network
- Underground LV Network

Semi-rural

- Overhead Primary Network
- Overhead/Underground 11kV Network
- Overhead/Underground LV Network

Rural

- Overhead Primary Network
- Overhead 11kV Network

- Overhead LV Network

Circuits could also be classified on more than one factor, e.g. Number of customers connected. Circuit classification could include definitions based on the percentage of the circuit overhead/underground.

6.2.6 Telephone Response

Best practice telephone call handling and messaging systems should typically include the following main features:

a. Message break out at telecom service provider level with messaging based on local telephone exchange i.e. several hundred messages areas;

b. Computer based pre-recorded messaging and automatic message set up from NMS/FMS systems;

c. Facilities for updating messages from different locations, including by field operatives;

d. Telephone response to meet Ofgem standards defined at the point of interface with a human operator;

e. Messages to be tested as providing a substantive response by routine analysis of customer habits relating to messages, e.g. listen through the complete message, hang up, redial, transfer to operator; and

f. Facilities for obtaining information from customers about new supply interruptions and reports of damage and danger.

It is noted that customers consistently report poor telephone response as being the worst feature of severe weather emergencies and this area appears to be in need of improvement.

6.3 Long Term

6.3.1 Worst Served Customer

It is anticipated that in the long term there should be a move towards capturing customer to network connectivity down to individual phase connections on three phase and two phase systems so that automatic payments may be made to worst served customers experiencing more than a certain number of interruptions per year, again considering the need for averaging over a two to five year period.

7. COSTS

Many of the recommendations relating to quality procedures and new measurements are likely to be achievable at minimal additional cost and may reduce costs due to improved organisation and quality processes.

The recommendations embrace best practice but do not go beyond what some companies are already doing or intend to do, often associated with business separation, which by using new technology and outsourcing can reduce overall costs including labour. The most significant costs relate to complete new systems which are identified in round figures below. The costs detailed below are indicative only and represent the maximum costs for such systems.

a. NMS system £4m

b. FMS system £1.5m

c. Telephony and messaging £400k and £60k per year

d. Customer information systems, mainly a business separation cost.

e. Customer connectivity to LV outgoing circuits £300k

f. Customer connectivity to LV phase (Various estimates have been made by distribution businesses of up to £10 per customer but this depends on the level of existing information and technology available for data capture e.g. radio phase comparison methods and GPS. Most companies already appear to have reasonable records of phase connections, although the accuracy may be suspect and this information has not always been transferred from paper to computer based maps.

Most companies are implementing systems and the costs of the additional features (for some) are generally marginal. Most companies will face the cost of creating a customer to network link on the low voltage network and re-arrange telephone and messaging systems. However this addresses an area which has been identified as one of poor performance especially in severe weather.

Further work would be necessary to clarify the costs of these systems for individual companies as these costs will vary between companies depending upon the company's present systems.

APPENDIX A

DISTRIBUTION COMPANY REPORTS

SUMMARY OF CAPABILITY

Table A.1 below shows a summary of the companies' current and planned capabilities for incident reporting and telephone response as identified in the following distribution company reports. The processes involved are described in detail in Section 4 and listed below in ascending order of accuracy or responsiveness. A detailed breakdown of accuracy and responsiveness is set out in Section 5.

Table A.1 - Summary of Companies' current and planned capabilities

	PESs - Current Systems	PESs - Planned Systems
HV Incident Report Capture		
– Manual Capture	EM, LE, ME, NW, SE, SO, SW, WP	EM, LE, ME, NW, SO, SW, WP
– Automatic Capture	EE, MW, NE, YE, SH, SP	EE, MW, NE, SE, YE, SH, SP
LV Incident Report Capture		
– Manual Capture	EE, LE, MW, ME, NW, SE, SO, SW, WP	EE, LE, MW, ME, NW, SO, SW, WP
– Automatic Capture	EM, NE, YE	EM, NE, SE, YE
Customer Connectivity		
– No customer connectivity		
– Connectivity by post code or geography	EE, LE, SO	EE, SO, LE
– Connectivity by HV/LV Transformer	MW, NW, SE, SW, WP, YE, SP	MW, NW, SE, SW, WP, YE, SP
– Connectivity by LV Circuit	EM, NE, SH	EM, NE, SH
– Connectivity by LV node	ME	ME
– Connectivity by LV node and phase		
Transient Monitoring		
– None	MW, SP	MW, SP
– At source only	EE, EM, ME, SE, SO, SW, WP,YE	EM, SO, WP,YE
– At source, downstream & PODs	NW, SH	ME, SE, SW, SH
– Overall customer transients	LE, NE	EE, LE, NE, NW
Customer Records		
– Amended Historical Database	EE, EM, LE, MW, NW, SE, SO, WP, YE, SP	EE, EM, LE, MW, NW, SE, SO, SP
– MPAS	ME, NE, SW, SH	ME, NE, SW, WP, YE, SH
Circuit Records		
– Amended Historical Database	EE, LE, MW, NE, NW, SE, YE, SH, SP	EE, LE, NE, SE
– GIS Vectored	EM, ME, SO, SW, WP	EM, MW, ME, NW, SO, SW, WP, YE, SH, SP
Telephone Response		
– Supply call centre	EM, LE, MW, SW, WP, SP	
– Distribution Call Centre	ME, NE, SE, SO, YE, , SH	EM,MW, ME, NE, SE, SO, SW,YE, SP, SH
– Significant Outsourcing (inc. overspill)	EE, NW	EE, NW, LE, WP
Telephone Messaging Facilities		
– Non-CLI Messaging		
– CLI Messaging (coarse granularity)	EE, LE, ME, WP	EE, LE, WP
– CLI Messaging (fine granularity)	EM, MW, SO, SW, SP	EM, ME, MW, SO, SW, SP
– Computer assisted flexible CLI messaging on service provider network.	NE, NW, SE, YE, SH	NE, NW, SE, YE, SH

KEY

EE	Eastern Electricity	NE	Northern Electric	WP	Western Power Distribution
EM	East Midlands Electricity	NW	NORWEB	YE	Yorkshire Electricity
LE	London Electricity	SE	SEEBOARD	SP	Scottish Power
MW	MANWEB	SO	Southern Electricity	SH	Scottish Hydro
ME	Midlands Electricity	SW	SWALEC		

APPENDIX A1

REVIEW OF MEASUREMENT SYSTEMS

EASTERN ELECTRICITY (Eastern)

Eastern is currently changing its organisation and systems as part of the joint venture with London. Services to manage and operate both companies' networks will be provided by 24 Seven Utility Services which incorporates most of the staff previously under the employ of the two distributors. Eastern will maintain its own strategy through contracts with the service provider but it is likely that common information systems and facilities will be developed to serve both companies. In particular incident management and network control will be centralised at Ipswich. The following commentary relates mainly to the existing situation.

A1.1 Information Systems and Data

Eastern operates a distribution Operations Centre at Ipswich, which includes a distribution only call centre, HV and LV Control Centre and incident despatch and associated information systems.

A1.1.1 Fault Management System (FMS)

Eastern uses a server based computer system Respond 2 as its fault management system (FMS), which includes associated fault reporting and work control facilities. Eastern does not therefore require a separate NaFIRS reporting IS system and does not contribute figures to the NaFIRS annual report for Great Britain published by the Electricity Association. Respond 2 forms the basis for all internal and external network performance reporting. Fault reports are automatically raised in Respond 2 for all LV and HV jobs classified as faults. The initial fault reporting data is input into the fault reporting system automatically which improves the accuracy and consistency of incident capture.

Customers are not directly linked with the network in Respond 2 but are linked to distribution transformers by parish or post code for the purpose of associating customer no supply calls to incidents and for providing information to call takers and telephone interactive voice messaging. This system provides a reasonable means of association of calls to incidents, particularly as most HV incidents are identified from SCADA or Power Outage Devices (PODs). 1900 PODS are installed at customers premises. Most HV incidents are immediately alarmed in the control centre and automatically generate an interactive voice message to incoming telephone calls from the appropriate parish/post code areas.

A1.1.2 Network Management System (NMS)

The Network Management System, known as CROS, is a computer based system for HV network control including network diagrams and switching logs. CROS also incorporates most SCADA facilities, although a stand-alone secondary system is used for monitoring and controlling HV recloser and circuit-breaker operations out on the HV network. CROS incorporates network connectivity and maintains a count of customer numbers on each HV circuit and distribution transformer, based on an average number of customers per kVA of transformer capacity for different types of circuit e.g. rural and urban. The system does not therefore accurately identify the number of customers affected by an individual HV incident. However the algorithm for calculating customer numbers per kVA is recalculated annually and is fully reconciled with total numbers of customers. The overall accuracy of average customer is considered by PB Power to be reasonably accurate to within $\pm$ 5%.

A more modern NMS system is currently being implemented (132 kV and 33 kV systems are complete) which has the potential to interface dynamically with the FMS system.

Eastern also operates a low voltage control centre at the Ipswich Operations Centre based on real time annotation of computer based low voltage geo-schematic LV control diagrams.

A1.1.3 Plant and Circuit Records

Plant data is taken from an Asset Management System plant file, which was demonstrated and incorporates good control of plant details is fully reconciled with the NMS diagram and numbering.

Eastern has a raster based mains record system which has no functionality for measuring network length. Network length data is maintained on a spreadsheet based on historical measurements updated annually

from project records of mains laid. PB Power does not consider this updating process to have an accuracy greater than 90%.

A1.1.4 Customer Numbers

The distribution call centre has a customer database, which originated from the supply business. It is separate from the distribution customer database associated with the meterpoint registration service, which is operated by Eastern and not by 24 Seven. The database is updated for new connections but it appears that names of occupiers are not readily updated. This can potentially cause problems identifying particular customers premises from emergency calls, for example flats and premises without distinctive numbers. There is no specific customer to network link in the customer database although the 94 specialist distribution supply technicians attending faults have remote PC access to mains records and network schematic diagrams which enables them to identify customers off supply on a case by case basis.

A1.2 Documentation of Policies and Procedures

Eastern indicate that all fault reporting is in accordance with NaFIRS and Engineering Recommendation G42/3, although it has its own IS system integrated into the Respond 2 FMS system and does not contribute to the Electricity Association NaFIRS scheme. The Eastern Guidelines for Fault Reporting state that the scheme is based on NaFIRS and the Guidelines reflect most of the features of Engineering Recommendation G42/3 in a simplified format. The system includes some variations in fault cause categories which are not considered to materially affect overall comparability with other companies figures.

GS and OS Standards are in addition comprehensively documented.

All network performance reporting is carried out in a controlled environment at the Ipswich Operations Centre and the integrated FMS and performance reporting ensures the capture of incidents. Both network performance reporting and GS and OS standards are audited annually, although these processes are not accredited to ISO 9002.

No additional information or guidance is provided for Condition 9 reports or quality of supply reports, though the responsibility for producing these documents rests with a dedicated team within the Network Management organisation and so is carefully controlled.

A1.3 EHV and HV Incident Reporting

A1.3.1 Incident Capture

HV incidents are mainly identified from information from SCADA or PODs and in most cases the incident automatically sets up a message on the interactive voice processor. An incident is immediately set up in the Respond 2 system in order to despatch field staff to the fault and this automatically raises an incident report with the same job number.

HV NaFIRS PC system now allows for a flag to be set to discount repeated interruptions that arise during restoration stages of the same incident. Eastern adopts a similar system.

Eastern confirms that the count of incidents includes transient incidents less than one minute on 132 kV circuits as these are defined incidents within NaFIRS. Transient interruptions are those of less than 1 minute arising due to automatic switching and any other cause.

A1.3.2 Number of Customers Affected

As the incident report is updated during the course of the incident, the number of customers restored at each restoration stage is also updated based on the average number of customers per kVA of distribution transformer capacity as described above and calculated from the actual HV network configuration.

A1.3.3 Incident Duration and Restoration Stages

The incident report in Respond 2 is completed on screen from details on the CROS switching log and field reports by the HV control engineer as the restoration and repair is completed. The incident time is taken from

earliest customer report or SCADA alarm. A notes page in Respond 2 is updated with relevant information for customers as work progresses. The incident report can record unlimited restoration stages.

Eastern does not adopt block reporting in severe weather and has not invoked severe weather exemptions. Adjustment for severe weather could lead to inconsistencies depending on company operational performance. For example Eastern suffered 339 HV incidents during a three day period of lightning in 1999 and over 93% were restored within 3 hours and all customers were restored within 24 hours. Similar incidents in other companies may have lead to restorations over 24 hours and calls for severe weather exemptions.

A1.3.4 Fault Cause

The fault cause is added to the Incident Report by the control engineer based on reports from the field.

A1.3.5 Sample Checks

A sample of HV NaFIRS reports was examined. Fault report Job No 3453055999 had been accurately reported and data reconciled with information in NMS and Respond 2. However it was noted that the incident cause was attributed to unknown cause (Code 99) when the actual cause was third party cable damage.

A1.3.6 Evaluation of Lost Demand

Load interrupted is not recorded or reported in Respond 2 but is available within the CROS FMS system.

A1.4 LV Incident Reporting

A1.4.1 Incident Capture

Eastern operates low voltage control and incident management at Ipswich, including all input to the low voltage fault reporting within Respond 2. Customer calls are associated by Parish and Post Code and multiple interruptions are associated with reference to LV geo-schematic plans and despatched. All reportable jobs raised in within Respond 2 automatically set up a fault report in the same system.

Eastern's Guidance on LV fault reporting indicates that all LV faults are reported except consumer cut out fuse operations. However in practice Eastern appears to report only those LV faults which interrupt supplies to more than one metered customer, excluding cut out fuse operations.

A1.4.2 Number of Customers Affected

Customer numbers are based on the average numbers of customers per low voltage outgoing circuit, again based on the average number of customers per kVA of transformer capacity, unless more accurate information is available from site. Eastern is of the opinion that this method is accurate and consistent for overall and average incident reporting but is not accurate for individual incidents.

A1.4.3 Incident Duration and Restoration Stages

Restoration times are also recorded in Respond 2 and used as the basis for fault reporting.

A1.4.4 Fault Cause

Fault causes are mainly reported from site and added to the fault report in LV Control.

A1.4.5 Sample Check

A sample of LV NaFIRS reports was examined. Fault report 3534049689 was examined and restoration times were accurately recorded in line with the information in Respond 2. It was noted that Eastern classified this fault as "no fault found" as the fuse was successfully replaced. This classification is equivalent to the NaFIRS "unknown" cause and possibly encourages staff to identify a fault cause in all cases where a fault is found.

A1.5 Prearranged Interruptions

Pre-arranged interruptions are recorded in Respond 2 IS system and notices hand distributed to customers. Notices are not provided where the interruption is associated with customer initiated work on single services.

A1.6 Condition 9 Reports

Condition 9 Reports are to the standard format and separately identify low voltage service and mains incidents. 24/18 hour interruptions reported in Condition 9 do not exclude events which are discounted under GS and OS standards.

Eastern is currently implementing a new NMS system for HV and LV control and is reviewing its arrangements for fault management and telephone response in the light of the joint venture and the proposed Ofgem performance standards. These activities will continue at Ipswich with replacement FMS and telephone response facilities operated by 24 seven Utility Services.

A1.7 Future OFGEM Requirements

Quality of Supply Reports are disaggregated into three geographical areas agreed with the ECC, although in practice Eastern manages its network in four areas. The Quality of Supply Report is supplemented by a summary Progress Report and a quarterly progress report to the ECC.

A1.7.1 Worst Served Customers

Eastern does not measure repeated interruptions to individual or groups of customers and has no facility for identifying such customers. However Eastern does recognise the need for a customer to network link for its new NMS system. Eastern is not able to provide a cost benefit for identifying worst served customers at low voltage. A pilot study has indicated that customers could be associated with the LV network to an accuracy of about 85% - 90% from records. Eastern argue that a higher accuracy would require expensive on site investigations and would not address all problems of LV connectivity including phasing and uncertain connection points.

Eastern's quality of supply reports indicates that it is considering incorporating a customer to HV network link in its new NMS system but has no plans for extending this to the LV network. The present arrangements are said to provide a consistent and reasonably accurate measure of overall performance. However it is acknowledged that it is not possible to identify repeated interruptions experienced by individual and groups of customers and that Eastern may need to respond to changes in Ofgem performance standards.

A1.7.2 Transient (Short Term Interruptions)

Transient interruptions of less than one minute are monitored for source circuit breaker recloser operations directly from the SCADA system. In addition, data from the 1900 installed PODs is analysed and extrapolated to provide an estimate of overall numbers of customer transient interruptions. This information is reported quarterly to the Consumers' Committee. In future, it will be possible to monitor downstream recloser operations directly using the NMS.

A1.7.3 Telephone response

Eastern Operations Centre for distribution calls, HV and LV control and despatch is independent from supply and operates normally with up to 10 operators in working hours and has overspill arrangements under a contract which is used on a daily basis. All call takers have access to the Respond 2 system.

All distribution no supply calls are presented on 200 incoming lines to call takers. Most 11 kV faults result in the automatic set up of a standard voice message on the voice processor linked to CLI areas of BT exchanges associated with post codes and parishes supplied by affected distribution substations and 11 kV circuits. Messages are set up manually for low voltage faults. Eastern also use follow up bespoke messages and are able to identify callers who listen to the complete message as an indicator of customer satisfaction. This indicates that 90% of callers listen to the appropriate message, which represents a good level of targeting and satisfaction of customer needs for information.

Eastern has no facility to break out to provide messaging at the BT exchange level to a larger number of callers during widespread interruptions but has facilities for escalating the response under the contract that 24 Seven has with its service provider.

Eastern measures service levels on its own exchange against a target of answering 85% of calls within 10 seconds by its call takers, not taking account of the large volumes handled by the messaging system.

A1.7.4 Medium Term Performance Monitoring

Eastern supports accreditation of asset management systems to underpin medium term system performance in addition to use of reliability index or other indices, possibly using exponential averaging over five years adopted by Eastern.

A1.7.5 Other

Eastern has not systematically monitored other aspects of power quality but responds to customers needs, particularly large customers most likely to be sensitive to power quality. However it is now participating in an industry-wide project on power quality co-ordinated by the Electricity Association which involves installing quality monitoring equipment at a number of sites.

A1.8 Audits

Eastern's centralised operations at Ipswich include all aspects of incident management network control and network performance reporting and associated IT systems and data management. It operates in a quality assurance environment with controls on training and authorisation of staff for operational and administrative processes.

Quality assurance procedures are in place for both network performance reporting and GS and OS standards and external reports were provided and showed a good standard of quality management.

APPENDIX A2

REVIEW OF MEASUREMENT SYSTEMS

EAST MIDLANDS ELECTRICITY (East Midlands)

A2.1 Information Systems and Data

East Midlands has centralised HV Control and LV and HV fault management and despatch for repair and restoration. All customer calls are currently taken by the supply business which has distribution specialists and access to the Customer Logging and Sorting System (CLASS). Supply also operates the voice messaging facility to the instructions of the incident management centre.

A2.1.1 NaFIRS

East Midlands uses the PC version of NaFIRS as the basis for all internal and external network performance reporting. LV incidents are automatically initiated from within the CLASS FMS system and all other data is input manually. PC NaFIRS has more advanced facilities for reporting and audit and East Midlands produces daily, weekly and monthly reports and a monthly audit.

A2.1.2 Fault Management System (FMS)

A mainframe FMS system CLASS is used for customer call logging, incident management and information for customer no supply calls. CLASS links customers with LV circuits emanating from HV/LV transformers. The system enables customer no supply calls to be associated in order to identify LV and HV incidents not identified from SCADA and site reports. Customer numbers can be identified for most faults on low voltage and high voltage systems. For LV single phase faults the numbers of customers affected is taken as one third of the number on the whole circuit. Customer numbers are identified by site staff where a complete circuit is not affected or for partial restorations.

The system has been in operation for ten years and is not linked to the more recent GIS geographic mains records. The implementation of CLASS resulted in a 10% step change in the customer affects reported in NaFIRS. The system is considered by East Midlands to have improved in accuracy over time and currently customer data is being cleansed prior to implementation of a new automated process later in 2000.

The connectivity model of customers and network does not dynamically change with network reconfiguration. However the manual update of CLASS during supply interruptions is carried out so as to capture the real time network configuration for customer information and fault reporting purposes. This enables East Midlands to capture the number of customers off supply with reasonable accuracy in order to identify worst served customers, including aggregation across all voltages.

A2.1.3 Network Management System (NMS)

The Network Management System (NMS) is a computer based system integrated to SCADA for the 132 kV and 33 kV network. NMS is currently being replaced by a system which will include the 11kV/6.6kV network which is currently based on wall diagrams and manual control logs. The control diagrams are annotated with circuit reference numbers used in CLASS so that parts of the network off supply can be input to CLASS in real time as restoration of supplies progresses. CLASS then identifies the customers and areas affected by an HV incident.

East Midlands has contracted out updating of IS data records to a specialist contractor operating a quality process (Central Records Updating Facility CRUF), including records of new customers in CIS and CLASS and the GIS mains records and Asset Repository. In future all circuit and plant information will be input into NaFIRS from the new data cleansed records. There are currently no plans to duplicate the customer connectivity model within the GIS system of mains records.

A new NMS system is currently being implemented which will replace the existing NMS and manual 11kV control processes. The system will link to an FMS system which will replace the existing CLASS system maintaining dynamic network connectivity as system configuration changes in lieu of the present manual systems. NMS will also facilitate automatic reporting of transient interruptions of less than one minute from SCADA information.

A2.2 Documentation of Policies and Procedures

East Midlands indicate that all fault reporting is strictly in accordance with NaFIRS and Engineering Recommendation G42/3 and additional written procedures associated with NaFIRS reporting are provided for administrators and users. All network performance reporting is carried out in a controlled environment at Nottingham Control Centre / Despatch Centre and staff are trained and authorised to enter data to the various systems.

GS and OS Standards are in addition comprehensively documented.

East Midlands has an internal procedure for producing Condition 9 reports.

A2.3 EHV and HV Incident Reporting

A2.3.1 Incident Capture

HV NaFIRS reports are initiated on notification of a supply interruption from Scada, or the CLASS FMS system. The initiation and completion of HV fault reports is not automatically linked to NMS or FMS but is input by despatchers working with control engineers in real time.

HV PC NaFIRS system now allows for a flag to be set to discount repeated interruptions that arise during restoration stages of the same incident. East Midlands uses this system but indicate that their method of fault location does not generally give rise to a significant number of repeat interruptions.

The count of EHV/HV incidents appears to exclude transient incidents less than one minute on 132 kV circuits. Transient interruptions are those of less than 1 minute arising from due to automatic switching and any other cause.

A monthly audit is carried out on HV NaFIRS and there is a reasonable expectation that HV incidents are correctly identified and reported in the control environment and is considered to be accurate to within ±1% overall.

A2.3.2 Number of Customers Affected

Associated customer groups are identified at the time of the fault and entered into the manual HV switching log and CLASS FMS system in real time taking into account abnormal feeding arrangements. The number of customers affected by the incident for NaFIRS purposes are then taken from the switching log information.

A2.3.3 Incident Duration and Restoration Stages

Restoration stages and times are recorded in real time during the course of the incident in the manual switching log and CLASS FMS system. The HV NaFIRS report for the incident is then completed from the information on the switching logs.

A2.3.4 Fault Cause

Additional engineering details and fault cause are input from information from site or followed up by “operational review” staff. Incident time is taken from the earliest time an incident is reported to the company.

A2.3.5 Evaluation of lost demand

Load interrupted is reported in HV PC NaFIRS as maximum demand not actual demand as required by the NaFIRS reporting instructions and is estimated from historic SCADA data.

A2.3.6 Sample Check

A sample of HV NaFIRS reports was examined. Fault report 520006 had been accurately reported and data reconciled with information on the associated 11 kV control switching log, SCADA log and records on the CLASS system. The incident cause was attributed to damage by unknown third party although this is not recorded on the documentation, probably completed by enquiries from operational review staff.

A2.4 LV Incident Reporting

A2.4.1 Incident Capture

All low voltage fault management, despatch and PC NaFIRS reporting is carried out at Nottingham operations centre. Customer calls are associated within CLASS at a low voltage circuit level and despatched.

LV PC NaFIRS reports are initiated automatically from CLASS for all customer involved incidents. The fault reports are then completed from information within CLASS.

A2.4.2 Number of Customers Affected

Customer numbers are taken from CLASS where a complete low voltage circuit is affected (divided by three for single phase fuse operations). For partial LV circuit interruptions and restorations customer numbers are assessed and reported from site. Site restoration and repair staff are equipped with a PC and CD ROM of the LV mains records.

A2.4.3 Incident Duration and Restoration Stages

Restoration times are as reported from site.

A2.4.4 Fault Cause

Fault causes are also mainly reported from site. Details are recorded in the CLASS system which provides information for customer information, voice messaging and fault reporting.

A2.4.5 Sample Check

A sample of LV NaFIRS reports was examined. Fault report 520035 was examined and customer numbers and restoration times were accurately recorded from information in CLASS. The open circuit fault was cause unknown as it was not discovered at the time of restoration by LV linking. It is not known whether a subsequent fault was found and diagnosed.

A2.5 Prearranged Interruptions

Pre-arranged interruptions are recorded in the CLASS system and automatically initiate an incident report in PC NaFIRS. Notices are hand distributed to customers to pick up any anomalies in the CLASS connectivity model. Statutory notices are not provided where the interruption is associated with customer initiated work on single services.

A2.6 Condition 9 Reports

Condition 9 Reports are to the standard format and separately identify low voltage service and mains incidents. 24/18 hour interruptions reported in Condition 9 do not exclude events which are discounted under GS and OS standards.

A2.7 Future OFGEM Requirements

Quality of Supply Reports are disaggregated into six geographical (County) areas agreed with the ECC, although East Midlands no longer manage their operations based on these areas

A2.7.1 Worst Served Customers

Numbers and percentage of worst served customers experiencing 6 or more interruptions at all voltages are routinely monitored on a monthly basis and included in disaggregated reports in the annual Quality of Supply Reports. (Targets for six and above 1% and ten and above 0.05%). However the CLASS system cannot identify the specific customers affected by some LV single phase incidents which would be required for a guaranteed standard for worst served customers with automatic payments. Initially East Midlands identified about 120,000 worst served customers but these have been managed down to20,000 and 25% of these are considered to be due to random effects where specific cause and improvement actions cannot be identified.

East Midlands currently monitors worst served customers overall, which will also support a GS standard based on non automatic payments. However it would not be suitable for a GS standard based on automatic payments due to the uncertainty of phase connections of LV customers and there are no plans to extend the present connectivity model to include phase connections.

A2.7.2 Transient (Short Term Interruptions)

Transient interruptions are not currently targeted or reported but this will be possible in the new CLASS system. East Midlands adopt the EN50160 definition of short term interruptions as those less than 3 minutes for power quality. However the NaFIRS definition of one minute is used for performance reporting. East Midlands quality of supply monitoring includes a sample of transients experienced by customers.

A2.7.3 Telephone response

East Midlands telephone response to distribution calls is provided at the highest priority level from within the Powergen Retail supply "virtual" call centre using specialist agents on distribution with overspill to other agents. Agents have access to CLASS and set up messages on the interactive voice processor equipment on the request of distribution despatchers. There are 360 incoming lines which can be redirected using CLI to messages on 168 voice ports covering 300 BT exchange areas. Further overspill is available for 1200 lines, which can give messages at service provider level outside the company.

The present facilities will provide response figures based on 20 seconds not the 15 seconds suggested as a possible standard by Ofgem.

East Midlands is currently reviewing the options for a new distribution only call centre and telephony arrangements separate from supply to meet the proposed Ofgem standards. The present customer telephone response is provided by Powergen Retail supply business and East Midlands demonstrated a customer outage and communications system which is being considered for a distribution only call centre in the future.

A2.7.4 Medium Term Performance

Asset management is becoming increasingly sophisticated. East Midlands carries out an annual plant and network review which is increasingly based on condition and performance criteria. The investment programme is prioritised by decision tools and consideration and balancing of a wide range of drivers such as safety, environment, condition as a measure of medium term resilience and actual and modelled performance both average and worst served.

A2.7.5 Other

Power quality is comprehensively monitored at 44 sites giving a representative sample of power quality including voltage dips across the network which is reported in the quality of supply report.

East Midlands uses the facilities in PC NaFIRS for producing daily, weekly and monthly internal reports on network performance.

As noted above East Midlands routinely monitors and sets targets for worst served customers.

East Midlands does not define severe weather or adjust NaFIRS or Condition 9 reports for severe weather but would adopt for GS/OS standards where appropriate.

A2.8 Audits

The centralised operations at Nottingham include all aspects of incident management and network performance reporting and associated IT systems and data management which is overseen by a specialist system performance and operational review team in a quality environment with controls on training and authorisation of staff for operational and administrative processes.

Quality assurance procedures are in place for both network performance reporting and GS and OS standards with internal monthly and external annual reviews. The processes are not accredited to ISO 9002 but follow a similar format.

APPENDIX A3

REVIEW OF MEASUREMENT SYSTEMS

LONDON ELECTRICITY (London)

London is currently changing its organisation and systems as part of the joint venture with Eastern. Services to manage and operate both companies will be provided by 24 Seven Utility Services which incorporates most of the staff of the two distributors. London will maintain its own strategy through contracts with the service provider but it is likely that common information systems and facilities will be developed to serve both companies. In particular incident management and network control are likely to be centralised at Ipswich. The following commentary relates mainly to the existing situation.

A3.1 Information Systems and Data

A3.1.1 NaFIRS

London uses a mainframe version of NaFIRS, called London Electricity Fault and Interruption Reporting System (LEFIRS). This is the basis for all internal and external network performance reporting and all data is input into this system manually with no automatic links to other systems. LEFIRS is based on the 1996 version of NaFIRS and is very similar except for fault cause codes which are tailored to suit the London network. The system is considered to be consistent with NaFIRS and London provides data into NaFIRS for consolidation into reports for Great Britain.

A3.1.2 Fault Management System (FMS)

London operates a centralised HV and LV network control and despatch system, currently from two locations (HV and LV), with plans to transfer to a combined centre at Ipswich, initially using the same processes.

A mainframe Engineering Resource Management System, (ERMS) is used for recording all work activities including fault despatch and recording details required for LEFIRS reporting. London maintains close control of both LV and HV network operations associated with fault location repair and restoration and has good real time records of activities including restoration times.

A Power Availability Information Network (PAIN) which is through a web browser interface provides a summary of the status of all incidents for the customer service centre in Sunderland. PAIN is updated automatically at 15 minute intervals from ERMS and the information is also used to set up messages for each significant incident in the voice processor at the call centre. In future call takers for distribution will be based at Ipswich with overspill calls being let out to contract to a service provider.

A3.1.3 Network Management System (NMS)

The Network Management System, known as CORGIS is a computer based system which has replaced HV control room wall diagrams but switching logs continue to be manually produced. CORGIS incorporates network connectivity which identifies distribution transformers affected by HV incidents. The HV network has a high level of SCADA and remote control facilities and all HV faults are identified from SCADA alarms. There is not the same driver therefore for sophisticated computer based customer to network links required by companies with mixed overhead and underground networks. Customers off supply are identified by Post Codes areas which are listed against each distribution transformer. Customer numbers for HV network performance reporting are based on an average figure of 156 per distribution transformer, except for transformers supplying a single HV customer.

Low voltage NMS control system is based on LV geo-schematic electronic maps which are dressed to show normal LV circuit feeding arrangements.

A3.1.4 Plant and Circuit Records

Plant data is taken from an asset management system plant file, which was not demonstrated but is considered to be accurate to within ± 1%.

London has electronic mains records which have been used as the basis for the LV geo-schematic diagrams used by LV control and for similar HV diagrams in the power system analysis package DINIS. Circuit lengths are based on an initial count from mains records updated from a computer based process SANS which

records additions and deletions from the network on a job by job basis. The circuit lengths reconcile with the geo-schematic records to within ± 3% and are estimated to have an accuracy of not better than 95% overall.

A3.1.5 Customer Numbers

Customer numbers for HV network performance reporting are based on an average figure of 156 per distribution transformer, except for transformers supplying a single HV customer.

Customer numbers affected by LV faults are assessed by site staff with reference to detailed plans, or based on average numbers of customers per low voltage circuit. London conducts a detailed investigation of fault reports to geographically identify customers and circuits suffering multiple interruptions at both HV and LV. The approach to date has been to tackle worst served customers at LV where the problem of multiple interruptions is most marked in London.

London has also devised automatic methods of associating customers with distribution transformers and assessed the accuracy of reporting various indices. Whereas accuracy overall was between ±1% and ±2.5%, some LV indices were understated by 9% and HV indices overstated by 9%.

London has drawn up and costed a specification for a connectivity model and customer to network link but they argue that such a model could not be cost justified and would not improve accuracy of reporting, especially at LV.

A3.2 Documentation of Policies and Procedures

LEFIRS is comprehensively documented system which include the main features of the NaFIRS instructions in Engineering Recommendation G42/3 but also additional local procedures which are subject to quality control procedures. Both network performance reporting and GS and OS standards are ISO accredited and subject to six monthly audit.

GS and OS Standards are in addition comprehensively documented.

No additional information or guidance is provided for Condition 9 reports or quality of supply reports.

A3.3 EHV and HV Incident Reporting

A3.3.1 Incident Capture

HV LEFIRS reports are initiated by the control engineer on notification of a supply interruption from information from Scada, despatchers and/or ERMS. The initiation and completion of fault reports is not automatically linked to NMS or FMS. The information is input into the computer based HV LEFIRS system and control is maintained of incidents reported by adopting the ERMS project number as the LEFIRS number.

There is a reasonable expectation that HV incidents are correctly identified and reported in the control environment, limited by the process of identifying customer numbers. Customer effects are not accurately reported for individual incidents.

A3.3.2 Number of Customers Affected

The control engineer completes a Part 1 pro forma HV Fault Interruption report, taking restoration times from the HV switching operations log and taking the number of customers affected by identifying the number of distribution transformers off supply at each stage and using the average number 156 (or one for supplies to HV customers).

A3.3.3 Incident Duration and Restoration Stages

HV PC NaFIRS computer system now allows for a flag to be set to discount repeated interruptions that arise during restoration stages of the same incident. London adopts a similar system within LEFIRS.

LEFIRS allows for up to 6 restoration stages and customer effects for additional stages are averaged over stages five and six.

Incident time is taken from customer reports where these are earlier than the incident report time.

A3.3.4 Fault Cause

Part 2 of the pro forma HV Interruption report is completed by the control engineer from information received from site or ERMS after the completion of the repair and includes details of the fault cause and equipment involved.

A3.3.5 Evaluation of lost demand

Load interrupted is not recorded or reported under LEFIRS

A3.3.6 Sample Check

A sample of HV NaFIRS reports was examined. Fault report 259832 had been accurately reported and data reconciled with information on the switching log and ERMS.

A3.4 LV Incident Reporting

A3.4.1 Incident Capture

LV control and incident management is controlled at each stage from the LV control centre at City Road and all work and operations recorded within ERMS.

LEFIRS reports are then completed from information in ERMS.

A3.4.2 Number of Customers Affected

Customer numbers are either identified on site or an average number is recorded based on 39 customers for a three phase affecting one outgoing LV circuit or 13 customers for a single phase incident. This mixed practice would appear to work against any benefits of using average numbers.

A3.4.3 Fault Cause

ERMS is also used to capture data on incident causes reported from site.

A3.4.4 Sample Check

A sample of LV NaFIRS reports was examined. Fault reports 0361 and 0362 were examined and restoration times were accurately recorded from data in ERMS. There was some inconsistency in reporting an incident where a service fuse had operated. Such incidents are not reportable under G42/3 NaFIRS reporting instructions, however these are not wholly adopted by London.

A3.5 Prearranged interruptions

Pre-arranged interruptions are recorded in the ERMS system and notices are not provided where the interruption is associated with customer initiated work on single services.

A3.6 Condition 9 Reports

Condition 9 Reports are to the standard format and separately identify low voltage service and mains incidents. 24/18 hour interruptions in Condition 9 do not exclude events which are discounted under GS and OS standards.

A3.7 Future OFGEM Requirements

Quality of Supply Reports targets and performance are not disaggregated into geographical areas.

A3.7.1 Worst Served Customers

London report on the aggregate number of customers affected by five or more LV incidents (1506 in 1998/99 and about 500 in 1999/2000 and exclude repeated interruptions on the same incident). Reports include action taken for each incident. The figures do not aggregate interruptions due to incidents at higher voltage levels as causation is not normally linked between voltage levels.

London has no plans for refining the customer to network link. The present arrangements are said to provide a consistent and reasonably accurate measure of overall performance.

A3.7.2 Transient (Short Term Interruptions)

London has less short term interruptions than companies with large overhead line networks equipped with automatic reclosing. During 1998/99 London had six transient interruptions associated with automatic restoration schemes affecting 52,500 customers and these were reported in the Quality of Supply Report. London would favour a move to the European definition of short term interruptions based on three minutes.

A3.7.3 Telephone response

London currently operates a combined supply and distribution customer service call centre from Sunderland, which takes all distribution no supply calls and despatches electricians to incidents affecting one customer. IT systems do not automatically associate calls for HV and LV incidents. Repeat calls considered to be related to single incidents are identified manually using post code or other location data such as the callers address and referred to LV Control Centre for despatch. Voice messages are set up for all significant incidents on Post Code areas. In future call handling will be set up for distribution no supply calls at Ipswich to meet the Ofgem requirements for telephone response, including contracted service to handle overspill calls.

A3.7.4 Other

London has a comprehensive IT system, called Corvu, for extracting and presenting information from NaFIRS and other statistics for network performance analysis and reporting. A Network Monitor monthly review is produced, highlighting key indicators, including process control limits. London also monitors percentage of customers restored in 30 mins, and 6hr increments up to 24 hours and also the number of customer LV groups affected five or more times by LV incidents.

The inner London area has high load density and a highly interconnected network. Extensive remote control has been deployed in outer areas with plans for automation at one in two distribution substations such that currently 60% of lost demand can be restored in 30 minutes for HV faults.

A3.8 Audits

London has a comprehensive Quality Policy Manual Procedures and Process Maps associated with GS and OS standards but these do not appear to cover LEFIRS and Condition 9 reporting, although these activities operate in a centralised quality environment with procedures for authorisation of staff to carry out all functions.

London will need to revise its quality procedures manual and accreditation processes in line with the new contractual arrangements with 24Seven Utility Services.

Between 1995 and 1998, London accredited its asset management and investment processes to ISO 9001. London continues to maintain the processes but has ceased to pursue formal accreditation.

APPENDIX A4

REVIEW OF MEASUREMENT SYSTEMS

MANWEB

Manweb operates a Call Centres in Warrington, Rhostyllen (Wrexham) and Caernarfon which are linked to three regional daytime 11/6.6kV Control and Dispatch Centres. A Central Control Room in the Wirral is responsible for the control of the 132kV and 33kV system and takes over responsibility for the rest of the distribution system at night. The Distribution Control and Despatch Centres co-ordinate the activities of several Regional Depots.

The information systems described below are networked between Call Centres, Control Room, Regional Depots and Emergency Control Centres.

A4.1 Information Systems and Data

The major information systems employed by Manweb are:

- Resource, Despatch, Update Customer Messages (TroubleCall)
- Integrated Control Network Diagram (ICOND)
- Network Management System (NMS) for telecontrol (SCADA)
- Graphical Decision Support System (GODESS)
- PoweR System PErformance Reporting (PROSPER) which is an enhancement of NaFIRS. Information for NaFIRS reports is extracted from Prosper.

The ICOND system has been introduced into Manweb during the past year and will be fully commissioned later this year.

Incident reports are created in Troublecall & ICOND by the relevant dispatcher or Control Engineer, with reference to the incident or switching log and the dynamic system and customer connectivity model that supports both ICOND and Troublecall.

A4.1.1 Plant and Circuit Records

Plant data is extracted from the Plant and Circuits database (UdB) which is common to Manweb and Scottish Power (SP)and. The UdB is continually updated as plant and circuit information is validated when required using the SP asset inspection systems.

Circuit lengths are collected manually from the Manweb regions. The UdB will be populated through GIS in the future when vectorisation has been put in place. All new entries have been vectorised for the past few years.

Circuit length excludes services which are defined as the low voltage cable between the mains cable breach joint and the cable head cut out.

A4.1.2 Customer Numbers

In the vast majority of cases, customer numbers relate to the number of active services. The two exceptions to this are firstly some instances where a two-metered property has identical billing tariffs for both services - in these cases, it is deemed as just one customer; secondly, at any given time there are a small number of empty/derelict properties which are recognised by the Troublecall system as still being active and these premises are each regarded as the equivalent of one customer. The numbers involved in these exceptions are so small that there would be a negligible difference to the reported performance.

The accumulated effect over the last few years of such things as bulk data loads relating to new system implementations, occasional interface failures, some IT system logic flaws etc has resulted in a degree of 'data drift' between the Customer Directory and the Troublecall systems. However, a full-scale reconciliation programme, started in January 2000, is now nearing completion and will ensure a high degree of data consistency between these systems.

The Customer Directory is updated on a daily basis by data interfaces from a number of billing systems, customer capture systems and manual input of Data Transfer Network (DTN) information about lost supply customers. The Customer Directory in turn updates Troublecall also on a daily basis with all relevant

changes to names, addresses, telephone numbers, new services, closed services etc. The data content of these systems is continuously monitored and reviewed without there necessarily being any specific checkpoints.

A4.2 Documentation of Policies and Procedures

Procedures for GS and OAS Standards are accredited to ISO 9002 and are documented accordingly.

Incident reports are created using, TroubleCall, ICOND and PROSPER and user guides are available for these systems.

A4.3 EHV and HV Incident Reporting

The progress of HV incidents is managed by the control room system ICOND (NB resource allocation and information relevant to customer calls is managed by Troublecall system in a similar manner to LV incidents). The current status of the network connectivity is maintained in the ICOND system. Completion of the supply restoration stages includes an electronic trace of the section of HV network affected, this captures a list of the secondary transformers and calculates the number of customers affected by each restoration stage. Full details of the incident are transferred to the Prosper database by a batch process run twice per day.

A4.3.1 Incident Capture

All switching actions relating to a particular incident are recorded as the incident progresses in an electronic switching log within the ICOND system. At an appropriate time when the Control Engineer is not otherwise engaged, the Control Engineer, using the switching log as a guide completes the fault report and supply restoration stages. The time of the incident for reporting purposes is either the time taken from the SCADA system or the time at which the fault was first reported provided it was subsequently confirmed as a fault.

There are no automatic links to ICOND or Prosper for control information relating to 132kV. Reports on such incidents are initiated by the control engineer. However, such incidents are relatively few in number.

A4.3.2 Number of Customers Affected

For customer interruptions caused by faults at HV and above, each restoration stage is supported by a trace of the dynamic network connectivity model in ICOND which identifies both the secondary transformers affected and the total number of customers connected to these transformers. The computer system linking customers utilises a dynamic network model which reflects feeding arrangement.

A4.3.3 Incident Duration and Restoration Stages

The control engineer ensures that the interruption time corresponds to the time that the company "became aware of the fault" and inputs the time of restoration stages. Some discretion is used in deciding whether to disregard very short periods of supply restoration. Although the Manweb now uses the latest NaFIRS input arrangements the approach of individual control engineers has been conditioned by an earlier need to amalgamate restoration stages where the number exceeded eight. Typically, a control engineer may disregard a restoration that lasted less than say 5 (or even 15) minutes. Manweb does not currently have the tick box facility to discount repeated interruptions in the same incident which is available within PC NaFIRS but could achieve this by other means within PROSPER.

A4.3.4 Fault Cause

Information of the cause of a fault and on equipment affected is obtained from site staff.

A4.4 LV Incident Reporting

LV Incidents are managed in the Troublecall system by dedicated Dispatchers. As the incident progresses the Dispatchers make entries in the incident log relating to the progress of the incident (staff dispatched, estimated time of arrival, arrival on site, customers off, estimated time of repair, customers on, etc.). This information is available in real time to the call takers in the customer call centre to update customers who call in. On completion of the incident the Dispatcher completes the incident report by adding information, such as the incident cause and equipment affected, which is provided by the staff on site. Full details of the incident are transferred to the Prosper database by a batch process run twice per day.

A4.4.1 Incident Capture

LV incident reports are raised in Troublecall. LV Dispatchers are responsible for the input of information relating to LV incidents. The time of the incident for reporting purposes is the time at which the fault was first reported provided it was subsequently confirmed as a fault. Incident capture is essentially 100%.

A4.4.2 Number of Customers Affected

The number of customers affected by an LV incident is estimated by the on-site resource and the Dispatcher with the system assisting by indicating the total customers supplied by the secondary transformer which supplies the affected network. This is a structured estimate based on total customers connected to transformer and knowledge of number of feeders/phases affected. Any records regarding the phase of connection of individual customers are not reliable.

A4.4.3 Incident Duration and Restoration Stages

Calls are received by the call centre and logged in Troublecall. Troublecall has an in-built delay of five minutes in relaying individual no supply calls to the dispatchers to allow time for a more accurate view of incidents to be formed. Should 3 related calls be received within the five minutes the call details are relayed immediately to the dispatcher. The Troublecall log contains all details of the incident such as time of first call, time of dispatch of staff, time of arrival on site and time of confirmation of the incident by field staff. Once the extent of the incident is confirmed by field staff, the dispatcher makes an entry in the log confirming the number of customers off supply and adjusting the time off (the default is the current time) to reflect the time of first call first or other appropriate time reported by the field staff in the case of manual disconnection of supplies. Similar entries are made for each and every further disconnection or restoration of supplies. The number of supply restorations must equal the number of interruptions before an incident can be closed.

For LV incidents the dispatchers have no discretion in the creation of restoration stages. Troublecall produces the restoration stages on the fault report from every supply interruption confirmed from site and restoration recorded in the Troublecall log.

A4.4.4 Fault Cause

LV dispatchers obtain information on "fault cause" and "equipment/component affected" from site staff.

A4.5 Prearranged Interruptions

Pre-arranged outages are reported in a similar manner to faults i.e. LV via Troublecall and HV via ICOND. Pre-arranged interruptions reported in NaFIRS include only those where statutory notice has been provided. Emergency disconnections without the statutory notice are reported as faults.

A4.6 Condition 9 Reports

Condition 9 statements produced by Manweb conform to the Ofgem standards.

A4.7 Future OFGEM Requirements

Manweb Quality of Supply reports contain data on Targets, Company & Regional Performance, Investment to benefit worst served customers, Capital Investment and Major Projects. The present and proposed measurement processes that are applicable to future Ofgem requirements are described below.

A4.7.1 Worst Served Customers

Manweb Quality of Supply reports provide a list of worst performing circuits and indicate the work Manweb propose to undertake on these circuits to improve performance in the coming year. Historically the circuits in this list have been selected based upon CML. However from this year, 2000/01, locations will be selected based upon the number of supply interruptions due to high voltage faults experienced by customers in the area. Each area will be identified by the circuit which provides supply.

The Manweb reporting systems capture the secondary transformers affected by HV and above incidents with a high degree of accuracy. Manweb also record the secondary transformer which supplies the network affected by every LV incident. Whilst this is insufficient to identify individual worst served customers it will support the identification of worst served customers due to HV incidents and also the LV networks experiencing high numbers of faults. Manweb consider this represents a cost effective compromise to the required level of reporting.

A4.7.2 Transient (Short Term Interruptions)

Manweb currently have no comprehensive monitoring facilities for transient interruptions and do not report transients in the QOS reports.

Manweb has the ability, via the SCADA system, to monitor transient interruptions that result from the operation of circuit breakers at Primary substations. However, the majority of transient interruptions result from the operation of pole mounted reclosers situated at remote locations on the overhead line network and Manweb currently have no monitoring facilities for these devices. SP has undertaken trials of Power Fail Monitors but have concluded that this technology gives spurious indications, is unreliable and is costly to maintain. SP has also explored the use of disturbance monitors situated at Primary substations, and whilst this technology has the potential to report transient interruptions with an accuracy around 70%, SP consider that the cost of such equipment cannot be justified by the need to measure transient interruptions alone. SP are reviewing the economics of a process based on manual readings from the counters on pole mounted reclosers to meet Ofgem's requirement for the reporting of transients.

A4.7.3 Telephone response

Call Centre Services are provided by Scottish Power Customer Services. This is currently being re-organised to provide dedicated agents providing distribution services only, but with overflow to other agents for abnormal call volumes. These arrangements are detailed in a Service Level Agreement.

Scottish Power's call centres have connections with the BT network and with the network of Scottish Power's telecom company, Thus. . The call centre in Scotland is situated Glasgow and in Manweb at Warrington and Wrexham (with a satellite at Caernarfon which has a strong Welsh speaking capability). The Manweb facilities supports the Scottish call centre at times of heavy demand and vice versa.

The range of daily call volumes for SP in normal conditions is 1000-1550 per day. The range of daily call volumes in Manweb in normal conditions is 750-1450 calls per day. The options available to handle an increase in call volume are to distribute calls between distribution call centre sites, utilise IVR messaging facilities where appropriate, overflow calls to customer services (during normal working hours) and utilise standby processes to bring in additional staff and managers.

The Customer Contact telephony systems have been designed to utilise Call Line Identity (CLI) to recognise the customers line location to link the customer to the TroubleCall fault logging system via an automated Fault Call Handling system that utilises Interactive Voice Response (IVR) equipment. The automated system aims to:

- Quickly provide customers with appropriate available voice messages regarding the situation.
- Provide the facility for customer sto speak to agents if desired or necessary.
- Provide the facility for automated fault logging.
- Provide the ability to prioritise callers with critical information about the fault or personal special needs.
- Enable multiple call centres to handle calls from any location and deliver consistent messages and service to these customers.
- Provide IVR messages at different levels - Zone, District or incident.

The Virtual call centre operation can distribute calls to all SP call centres. This aims to maximise the utilisation of lines and staff and provide a high quality service for customers. The telephony systems are designed to take over 200,000 calls per hour through 1350 lines routed into the call centres and 1200 lines on Mass Calling Platform. This is equivalent to 0.82 lines per 1000 customers.

A 1200 line Thus telecom Mass Calling Platform (MCP) is in place to cope with customer calls in the event that the Call Centres cannot cope with customer demand. The message system is granulated to the level of district messages, so that callers can hear area specific messages or a general message designed for all callers. Over 200,000 messages per hour, assuming a message of 15 seconds, can be handled by MCP. Procedures are in place that BT will inform SP if call gapping is needed and adopted to protect the BT network.

Management Information Systems are an integrated part of the telephony design. Data is available on-line and historically as printed reports. Performance is monitored for individuals, call types and as a total service. The service provision and Key Performance Indicators will be monitored and reported as defined within the Service Level Agreement.

A4.7.4 Medium Term Performance Monitoring

SP has an approach to asset management which ensures the long term sustainability of network and asset performance whilst prioritising asset investment in an optimal manner.

Long term (5-20 years) investment planning is based on decision support tools which utilise statistical data such as asset age profiles, reliability indices etc. In the medium term (2-5 years), the SP investment plans are further refined by reference to known type / operational defects, worst asset league tables etc. A fully prioritised, detailed short term (0-2 years) work programme is developed using information from the asset inspection and performance assessment systems.

The severe weather events of recent years have raised awareness regarding rural network performance and the asset investment plans include initiatives which will in the longer term make the network more resilient to such abnormal conditions. Examples of this improvement programme include replacement, on a tapered basis, of post-war light construction standard (BS1320) overhead lines with a more robust design and clearance of trees to falling distance on strategic circuits.

SP are progressively improving the availability and quality of data within asset information systems. A good example is the recent programme of work to inspect all of the overhead line network and update the line defect database and wood pole position information within the GIS system. This initiative will ensure that future maintenance and condition assessments are accurately recorded within the asset database.

SP are currently implementing a new asset inspection system using portable data capture devices. SP consider this will improve the management and control of inspection activities, ensure full compliance with statutory requirements and enhance quality of data capture. An important element of this development has been the preparation of a comprehensive and fully documented asset data standard which defines the information necessary to support asset management decisions.

A4.8 Audits

Under ISO quality accreditation periodic audits are undertaken to compare the information in Troublecall and ICOND with that held in Prosper. The audit examines all incidents handled in a 24 hour period. Under the SP internal audit programme each operational location is visited at least twice per year to check on numbers being reported against Guaranteed and Overall Standards. Audit reports are available for the past two years, and samples were provided for inspection.

APPENDIX A5

REVIEW OF MEASUREMENT SYSTEMS

GPU POWER UK (Midlands)

Midlands is a distribution only business operated by GPU Power UK, with HV control and incident management and despatch operated on a 24 hour basis from Tipton. Additionally, during office hours, despatch is undertaken from two further centres across the region. Call taking is predominantly undertaken in-house, using voice processor technology and call line identification, with an overspill provided by National Power on a contract basis.

A5.1 Information Systems and Data

A5.1.1 NaFIRS

Midlands uses a mainframe version of NaFIRS (FIRS) as the basis for all internal and external network performance reporting. The system is based on NaFIRS but may not include recent amendments. Input to this system is by manual transcription of CIRAS (Control and Incident Room Automation) for all incidents, FIRS not currently being linked. However, Midlands is working to integrate a replacement of the mainframe FIRS system, with CIRAS, which will provide further confidence on reporting accuracy.

A5.1.2 Fault Management System (FMS) and Network Management System (NMS)

Midlands CIRAS system is a server based system which combines a Network Management System (NMS) and Fault Management System (FMS). CIRAS links customers with sections of the low voltage network (LV nodes) in a GIS mains records system. CIRAS can then associate customer calls to identify HV and LV incidents. The model of customers linked to network is dynamically linked to HV/LV substations HV fault reporting thereby takes account of dynamic changes on the HV network. CIRAS is not dynamically updated for short-term operational changes on the LV system.

The centralised NMS system is in the final stages of implementation and control engineers in the interim separately update the CIRAS system by inputting switching actions from the current manual switching log to ensure that the dynamic state of the HV network and fault history record is accurate.

CIRAS has a high level of functionality with three main screen types: Call takers are presented with a cue screen to systematically record information and advise customers. Reports are associated together on a follow up screen where update information can be provided by despatchers. An outage screen provides more comprehensive information as a confirmed fault outage progresses. The system is supported by comprehensive help menus and management summary information.

A5.1.3 Plant and Circuit Records

Midlands uses a server based GIS information system of geographic and geo-schematic plans of overhead lines and underground cables at all voltages. Geographic records within GIS are mainly raster diagrams, which cannot produce details of circuit length. Circuit lengths at all voltages are therefore taken from the vectorised geo-schematic records which are originated at a different scale and accuracy but are estimated by PB Power to be accurate to within ± 2%. Actual services routes are not always shown in GIS but customers are logically attached to low voltage nodes. View only GIS records are widely available in offices and on PCs in the field through the MIDAS system.

Plant data is taken from a plant file, which was not reviewed but is understood from Midlands to be accurate to within ± 1%. The system is not integrated with the GIS records but is reconciled with the NMS system.

Midlands is in the final stages of implementing an integrated asset information system DEGIS that supports most aspects of asset management including network performance.

A5.1.4 Customer Numbers

Midlands operates a distribution only business and the original customer records were provided by the supply business sold to National Power. The update of records is via the Data Transfer Network (DTN) and

Midlands is critical of the quality of information provided from this source. In particular customer names data may not be universally available from suppliers and is of poor quality. Midlands identifies customers by MPAN metering points, excluding most aggregated metering points associated with unmetered supplies. However Midlands also includes certain sensitive unmetered exit points associated with cathodic protection and telecommunications sites.

Midlands indicate that 98.7% of customers are attached to the network at any point in time. The remaining 1.3% are in active state such as new additions to the network and change of tenancy.

A5.2 Documentation of Policies and Procedures

Midlands indicate that all fault reporting is strictly in accordance with NaFIRS but no additional written procedures or guidance notes are provided to users. This appears to be a shortcoming especially for LV incidents where the reporting procedures require considerable co-ordination between operating units, central despatchers and customer service ACD call centre staff. CIRAS is increasingly being used as the primary source for fault reporting. Time Claim forms, which incorporate incident details together with damage identified and the repair undertaken, are used to confirm the initial entry.

Documentation for the CIRAS system is provided within the help screens and the system appeared to be well understood by users.

Procedures for GS and OS Standards procedures are well documented in a standards of service quality manual and accredited to ISO 9002 and subject to six monthly accreditation audit and an annual probity audit required by Ofgem.

Condition 9 reports and quality of supply reports are compiled from the Ofgem requirements with no additional company documentation.

Midlands has documented procedures for the editing and updating of mains records including the customer links which comply with ISO 9000 and for which they are working towards final accreditation and audit by the end of this year. The system does not currently include data capture of records on site and this is being addressed through contracts and SLAs.

A5.3 EHV and HV Incident Reporting

A5.3.1 Incident Capture

HV FIRS initial fault reports are initiated at the control centre by the control engineer with reference to the switching log. The initiation and completion of fault reports is not currently automatically linked to NMS or CIRAS but is primarily controlled by the sequential numbering of forms and a control sheet with subsequent manual entry to CIRAS. Midlands reported that all HV faults are managed under central control with no delegated control for faults or block reporting under storm conditions.

Midlands confirms that the count of incidents includes transient incidents less than one minute for 132 kV circuits as these are defined incidents within NaFIRS and have not been excluded. Transient interruptions of less than one minute from any cause are excluded from the figures including operational switching, although operations associated with embargoed switchgear are mainly taken to result in interruptions of greater than one minute and are therefore recorded.

Midlands reports to NaFIRS but does not provide disaggregate data to the three regions adopted for quality of supply reporting. Midlands does not report under NaFIRS Table 8 which provides a more detailed breakdown of HV interruption duration.

A5.3.2 Number of customers affected

The NaFIRS report is completed in the incident centres and entered manually into the FIRS mainframe system. Numbers of customers affected is taken from CIRAS which is currently updated by control engineers but from later in 2000 will be directly linked to live NMS operations.

A5.3.3 Incident Duration and Restoration Stages

Discretion is used as to the number of restoration stages recorded but only short re-interruptions are excluded. Midlands does not use the facility available in the latest version of PC NaFIRS to exclude all re-interruptions experienced during the course of a single incident.

The industry standard PC NaFIRS system now allows for a flag to be set to discount repeated interruptions that arise during the restoration stages. Midlands does not use this facility which has the effect of Midlands reporting a higher the number of interruptions compared with distributors that use this flag (by about 10% to 15%). (The flag is understood to have been introduced fairly recently to offset step increases in number of interruptions which arise from more accurate reporting of restoration stages, especially where these are automatically completed from NMS systems).

A5.3.4 Fault Cause

Faulted equipment and fault cause data is captured from a number of sources, including the initial fault report, CIRAS, and the reverse of the completed Time Claim Forms with comparisons being undertaken to ensure accuracy of reporting. It was noted that the forms are structured primarily to capture third party damage information and do not fully reflect NaFIRS reporting categories for equipment and fault causes.

A5.3.5 Evaluation of lost demand

Load interrupted is reported under HV NaFIRS from SCADA data but is not used for internal or external reporting but may be used as a guide to corroborate numbers of customers.

A5.3.6 Sample Check

A sample of HV Fault reports were examined and customer numbers that had been derived from CIRAS and manually input were estimated to be accurate to within ± 1%. It was particularly noted that the incident time report was taken from CIRAS earliest reports from customers and not from control centre logs. There was an accurate match between restoration stages on the control log and the fault report, although some short re-interruption stages were omitted.

The CIRAS history record correlated with known incidents affecting one customer over the past nine months.

A5.4 LV Incident Reporting

A5.4.1 Incident Capture

Low voltage FIRS reporting is the responsibility of the three incident centres. LV fault report pro-formas are initiated by incident centre despatchers and updated as the fault progresses and from information on the Time Claim forms completed on site. The on site forms appeared to be completed to a reasonable standard and reconciled with the incident centre report and CIRAS record.

Low voltage incidents are initiated within CIRAS, updated by despatchers who initiate a manual LV fault report form. Low voltage incidents site details are input onto the reverse of Time Claim forms and are compared with despatchers reports and input manually into LV FIRS.

A5.4.2 Number of Customers Affected

Midlands report all low voltage incidents including all single service interruptions and cut out faults, but not cut out fuse operations but including incidents affecting sensitive unmetered supplies such as telecom sites. CIRAS has links to customers at the low voltage node level and mains records are available on site through MIDAS. This provides a reasonable level of accuracy of reporting low voltage customer effects, although phase details are not always available.

Midlands is of the view that improvements in CIRAS low voltage connectivity and phases would not overcome inaccuracies due to unknown phase data, open circuit faults and partial restorations on low voltage circuits, including use of mobile generators and temporary connections. Lack of information for low voltage incidents would also put uncertainty on any GS or OS standard for worst served customers. Midlands indicates that cost of the present level of data conversion for connectivity is £5.4m and full conversion for connectivity would be significantly higher.

A5.4.3 Incident Duration and Restoration Stages

The system does not always take account of re-interruptions or temporary restorations and mobile generators. There will therefore always be a level of inaccuracy in low voltage reporting which will have an impact on the identification of worst served customers, both individually and in aggregate. Midlands hope to overcome this by creating dynamic links in the low voltage model and by good on site reporting linked to service level agreements.

A5.4.4 Fault Cause

It was noted that the LV Fault Report forms are structured primarily to capture third party damage information and do not fully reflect NaFIRS reporting categories for equipment and fault causes. Fault cause data is not therefore considered fully consistent with NaFIRS.

A5.5 Prearranged Interruptions

Pre-arranged outages will be notified to customers by post from within CIRAS system for all customer outages. Currently, however, customers affected are calculated from CIRAS and the notification delivered by hand.

A5.6 Condition 9 Reports

Condition 9 Reports are to the standard format and separately identify low voltage service and mains incidents. 18-hour interruptions in Condition 9 do not exclude events which are discounted under GS and OS standards.

Condition 9 reports exclude non-customer involved LV faults but include services as defined previously.

A5.7 Future OFGEM Requirements

Quality of Supply Reports are disaggregated by the three incident centre regions to the requirements of the ECC.

A5.7.1 Worst Served Customers

Midlands does not report on worst served customers in the quality of supply report but is building up history data and will soon be in a position to report on individual and aggregate worst served customer performance with accuracy limited only by lack of phase data and low voltage dynamic customer links.

Midlands carries out circuit monitoring for each protected section of HV circuit and can therefore distinguish between incidents affecting different zones of a high voltage circuit for the purposes of monitoring numbers of customers affected by HV incidents and targeting investment.

Midlands report progress of schemes associated with 100 worst performing circuits based on the highest aggregate CMLs lost with some modification for frequency of interruptions.

Midlands already provides automatic payments for GS Standards for 18-hour interruptions.

A5.7.2 Transient (Short term interruptions)

Transient interruptions of less than one minute are not currently reported but Midlands is developing a system for monitoring and reporting based on operations of source and downstream auto reclosing devices and manual count of certain downstream reclosers. Midlands has identified potential anomalies in counting reclosures due to repeated shots taken by some devices on the same fault clearance i.e. within the one minute period.

A5.7.3 Telephone response

Midlands Power Loss Help line (PLH) incoming lines are automatically diverted to two Voice Processor systems and information about outages is provided for nine geographical regions by Call Line Identification. (210 lines outside normal hours and 140 at other times.)

Information from incoming calls is then provided to the incident centres for call details to be entered into CIRAS as described above.

Contracted overspill arrangements are in place with National Power Customer Enquiry Centre (CEC) until 2001. CEC has access to the CIRAS screens.

The PLH ISDX has the capability for producing reports on average time to answer and other measures down to console level but no details were provided on performance and no standards are currently reported. CEC has similar capability but no numerical service levels are currently included in the contract.

An overflow of up to 1800 lines is available to the BT exchange where one simple message indicating busy lines is provided.

Midlands is considering options for new telephone and messaging systems and contracted telephony overspill arrangements to follow the ending of the contract with National Power.

A5.7.4 Other

Midlands does not systematically monitor other aspects of power quality but responds to customers needs, particularly large customers most likely to be sensitive to power quality.

Midlands has worked with the Weather Centres to develop techniques for identifying correlation between incidents and weather and claim to have a process for normalising network performance for weather. These techniques are not used for normal reporting but are being used to develop means of measuring medium term reliability in conjunction with improved condition monitoring, especially for overhead lines.

A5.8 Audits

GS and OS Standards are well documented and accredited to ISO 9002 and subject to a six month 9002 audit, copies of which were reviewed for October 1999 and April 2000.

The procedures for composite records editing including updating of customer records are carried out to ISO 9002 quality standards but this does not include record updating from site. Midlands concludes that their policy would not allow updating from the field because of the importance of the network model as a primary source and its use in safety management.

No audits have been carried out on NaFIRS, Condition 9 or Quality of Supply Report data but Midlands is considering further extension of ISO 9002 quality systems into other CIRAS functions.

APPENDIX A6

REVIEW OF MEASUREMENT SYSTEMS

NORTHERN (NEDL)

NEDL operates a central Operations Centre and an HV network Control Centre in Tyne & Wear. A common Information System networked between the Operations Centre, the Control Centre and the Field Operations Centres is used for network performance and fault reporting.

A6.1 Information Systems and Data

The Central Network Database (CNDB) is the collective name describing the major applications that support the management and operation of the NEDL distribution network. It comprises of three major applications which all utilise a single central Oracle database. These systems are Asset Management (AMS), Trouble Management (TMS) and the Customer Premise Network Link (CPNL). Further applications have been recently added relating to maintenance of the premise/network connectivity model (Graphical Tools), network performance reporting (IRIS) and customer investigation/complaint handling (CIMS). A further application to enable NEDL to undertake its Safety Fault and Information Centre (SFIC) obligations also operates against the CNDB.

A6.1.1 Trouble Management System (TMS)

The Trouble Management System controls and monitors the real-time process of fault handling, from initial contact with the Distribution Call Centre, dispatch of field resource, identification of cause, and subsequent repair/restoration of supply. TMS is also used to measure NEDL performance against GS1, Service Fuse Failure. TMS is currently used to log all network related customer enquiries and interfaces with IRIS, CIMS, SFIC and NMS.

Functionality has been developed and tested to create a real-time link between NMS and TMS. Data associated with the beginning and progress of each HV fault will be passed across the link as the stages in restoration of supplies occur. Business processes are currently being reviewed prior to commissioning the live link.

A6.1.2 Customer Premise Network Link (CPNL)

The Central Network Database holds a model of the customer, supplier, premise, plant and circuit components for the NEDL network franchise area. The logical connection between the premise and the LV main was derived using a 'snapping'' technique that assumed that the premise was connected to the nearest LV feeder in the vicinity. The model produced is adequate for most fault localisation and dispatch activities. The model is more accurate in rural areas than urban communities due to lower network density giving improved probability of correct snapping.

The combination of some inaccuracies in LV network cable location; premise location and assumptions in the service connection "snapping" algorithm reduced the overall accuracy of the connected model to 70% correct premise to LV feeder and 90% premise to substation (NEDL estimates). In terms of incident reporting (NaFIRS) the customer numbers predicted are verified for accuracy by operational staff prior to committing the report as a formal record. Whereas the model produced is adequate for most fault localisation and dispatch activities it is not sufficiently accurate to meet future Ofgem requirements for automatic payment against the 18 hour standard for supply failure or measurements in relation to repeat interruptions.

A6.1.3 Incident Reporting and Information System (IRIS)

Management and reporting of incidents on the network via TMS is closely related to the requirements of the National Fault and Interruption Scheme (NaFIRS). Integration of the existing standalone NaFIRS reporting system into the CNDB has recently been completed. The previous NaFIRS system was operated under a distributed Microsoft Access database developed by HEED (Electricity Association). The replacement system utilises Oracle forms operating against the CNDB with auto population of many of the relevant fields from information available in TMS (e.g. interruption time, restoration time, customers affected etc.) The auto populated data is verified by authorised personnel and the description of fault cause, equipment involved etc. added before the report is committed as a formal record of the incident.

The IRIS system currently produces a monthly export of incident records in a format that is directly imported into NaFIRS. It is proposed to migrate pre-arranged interruption reporting into IRIS to gain similar consistency and efficiency savings. It is also proposed to move towards producing more user-specific reports directly from the IRIS database, although annual NaFIRS equivalent data will be retained.

A6.1.4 Network Management System (NMS)

The Supervisory Control and Data Acquisition (SCADA) system provides continuous monitoring of the NEDL EHV and HV network including all primary substations.

A new Network Management System (NMS) was fully commissioned during 1999, based on the GE-Harris ENMAC system. NMS stores and maintains a real time electronic schematic model of the EHV/HV System replacing the inflexible wall diagrams and time-expired Ferranti Argus control system. Functionality that links NMS to TMS and AMS has gone through acceptance testing and will shortly be commissioned.

A6.1.5 Plant and Circuit Records

AMS is the primary application for maintaining the asset register within the CNDB. Principle functional areas include identifying and managing maintenance tasks (cyclic, remedial or conditional), managing asset and network data (component data and characteristics), interfaces (NMS, Graphical Tools, and other CNDB applications).

New plant is registered in the Asset Management System (AM S) prior to creation of a network patch in NMS and physical commissioning on the system. Functionality has been developed and is currently being tested to create a link between AMS and NMS. With this functionality in place the real-time commissioning and decommissioning of plant via switching within the NMS diagram will be reflected into the plant status in AMS.

The reported circuit length and type information is based on amendments to a historic rolling total for each category based on additions and deletions to the totals. There are insufficient historic records on which to re-evaluate the totals. NEDL are presently undertaking a data cleansing exercise of computer records and when this exercise is completed (planned for 2002) an accurate record of total circuit lengths should be available.

A6.1.6 Customer Numbers

The premise counts in CNDB are synchronised with the "island agency" Metering Point Administration System (MPAS) via SFIC functionality. All premise information held within MPAS is now maintained via SFIC. As such, the CNDB data forms the most accurate source of information available for the connected premise base within the franchise area of NEDL.

Premises under construction (including plot number) are initially registered in an "in-house" New Connections Administration System (NCAS) that allocates a unique Metering Point Administration Number (MPAN) to the new property. NCAS interfaces with SFIC via nightly batch processes and new properties are appended to the formal premise register in the CNDB and MPAS.

Disconnection requests for premises are received via Supplier flows into SFIC. Once disconnection is physically complete the action is recorded within SFIC and the CNDB updated. Return flows are generated to the relevant Supplier and MPAS is informed.

Supplier flows are utilised to register customer name changes in the CNDB. Customer numbers within the CNDB were formally checked and audited against MPAS on the establishment of the SFIC functionality in 1998. Since then periodic manual reconciliation with MPAS has been undertaken - most recently in May 2000. The move to open market trading has represented a significant change within the industry, particularly in relation to creation, and ongoing maintenance of, customer and premise data.

The linkage between the CNDB and MPAS updates each night via batch processes. Exception reports are produced if transfer errors occur. Manual auditing to ensure reconciliation is carried out a least once per quarter.

The CNDB data now forms the most accurate source of information available for the connected premise base within the franchise area of NEDL. This source is completely stand-alone from Supply Business customer/premise registers other than information exchanged via national arrangements.

A6.2 Documentation of Policies and Procedures

Procedures for GS and OS Standards are documented in a format consistent with ISO 9002 requirements.

It is apparent that the documentation associated with the procedures linking the CNDB support processes is not fully implemented since many of the applications have only recently been commissioned. However in many cases the information required to reported into IRIS/NaFIRS is self-evident from input screens with dropdown menus with associated checks to ensure that all relevant information is reported.

A6.3 EHV and HV Incident Reporting

Reporting of Network Incidents has traditionally been carried out within a number of different paper and computer systems. The information recorded came from a number of different sources and relied on a relatively large number of operatives. The collation of information on HV faults has for some time been contained within the Control section. The use of a smaller number of operatives and recording systems has led to a greater consistency of component and cause reporting detail with HV faults, rather than LV faults.

Whilst the processes were rigorously checked and audited by NEDL, it is inevitable that some data would be missed or recorded incorrectly under such circumstances. NEDL consider that the technical guidance for the interpretation of data for NaFIRS has always been scant, which combined with the number of operatives, has led to a degree of subjectivity.

A6.3.1 Incident Capture

As part of the overall CNDB strategy, the various applications have been interconnected so that creation of an interruption within TMS or NMS will prompt the creation of an incident within IRIS. All the relevant available information presented within TMS will be automatically captured within IRIS. This provides for data entry efficiency savings with incident capture being effectively 100%.

A6.3.2 Number of Customers Affected

The number of customer affected are retrieved automatically by the relevant computer systems using the connectivity model. These are then confirmed or amended by the control engineer. The IRIS system allows all the data on customer numbers to be captured automatically in the NaFIRS format.

A6.3.3 Incident Duration and Restoration Stages

Restoration times are captured control engineers in both computer and paper based systems. For remote HV switching restoration times are taken from SCADA. For manual HV switching restoration times are from field operatives and checked for reasonableness. The IRIS system allows all the data on restoration stages to be captured in the NaFIRS format.

All customers who are restored for more than one minute are reported as a separate restoration stage.

A6.3.4 Fault Cause

Fault causes are entered into IRIS by the control staff based on information received from site. The IRIS system incorporates drop down menus for the NaFIRS causes and component codes to enhance quality of reporting by removing those not used within NaFIRS, either because of NEDL specific equipment or incorrect interpretation.

A6.3.5 Sample Check

A historic HV incident was selected at random at the Control Centre and the processes and information trail leading to information entered in the corresponding IRIS/NaFIRS record were scrutinised and found to be in order apart from a transcriptions error relating customer numbers to restoration stages.

A6.4 LV Incident Reporting

The collation of information on LV faults has now been focused on a smaller number of operatives in a single location (Restoration Dispatchers) to introduce the same level of consistency as for HV faults. As before, data on interruption times, customer numbers, cause of occurrence and components involved is taken from a combination of field reports and computer systems and input to the IRIS system.

A6.4.1 Incident Capture

The creation of an interruption within TMS will prompt the creation of an incident within IRIS. All the available information presented within TMS will be automatically captured within IRIS. This provides for data entry efficiency savings with incident capture being effectively 100%.

A6.4.2 Number of Customers Affected

The number of customer affected are retrieved automatically by the relevant computer systems using the connectivity model. These are then confirmed or amended by the restoration dispatcher. The IRIS system allows all the data on customer numbers to be captured automatically in the NaFIRS format.

A6.4.3 Incident Duration and Restoration Stages

Restoration times are reported from the field and recorded within the TMS as well as on a pro-forma. These times are reconciled to each other and then recorded in the IRIS/NaFIRS system.

A6.4.4 Fault Cause

Fault causes are entered into IRIS by restoration dispatchers based on information received from site. The IRIS system incorporates drop down menus for the NaFIRS causes and component codes. NEDL has rationalised the choices of cause and component codes to remove those not used within NaFIRS, either because of NEDL specific equipment or incorrect interpretation. Where possible auto-population of the IRIS records are carried out, such as for a Substation fuse operation for an intermittent fault.

A6.4.5 Sample Check

A historic LV incident was selected at random. The processes and information trail leading to information entered in the corresponding IRIS/NaFIRS record were scrutinised and found to be in order.

A6.5 Prearranged Interruptions

A further purpose of the CPNL functionality is to allow the identification of customers affected by pre-arranged interruptions. This information is currently published daily on a secure website providing guidance as and when needed to Suppliers. The premise to network model accuracy is currently insufficient to enable a direct notification of customers to be affected by an outage to be operated reliably.

A6.6 Condition 9 Reports

Condition 9 Reports are to the standard format and separately identify low voltage service and distributor faults. The total demand lost (MWh) per 100 connected customers is not reported as it is not required.

A6.7 Future OFGEM Requirements

Quality of Supply Reports are disaggregated into five counties, two of which are predominantly urban, whilst the other three are mainly rural.

The additional information provided on the number of transient interruptions, verified voltage complaints and capital expenditure information is taken from NEDL records. The present and proposed measurement processes that are applicable to future Ofgem requirements are described below.

A6.7.1 Worst Served Customers

Worst served customer is at present identified by using the HV feeder section with the highest number of main line faults. This is a temporary calculation until TMS is able directly to find the location of customers who have had the highest number of interruptions in the year, noting that this will not take account of phasing or open circuit faults. However, for system monitoring purposes this process will still be required as NEDL need to identify worst performing feeder sections to target refurbishment and improvement initiatives.

A6.7.2 Transients (Short Term Interruptions)

HV auto-recloser readings are collected and advances calculated on an annual basis (early April). Readings include all HV auto-reclosing circuit breakers, both ground and pole mounted. NEDL then use the NaFIRS final database and subtract lock-outs from the advance. The remaining events are transient operations. This result is then divided by 1.5 (the average number of operations per transient incident). The figure of 1.5 is derived from measurements recorded on site by transient recording monitors fitted on overhead lines

adjacent to pole mounted recloser locations and is the average number of shots to clear a fault. NEDL multiply the transient incidents by the number of customers in the protected zone to give the number of customer transient incidents and report an overall single figure in terms of Number of Transient Incidents per 100 Connected Customers.

There are no permanent LV auto-reclosers on the NEDL network as they are used only for intermittent faults and safety purposes. These are at present ignored as both the number of operations and the number of customers affected are small. EHV and 132 kV auto-reclosers are not counted as it is highly unlikely that customers will see these - all circuits run in parallel with others.

A6.7.3 Telephone Response

Call Centre services are provided in house by a dedicated team of NEDL Customer Advisors. The NEDL call centre has 2.5 lines per 1000 connected customers.

Daily customer call rates during normal conditions are approximately 600. During the five days of the 1998 Boxing Night Windstorm, call rates rose to an average of 20,000/day, with a maximum of 59,000 on 27/12/1998.

During escalated conditions, Call Centre resourcing is initially increased with shift staff not normally at work and other staff from within NEDL. An overflow arrangement has been established with NESL and up to 100 additional agents can be provided within an agreed time period.

Call performance is continually monitored via BT Management Information System (MIS) by the Team Managers and reported daily to NEDL management and to the Customer advisors.

The current ACD telephony system monitors distribution calls only. No-supply calls are also reported separately. There are no plans to change the existing system. Interactive Voice Response (IVR) is proactively used to provide information in relation to loss of supply, estimated time of restoration and cause if known. The message is regularly updated.

Calling Line Identity (CLI) is presented via the 0800 platform and is used to identify the geographic location from where the customer is calling. Only customers with matching CLI hear the IVR message. After hearing the message customers are still given the options to hold and speak to an agent. If all of the agents are busy the customer is provided with a Fasttrack route to report dangerous situations.

With the focus afforded by IVR, customers who are calling to report a loss of supply for the first time don't have to listen to a potentially long list of other villages/areas affected before being presented with the opportunity to report their new fault.

Call blocking is not invoked by NEDL. Without prior consultation, BT invokes call gapping to protect its network at times of increased traffic.

BT managed answering is used during escalated situations to complement in house IVR system. The messaging is similar to IVR providing customers with information in relation to the loss of supply, estimated time of restoration and cause if known. The message is area specific, but less granular than IVR.

The group Reports are checked against the agent performance reports and periodically audited against the 0800 effective and ineffective call handling report, which is produced by BT.

A6.7.4 Medium Term Performance Monitoring

Trend data in the NaFIRS System & Equipment Performance Report is monitored by asset managers. Security and availability data from NaFIRS will be analysed by excluding extreme events from daily totals of CI and CHL to determine underlying performance trends from plots of 365 day rolling averages.

Asset management is based on "whole-life" optimisation. Asset replacement modelling is undertaken on a five year cycle – data sourced from the CNDB provides an age based replacement programme. This is then re-profiled based on condition evaluation by asset managers.

It is proposed to develop the use of data gathered by Reliability Centred Maintenance (RCM) techniques input to our computer application Asset Management System (AMS).

A6.8 Audits

External Audit Reports in accordance with the Performance Standards Reporting Process, have been carried out by an external auditor.

APPENDIX A7

REVIEW OF MEASUREMENT SYSTEMS

NORWEB

The operation of the Norweb EHV and HV network is undertaken from the central Control Room located in Manchester.

Fault management of the LV network is undertaken from the central Network Restoration Centre located in Preston. The centre has two functions: Customer Service that deals with customer liaison (complaints etc) and service (service alterations, diversions, disconnection's, etc.) and Fault Management and Dispatch that deals with fault restoration.

The Norweb Call Centre at Bolton is managed by Vertex, a company within the United Utilities Group. Proposed new IT systems, including new Trouble-call and GIS systems, are also to be managed by Vertex.

A7.1 Information Systems and Data

Information, including "no supply" calls, received from customers is entered by Call Centre staff into a Customer Interruption & Fault Management System (CIFMS). This information is networked to staff concerned with HV and LV Fault restoration in Manchester and in Preston. A CIFMS algorithm identifies cases where several "no supplies" probably have a common cause. This is done by considering the post-codes of affected customers and the location of distribution substations.

Central Control Room staff use a SCADA system which provides indications from, and control of, approximately 350 grid/primary substations which supply a total of approximately 3000 outgoing 11/6.6kV circuits. The Control Centre also has a separate Control Room Management System (CRMS or Control 2000) which provides HV system graphics. This is a Ferranti Network Management System with a number of enhancements. These include algorithms to sort information from telecontrol, CIFMS, etc and features that provide control engineers with advice on the choice of open points for fault sectionalising.

"No supply" information is also captured automatically by approximately 1000 Power Outage Devices (PODS) that are situated downstream of auto reclosing circuit breakers. These are currently being supplemented by a further 500 devices to give increased reliability of the information which is input into CRMS. Although the primary purpose of the PODS is to monitor the operation of auto-reclosing circuit breakers that are remote from the SCADA system, it has recently been decided that this information will also feed directly into CIFMS.

Up to the end of March 2000 fault report data was input to Mainframe Computer TP NaFIRS system. From 1 April 2000 the PC NaFIRS system developed by Heed for the Electricity Association and is used.

For LV reporting, data is initially entered into CIFMS before being transferred by a batch process into PC NaFIRS.

A7.1.1 Plant and Circuit Records

Plant assets details reside on the Norweb mainframe 'Plant File' system and the Overhead Line assets details are held on a GIS system known as OHMS. The Underground Cable details are held on a number of systems including paper based mains records which has no associated attributes databases and planning tools such as DINIS and IPSA. For the underground cable network there is no system which maintains an accurate running total of circuits both in and out of commission.

For the last four years the total overhead circuit length as reported in the Condition 9 statement and the Quality of Supply report has been based upon the output from the OHMS GIS system. However the changes to the Underground Cable details are based upon manual collation of new circuit length commissioned and circuit length taken out of circuit. A change of UG cable length is therefore expected when a new GIS system is commissioned.

Circuit length is based upon the extension to all distributing mains. When a circuit is extended to provide a service to a single customer at low voltage, this is classified as a service. Norweb Distribution does not separately keep count of the lengths of services in commission.

A7.1.2 Customer Numbers

Customer numbers, defined as metered supplies, are obtained from the CRMS system, which uses information on the number of customers connected at each substation. The numbers were originally uploaded from the plant file, audited as part of CRMS commissioning, and are now updated as part of the routine amendment of HV system records. The plant file customer counts are historically a mix of structured estimates based on transformer capacity and a manual customer count relating customers to network. However, the total of customer numbers in the plant file is within ± 2% of total customer numbers obtained from customer records and MPAN information. Customer numbers in CRMS are adjusted once or twice per year to match the total connected customers, and it is planned to do this quarterly.

There is no connectivity between customer records and system information. The plant file has information on the number of customers supplied from each distribution substation but it is not possible to automatically identify the individual customers. New customer entries for some years have been made from the manual linking of customers to the network.

A7.2 Documentation of Policies and Procedures

Supply Restoration and Fault Management Procedures are set out in a company handbook (Code of Practice 601) though some updating is required to reflect recent organisational changes. The code of practice covers restoration standards, process and resource management, fault location strategy, incident management, use of mobile generators, out of hours service and field support. There is a separate Norweb Incident Management Plan (Code of Practice 604) that covers a wide range of incidents including loss of supply and severe weather. DGES Guaranteed Standards of Performance and Overall Standards of Performance is covered by CP 450.

Norweb use the standard NaFIRS reporting arrangements supplemented by company memoranda on reporting fault start times and the use of AB boxes for EHV/HV and for LV faults.

Condition 9 reports are produced in line with the Ofgem guidelines with any reporting issues being noted in the text.

A7.3 EHV and HV Incident Reporting

EHV and HV fault reports are produced by control engineers at the Central Control Room.

A7.3.1 Incident Capture

All 132kV & EHV incidents are captured by Telecontrol, and manually transferred into both the control room logs and NaFIRS. Telecontrol and CRMS maintain an electronic log of events. All HV incidents are captured from Telecontrol, CIFMS and/or PODs as appropriate

All Incidents are registered on CIFMS and No Supply calls flag up on the CRMS Graphics system, if the customer numbers exceed pre-determined rules. All incidents are recorded in the Control Log and in a register by geographic area plus they are cross-referenced to CIFMS.

The Control Room Manager carries out regular audits on the accuracy of fault reporting.

A7.3.2 Number of Customers Affected

The number of LV customers affected by HV faults are manually extracted from the customer numbers held against individual substations in the plant file. There is no connectivity between LV customers and substations in the IT systems.

One difficulty in establishing accurate customer numbers for HV unganged fuse operation or open circuit HV faults is a lack of reliable information on the phase connection of single-phase transformers and spur lines. Sometimes it is necessary to estimate which transformers, and hence how many consumers, have been affected by such a fault.

A7.3.3 Incident Duration and Restoration Stages

Restoration stages are recorded in the Switching Log and by direct input into CIFMS. Fault Interruption times are taken as the time at which the company first became aware of a fault, ie it is generally later than the Time of Incident (except for Deliberate Disconnection). Interruption times are taken to be the time of:

a. Telecontrol alarm on circuit breaker trip or auto reclose lock-out.

b. Service Electrician reports a dead incoming circuit

c. Second customer call regarding no supplies, or POD alarm, that can reasonably be related (even if they are preceded by a potentially associated neutral current alarm).

At the earliest opportunity the control engineer completes the Preliminary Fault Report with information taken the General Control Engineers Log, the Fault Switching Log, CIFMS and from discussion with site staff. The completed Fault Report is then passed to report to clerical staff for input to NaFIRS.

In the past if a fault had more than 8 restoration stages it was split and reported as two related incidents. This is no longer necessary as, since 1 April 2000, Norweb have been using the latest PC NaFIRS based reporting arrangements, which do not restrict the number of restoration stages. It is understood that all restorations of more than one minute are reported, even if they are of only fairly short duration.

A7.3.4 Fault Cause

Site staff advise the control engineers on the cause of the fault which recorded on the fault report.

A7.4 LV Incident Reporting

A7.4.1 Incident Capture

All LV incidents are entered into CIFMS by LV Fault Controllers. All LV fault records are time stamped and monitored by CIFMS. All CIFMS records are presented to the CRMS algorithms to check for possible HV faults.

A monthly correlation check is made between CIFMS and NaFIRS. This is necessary because there is scope for mis-reporting of LV NaFIRS, as CIFMS has a more comprehensive range of reportable incidents than NaFIRS.

A7.4.2 Number of Customers Affected

Information on the number of customers affected is provided by site staff who count the number of customers affected. Because of a lack of reliable information regarding the phase connection of individual properties, numbers often have to be estimated.

A7.4.3 Incident Duration and Restoration Stages

The start time is taken to be the time that site staff reported that there was no incoming supply at a property, or the time when a second related no supply call was received. Restoration times are as reported by site personnel.

A7.4.4 Fault Cause

Site staff advise the LV fault dispatchers on the cause of the fault which recorded in the fault report.

A7.5 Prearranged Interruptions

Pre arranged outages are all recorded into CIFMS and are currently manually transferred into NaFIRS from the CIFMS information. The number of customers affected are counted as part of the process for producing the statutory notifications.

A7.6 Condition 9 Reports

Norweb Distribution's Condition 9 Reports generally conform to the Ofgem guidelines, any issues being noted in the text.

A7.7 Future OFGEM Requirements

Quality of Supply reports are disaggregated into the territories of the former Manchester, Ashton, Preston, Bolton, Kendal and Carlisle Areas. Information is provided on Customer Interruptions, Customer Minutes Lost and Supplies Restored within 3/24 hours by Area, and on Pre-arranged interruption and Voltage complaints for the company as a whole. There is also information on Rogue Circuits, Exceptional Storms, and Maintenance, Capital Investment and Customer Service Initiatives.

A7.7.1 Worst Served Customers

It is planned to introduce a new computer based GIS and Trouble-Call system that will relate customers to the distribution network. The project has been agreed in principal but full Board approval is still outstanding. 'Without such a system Norweb will not be able to identify worst served customers. Norweb plan to have the necessary facilities in place by April 2002.

The system will cover all voltages of the distribution system and have the capability to provide full connectivity for all consumers. However, this will be limited by the availability and quality of data for input. Phase information of service and single phase transformer connections could restrict its ability to identify all consumers affected by faults.

A7.7.2 Transient (Short Term Interruptions)

Counting short duration interruptions is achieved by monitoring the operation of pole mounted auto reclosers through the installation of power fail monitoring (PODs) connected to low voltage supplies within selected customers premises. The information gathered at individual PODs is pooled into a central system from which system wide reports are produced. The central system analyses the data collected at individual PODs and is configured to ensure that loss of high voltage supply is confirmed by more than one device. When only one device reports an interruption this is assumed to be a low voltage system interruption. In addition, the operation of all Delayed Auto Reclose (132kV), High Speed Auto Reclose at primary substations (33kV and 11kV) and system automation schemes is recorded in telecontrol.

A7.7.3 Telephone response

The Norweb Call Centre is in Bolton and is run by Vertex. The Call Centre is known as the Suppliers Fault Information Centre (SFIC) and deals with all incoming BT calls regarding unplanned supply interruptions. There are 60 incoming lines corresponding to 0.03 lines per 1000 customers.

The normal call rate for the SFIC is as approximately 10000 per month (in hours) and approximately 14000 per month (out of hours). When severe weather conditions occur, the call rate rises dramatically and has been as high as 250000 attempted calls in one day. Additional agents are brought in answer customer calls; more use is made of messaging to try and relay information to larger numbers of customers calls and to keep them up to date with progress.

Monitoring no-supply calls at Bolton is currently done using the Aspect telecommunications system. However, this is due to change by the end of May 2000 when a new system will be introduced.
A new system has been procured from CIM Systems Ltd and BT. This will provide multi messaging facilities remotely on the BT network to relay fault information to customers, thus avoiding the call centre local exchange bottle-neck. This will considerably improve the existing messaging capacity. It will then be possible to message around 40 000 customer calls from various localities simultaneously: the current capability is of the order of 3 600 per hour.

The existing messaging boxes have been increased from 38 to 74 so that customer messages will be more specific to localities. Agents will be provided with information on the local origin of calls and their volumes. They will have the ability to modify the messages broadcast by BT local exchanges as appropriate. The interactive voice messaging has been professionally recorded and will give information such as type and reason for fault, area affected and likely restoration time.

Performance data incoming calls from May 2000 is provided from BT and CIM Systems Ltd and is available in real time. Norweb will also be making use of other BT reporting packages for weekly and monthly reporting.

A7.7.4 Medium Term Performance Monitoring

NaFIRS data is scrutinised periodically to seek trends. This is generally more informative for plant. Circuit trends tend to be picked up routinely under rogue circuit investigations.

As part of Norweb Distribution's response to the price review, an asset management strategy was developed. The short to medium term needs were then assessed via management workshops and modelling. The output from the short/medium term modelling has been used to draft the specific asset replacement policy for the price review period.

All current monitoring systems have been identified in the sections above. Any future development to the current monitoring systems and introduction will be driven by the improved data visibility facilitated through

the introduction of new and improved IT systems. In particular geographical displays and analysis of historic data are required to improve the Norweb understanding of network performance.

A7.8 Audits

Reporting to Ofgem is monitored internally by the Norweb DGES standards co-ordinator as part of an ISO 9002 accreditation for that activity. All failures are documented in accordance with the ISO accreditation. In addition regular auditing of NaFIRS inputs is carried out by the Control Room and Network Restoration Centre management.

APPENDIX A8

REVIEW OF MEASUREMENT SYSTEMS

SEEBOARD

Seeboard operates a centralised control and incident management centre at East Grinstead for HV and LV incidents, including call takers for distribution no supply calls. This is referred to as the trouble management centre (TMC).

A8.1 Information Systems and Data

A8.1.1 NaFIRS

Seeboard uses a mainframe version of NaFIRS as the basis for all internal and external network performance reporting and all data is input into this system manually with no automatic links to other systems.

A8.1.2 Fault Management System (FMS)

A mainframe Powercare IT system is used for managing all trouble related calls. Powercare IT is used for customer call logging, incident management and despatch. A server based FMS replacement of the Powercare IT system is in the course of implementation. Seeboard has a development path for FMS, which includes the integration of NaFIRS and facilities to meet Ofgem reporting requirements for worst served HV customers.

A8.1.3 Network Management System (NMS)

The Network Management System (NMS) is a computer based system which has replaced HV control room wall diagrams and manual switching logs. NMS incorporates network connectivity and maintains a total count of customer number on each transformer, which identifies the number of customers affected by an HV incident up to and including 132kV. NMS is being developed to integrate Scada and to interface dynamically with the new FMS system to identify particular customers affected by high voltage incidents.

A8.1.4 Plant and Circuit Records

Plant data is taken from an Asset Management System plant register, which was demonstrated and incorporates good control of plant details throughout its life and is reconciled with the NMS diagram and numbering.

The mains records and new GIS system were not investigated. Network length data was measured accurately from paper records 10 years ago and records are updated from a computer based process which records additions and deletions from the network on a job by job basis. The customer network link is also updated if anomalies are identified during the course of outages and pre-arranged interruptions. This process is estimated by PB Power to have an accuracy of not better than 95%.

A8.1.5 Customer Numbers

The customer to HV/LV transformer link was developed by reference to the supply business CIS customer records system and paper mains records and validated by Seeboard as having an accuracy of 98% based on quality controlled sampling. Individual customers are related to HV/LV transformers within NMS. The numbers affected by low voltage incidents are identified by site staff, and logged in the Powercare IT system, before being transferred to the NaFIRS reporting system.

Seeboard is implementing a digital mapping GIS system but has no firm plans to link customers with low voltage circuits at this stage. Investigation work is currently in progress to assess the practicality, magnitude, time-scale and cost of linking customers to LV feeders. The implementation of the more accurate customer to transformer link resulted in a 16% step change in the number of customers affected. This has been reported in NaFIRS and Condition 9 reports. Seeboard recognises the need to move to a consistent definition of customers and for a new distribution customer information system, possibly attached to distribution data services systems.

A8.2 Documentation of Policies and Procedures

Seeboard indicate that all fault reporting is strictly in accordance with NaFIRS and Engineering Recommendation G42/3 and no additional written procedures or guidance notes are provided to users. All network performance reporting is carried out in a quality controlled environment at East Grinstead Control Centre / Despatch Centre and staff are trained and authorised to enter data to the various systems. Both network performance reporting and GS and OS standards are accredited to ISO 9002 and subject to six monthly review.

GS and OS Standards are in addition comprehensively documented.

No additional information or guidance is provided for Condition 9 reports or quality of supply reports.

A8.3 EHV and HV Incident Reporting

A8.3.1 Incident Capture

HV NaFIRS reports are initiated by the control engineer on notification of a supply interruption from information from Scada, despatchers and/or Powercare IT. The initiation and completion of fault reports is not automatically linked to NMS or FMS.

Seeboard confirms that the count of incidents includes transient incidents less than one minute on 132 kV circuits as these are defined incidents within NaFIRS. Transient interruptions are those of less than 1 minute arising from due to automatic switching and any other cause.

A monthly audit is carried out on HV NaFIRS and there is a reasonable expectation that HV incidents are correctly identified and reported in the control environment and with the exception of fault causes is considered by PB Power to be accurate to within $\pm$ 1% overall.

A8.3.2 Number of Customers Affected

The number of customers affected are based on the list of transformers affected and customer numbers within NMS at each stage and entered into the HV NaFIRS report by the control engineer.

A8.3.3 Incident Duration and Restoration Stages

Incident time is taken from customer reports where these are earlier than the time that the incident is first reported. The control engineer completes a pro forma HV NaFIRS report, taking restoration times from the automatic switching log in NMS as restoration progresses.

The industry PC NaFIRS computer system now allows for a flag to be set to discount repeated interruptions that arise during restoration stages of the same incident. Seeboard adopt a similar system but repeated interruptions are recorded during fault restoration for customer information purposes but are then discounted as additional interruptions in network performance reporting.

A8.3.4 Fault Cause

Fault cause data is completed from information provided verbally from the field when available and input direct into the HV NaFIRS.

A8.3.5 Evaluation of Lost Demand

Load interrupted is not recorded or reported under HV NaFIRS.

A8.3.6 Sample Check

A sample of HV NaFIRS reports was examined. Fault report 0036 had been accurately reported and data reconciled with information in NMS and Powercare IT. However it was noted that the incident cause was attributed to unknown cause (Code 99) when the actual cause was third party cable damage.

A8.4 LV Incident Reporting

A8.4.1 Incident Capture

All low voltage NaFIRS reporting is carried out at East Grinstead from information taken from the Powercare IT system. Customer calls are associated within Powercare IT and despatched. Restoration times and an estimate of customer numbers are reported verbally from site and recorded in the Powercare IT system which provides information for customers and voice messaging and for performance reporting. There was some initial uncertainty about which low voltage faults are reported. Seeboard reports that all service faults are recorded, as detailed in Seeboard's quality procedures, including situations where a service fuse operated due to load or a fault on the customers equipment.

The LV NaFIRS report is completed from the information within Powercare IT. Low voltage incidents are subject to the same monthly quality checks as for HV NaFIRS and LV jobs in Powercare IT cannot be closed until confirmation of NaFIRS completion has been recorded.

A8.4.2 Number of Customers Affected

Estimates of customer numbers are reported in real time by radio/telephone from site.

Seeboard is of the view that extension of connectivity links between customers and the low voltage network would not overcome the problem that most customer effects would need to be assessed on site and would not be wholly accurate, taking into account unknown phase data, open circuit faults and partial restorations on low voltage circuits, including the use of mobile generation. Lack of information would also put uncertainty on any GS or OS standard for worst served customers.

A8.4.3 Fault Cause

Fault causes are also mainly reported from site at the time of the incident.

A8.4.4 Sample Check

A sample of LV NaFIRS reports was examined. Fault reports 0361 and 0362 were examined and restoration times were accurately recorded. However, it was noted that incident cause was completed as a clerical exercise. This small sample included some errors in reporting an incident where a service fuse had operated.

A8.5 Prearranged Interruptions

Pre-arranged interruptions are recorded in the Powercare IT system and notices hand distributed to customers. Notices are not provided where the interruption is associated with customer initiated work on single services.

A8.6 Condition 9 Reports

Condition 9 Reports are to the standard format and separately identify low voltage service and mains incidents. 18 hour interruptions reported under Condition 9 do not exclude events which are discounted under GS and OS standards. Seeboard Condition 9 report for 1998/99 included amendments to correct the previous 10 years of data in line with the more accurate count of customer numbers.

A8.7 Future OFGEM Requirements

Quality of Supply Reports are disaggregated into four geographical areas agreed with the ECC, although Seeboard do not manage their operations on an area basis.

Seeboard is following a strategy of incremental development of IT systems. The new FMS system will over the next year to provide improved interfacing to other systems with more automatic features and functionality for call takers / despatchers. Together with enhancements to the NMS system and telephone system Seeboard will have the capability to meet most Ofgem future requirements, however they are very concerned over the their ability to meet the future telephone response target during severe weather. Seeboard does not

have any firm plans currently for associating customers with the low voltage network which may impact on its capability to identify worst served customers. Investigation work is currently in progress to assess the practicality, magnitude, time-scale and cost of linking customers to LV feeders.

A8.7.1 Worst Served Customers

Seeboard report on the number of customers affected by more than four HV incidents. In 1998/99 6539 customers on our 20 targeted circuits for improvement experienced more than 4 incidents and the number of customers affected by more than four HV incidents averaged over five years was 1125. Seeboard explain that the difference between these figures show that worst served customers vary from year to year and there is an element of randomness about this measure. The twenty worst performing circuits are identified for investment and progress is reported in the quality of supply report.

It should be noted that Seeboard definition of worst served customers reflects customer interruptions at HV only and excludes interruptions at LV and at 22 kV and above.

A8.7.2 Transient (Short Term Interruptions)

Transient interruptions of less than one minute are monitored and reported for source circuit breakers only and Seeboard has undertaken to measure all transients including those on downstream reclosers by April 2001 and set targets by April 2003.

A8.7.3 Telephone response

Seeboard incident and despatch centre is independent from supply (except for provision of customer data from supply Customer Information System) and a contract for supply to take overspill calls. Calls also overspill to the Seeboard new connections operation. This is only at times of exceptional excessive call flow as in system emergency alerts, in system emergencies or when we may need to close the TMC operations for exceptional circumstances such as fire or bomb alerts etc.

Trouble calls are presented to a BT voice messaging system under predefined conditions. Typically, if an HV fault outage is ongoing, or if the call traffic from an exchange exceeds a pre set limit, nominally 3 consecutive calls. All other calls are delivered directly to our Agents within the TMC. This identifies calls by CLI and callers have the opportunity to listen to fault messages for one the appropriate service area (44 service areas/messages). BT intercepted calls are well within the proposed normal Ofgem standard and are averaged with the calls taken within the distribution incident centre, which monitors calls received and percentage of calls answered in 20 seconds.

Seeboard is currently reviewing the options for new distribution telephony arrangements, which will allow around 200 discrete areas for improved targeting of messages. Seeboard has reservations about is the practicality and appropriateness of the proposed standards of telephone response during emergency situations. For example, when an operational situation is still developing information is not always available from the field during the early stages of an incident.

A8.7.4 Medium Term Performance Monitoring

An Asset Replacement model is used to help determine the asset replacement needs, based on condition and trends in performance and condition monitoring data using a decision support system DSS. An holistic approach is adopted to combine criteria such as strategic importance, asset condition and duty, network development requirements, safety, environmental, quality of supply and overall customers needs.

Reliability Centred Maintenance (RCM) is being used to identify critical components and failure modes.

Profiling based on expected asset lives is used to identify risks in the long term programme.

A8.7.5 Other

Seeboard has a comprehensive IT system called Corvu for extracting and presenting information from NaFIRS and other statistics for network performance analysis and reporting.

Seeboard does not systematically monitor other aspects of power quality but responds to customers needs, particularly large customers most likely to be sensitive to power quality.

Seeboard has defined severe weather conditions which may lead to exemptions under GS/OS standards subject to consultation with the ECC.

A8.8 Audits

Seeboard's centralised operations at East Grinstead include all aspects of incident management and network performance reporting and associated IT systems and data management. It operates in a quality assurance environment with controls on training and authorisation of staff for operational and administrative processes.

Quality assurance procedures are in place for both network performance reporting and GS and OS standards and these were accredited to ISO 9002 in March 1998 and internal and external reports were provided and showed a good standard of quality management.

APPENDIX A9

REVIEW OF MEASUREMENT SYSTEMS

SOUTHERN ELECTRICITY (Southern)

Southern operates a centralised Network Management Centre (NMC) for control of the HV network and incident management and despatch, with support from the depots during normal hours. Fault reporting is the responsibility of the depots but most input for HV faults is at the control centre. Customer calls are currently all taken by the distribution Power Systems Emergency Service Centre at Portsmouth.

A9.1 Information Systems and Data

Southern is following a strategy of aligning its IT facilities with Scottish Hydro with the Energy ENMACS system in the process of implementation. The replacement of the present FMS by the SIMS system used by Scottish Hydro is being considered as an option. It is not planned to include a full customer to network link. Southern considers that the cost of upgrading Southern Electric's systems to the same position would not represent good value for money for customers. Investment is better directed at network improvements rather than the major IT development, data capture and ongoing maintenance that would be needed to track the customer to network links that would be necessary, for example for automatic GS payments based on the number of interruptions.

A9.1.1 NaFIRS

Southern uses a mainframe version of NaFIRS as the basis for all internal and external network performance reporting and all data is input into this system manually with no automatic links to other systems.

A9.1.2 Fault Management System (FMS)

A mainframe "Troublecall" FMS system is used for associating customer no supply calls to incidents by linking postcodes. There is no connectivity between individual customers and the network. Troublecall is used for customer call logging, incident management and despatch and can be viewed and used by all parties. Southern intends to adopt a graphical server based FMS system SIMS currently used by its sister company Scottish Hydro-Electric. SIMS will provide a link between customers and the network. Real time information from the NMS system will identify customers off supply as the HV network configuration changes. The SIMS system also has automatic links to NaFIRS and raises reports and inputs certain restoration times.

A9.1.3 Network Management System (NMS)

A computer based NMS system ENMAC is currently being implemented which will replace the current system of wall diagrams and manual switching logs and replace an integrate the existing SECAT SCADA system and a stand-alone PC system which monitors the 3000 remote operation point s embedded in the 11/6.6 kV network.

A9.1.4 Plant and Circuit Records

Plant data is taken from the Plant and Circuit Asset Register (PLACAR).

Network length data is extracted annually automatically from the GIS digital map mains records. Mains are distinguished form services defined by a cable supplying more than four customers and services to intensive users.

A9.1.5 Customer Numbers

Customer numbers affected by an incident are determined by using an average number of customers for different types of transformer: isolated pole mounted (3), village pole mounted (18), single HV customer (1), village ground mounted (36), Urban domestic (120) and urban commercial/industrial (18). The numbers of customers on individual HV feeders are calculated from the mix of transformers in that feeder and the overall customer numbers from this allocation are then reconciled with the total number of customers. This method is also used for LV incidents where customer numbers are based on average number of customers per low voltage circuit for the different transformer types above. Southern provided details of the calculation which reconciled with the overall number of customers recorded in the supply CSC customer information system.

Southern currently has no plans to link customers to network although their GIS mains records system does show logical service connections and in some cases phase details.

A9.2 Documentation of Policies and Procedures

Southern indicate that all fault reporting is strictly in accordance with NaFIRS and Engineering Recommendation G42/3. Additional guidance notes are also provided for fault reporting. The processes associated with network operation and fault response are well documented and include flow charts of procedures to provide guidance on operational actions and escalation actions for all types of incident. The systems are designed to expedite restoration and provide information feedback to customers.

All these operational procedures are subject to annual audit by external auditors, Marketing Quality Assurance (MQA), including both network performance reporting and GS and OS standards. The systems are not formally accredited to ISO 9002.

GS and OS Standards are in addition comprehensively documented.

No additional information or guidance is provided for Condition 9 reports or quality of supply reports, which follow Ofgem guidance.

A9.3 EHV and HV Incident Reporting

A9.3.1 Incident Capture

HV NaFIRS reports are initiated by the control engineer on notification of a supply interruption from information from SCADA, despatchers and/or Troublecall. The control sheet for the manual switching log includes a working sheet for identifying number of customers affected, based on transformer type, which the control engineer ascertains from the control diagram. The control sheet also includes an action check list including confirmation that the NaFIRS report has been raised. The initiation and completion of fault reports is not automatically linked to NMS or FMS.

Southern confirms that the count of incidents includes transient incidents less than one minute on 132 kV circuits as these are defined incidents within NaFIRS. Transient interruptions are those of less than 1 minute arising from due to automatic switching and any other cause.

A monthly audit is carried out on HV NaFIRS and there is a reasonable expectation that HV incidents are correctly identified and reported in the control environment and with the exception of fault causes is considered by PB Power to be accurate to within $\pm$ 1% overall.

A9.3.2 Number of Customers Affected

Customer effects recorded in NaFIRS for individual HV incident are not accurate and average performance figures cannot be assumed to be accurate to $\pm$ 5% based on the averaging method adopted. However this does not reflect adversely on fast response achieved by Southern in dealing with faults.

A9.3.3 Incident Duration and Restoration Stages

Incident time is taken from the first time the incident is reported to the company. The control engineer completes the restoration stages in NaFIRS, taking restoration times from the HV switching log.

HV PC NaFIRS system now allows for a flag to be set to discount repeated interruptions that arise during restoration stages of the same incident. Southern do not have this feature in mainframe NaFIRS but do not report restoration stages of less than five minutes. All re-interruptions outside this time are reported normally and the interruptions counted as additional interruptions in NaFIRS.

A9.3.4 Fault Cause

The NaFIRS report is completed as far as possible by the control engineer and depot staff confirm fault cause and equipment details and formally sign off the report.

A9.3.5 Evaluation of Lost Demand

Load interrupted based on real time telemetry (actual not maximum demand) is recorded but the information is not used.

A9.3.6 Sample Check

A sample of HV NaFIRS reports was examined. Fault reports 1172 and 0011 had been accurately reported and data reconciled with information on the control sheet, switching logs, and the Troublecall FMS system.

A9.4 LV Incident Reporting

A9.4.1 Incident Capture

Low voltage incident management and despatch is carried out in Network Management Centre. All low voltage NaFIRS reporting is carried out in the depot based on information in Troublecall and from the comprehensive pro forma work record sheets submitted by field staff with their time record claim forms. Customer calls are associated within NMS by postcode and despatched. Restoration times and an estimate of customer numbers are reported verbally from site and recorded in the Troublecall system, which provides information for customers and voice messaging and for performance reporting. All information required for fault reporting is also included on the work order sheets by field staff including fault cause. The NaFIRS report is completed in the depot. Depot income is based on the number of faults dealt with and reported in NaFIRS which acts as a check on fault reporting. The proposed new SIMS system has a direct link to NaFIRS. Types of LV faults reportable under NaFIRS appeared to be understood by reporting staff.

A9.4.2 Number of Customers Affected

Customer effects recorded in NaFIRS for individual LV incident are not accurate and average performance figures cannot assumed to be accurate to better than $\pm$ 5% based on the averaging method adopted. Southern is of the view that extension of connectivity links between customers and the low voltage network would not overcome the problem that most customer effects would need to be assessed on site and would not be accurate, taking into account unknown phase data, open circuit faults and partial restorations on low voltage circuits, including the use of mobile generation. Lack of information would also put uncertainty on any GS or OS standard for worst served customers. The exercise would be expensive and divert money from investment in the network.

A9.4.3 Sample Check

A sample of LV NaFIRS reports was examined. Fault reports 0384 and 0358 were examined and restoration times and other data was accurately recorded and paperwork indicated tight control of reporting systems. Incident 358 was associated with the connection of a generator whilst a problem was investigated on the network. This indicated that Southern report such disconnection's under NaFIRS.

A9.5 Prearranged Interruptions

Pre-arranged interruptions are recorded in the Troublecall (NMS) system and notices hand distributed to customers. Notices are not provided where the interruption is associated with customer initiated work on single services. Pre-arranged outage 0082 was identified in NaFIRS reconciled with the entry in Troublecall.

A9.6 Condition 9 Reports

Condition 9 Reports are to the standard format and separately identify low voltage service and mains incidents. 24/18 hour interruptions reported in Condition 9 do not exclude events which are discounted under GS and OS standards.

A9.7 Future OFGEM Requirements

Quality of Supply Reports are disaggregated into three geographical areas agreed with the ECC, although Southern manage their operations on the basis of 9 areas.

A9.7.1 Worst Served Customers

Southern are not able to identify individual or groups of customers subject to repeated interruptions and do not report worst served customers or worst circuits directly in the quality of supply reports but identify areas where work has been completed and performance improved and plans for future improvements.

Southern is monitoring repeat interruptions on low voltage circuits on a trial basis and has systems to monitor problems of repeat interruptions on its troublesome Consac LV cables. There are no firm plans for identifying individual worst served customers associated with LV incidents.

A9.7.2 Transient (Short Term Interruptions)

Transient interruptions of less than one minute are monitored and reported for source circuit breakers only.

A9.7.3 Telephone response

Southern takes distribution no supply calls in the distribution Power Systems Emergency Service Centre and agents input details of calls into Troublecall and can view progress and estimated restoration times.

As a matter of routine Southern sets up a message on the voice messaging system for each HV no supply incident within two minutes of the first report. Up to 30 messages can be set up covering 74 telephone areas linked to STD areas. Between 85% and 90% of callers listen to the whole of the message which is deemed to be a criteria for satisfactory telephone response. The message is updated as restorations progress.

Southern does not use the telecom service provider as another level of overspill as they consider that messages at this level would be too general and that calls giving information about damage and safety would be lost. Southern also occasionally blocks incoming lines and returns an engaged tone to avoid excessive waiting times. Southern provided comprehensive details of their telephone traffic to illustrate the pattern of calls and response which generally indicates a response to 85% of calls within 15 seconds and a daily range from 75% to 95%.

Southern is considering options for providing mutual telephone support with Scottish Hydro-Electric.

A9.7.4 Medium Term Performance Monitoring

Southern operates a three stage procedure for identifying and taking action where they identify poorly performing circuits. Criteria includes number of incidents, customer minutes lost on a circuit, complaints and a special condition survey. Remedial work is carried out by hot glove teams.

Southern's investment strategy is based on a system of planning briefs for schemes which are prioritised on a scoring system which takes account statutory requirements such as safety and environment, customer service improvements and asset condition. Long range investment plans take account asset age profiles. The technique leads to a series of programmes for overhead line refurbishment and urban and rural automation, Consac cable replacement and major infrastructure renewal.

Investment is directed towards prioritised programmes of work directed towards specific asset classes and performance improvement programmes. Long term asset replacement programmes are assessed for risk using profiling based on expected asset lives.

A9.7.5 Other

Southern monitors network performance on a daily, weekly and monthly basis and has internal target to restore 50% of customers associated with HV faults within 60 minutes, including analysis of failures against this target.

Southern does not systematically monitor other aspects of power quality but responds to customers needs, particularly large customers most likely to be sensitive to power quality.

A9.8 Audits

All of Southern's operational procedures, including those carried out at the Network Management Centre and depots and GS OS and network performance reporting subject to an annual audit by external auditors, MQA. The procedures are not accredited to ISO 9002 but appear to be robust.

Information provided by Southern included a sample of audit reports with an emphasis on improvement actions in addition to compliance issues.

APPENDIX A10

REVIEW OF MEASUREMENT SYSTEMS

SOUTH WALES ELECTRICITY (South Wales)

A10.1 Information Systems and Data

A10.1.1 NaFIRS

South Wales uses a server based version of NaFIRS as the basis for all internal and external network performance reporting. Input to this system is manual for all incidents and NaFIRS is linked to the PRAM project management system in order to capture LV incidents.

A10.1.2 Fault Management System (FMS)

A mainframe Fault Management System (FMS), (CONX) is used for identifying customers affected by HV incidents and has links between customers and HV/LV transformers and protected HV sections. Customer numbers can be aggregated for faults on higher voltage systems.

The CONX mainframe system needs to be replaced by a system based on PCs and file server and the specification will reflect current practices and Ofgem requirements. South Wales has reservations about building in connectivity to the low voltage network on the grounds that accuracy is unlikely to be improved for low voltage incidents.

A10.1.3 Network Management System (NMS)

The Network Management System (NMS) is computer based and replaced HV wall diagrams in 1994/95. NMS has connectivity and maintains a total count of customer numbers on each transformer, which allows the number of customers affected by each stage of restoration to be identified. NMS provides connectivity data dynamically back to CONX allowing CONX to monitor the individual customers affected by HV faults, including during abnormal feeding arrangements.

Low voltage incidents are recorded onto Time Claim forms by restoration and repair staff at depots and the information is manually transcribed the PRAM project management system which in turn automatically transfers the data to NaFIRS.

A10.1.4 Plant and Circuit Records

Plant data is taken from a plant file, which was not reviewed in detail but South Wales indicate that this is accurate to within ± 1%.

Low voltage circuit information is taken from an Intergraph GIS system which records all cables including services which are separately identified. Cable lengths are available as attributes between joints and can be summed periodically to give global figures. HV circuit lengths are taken from the DINIS power system analysis system as these are as laid measured lengths, which are likely to be more accurate than lengths measured electronically from diagrams. Overall circuit data is considered by PB Power to be accurate to within ± 2%.

A10.1.5 Customer Numbers

Customer data is updated daily to CONX from the supply business Customer Information System and customer numbers are based on metered services. However the NMS system which is used principally for identifying customer numbers affected by HV faults is updated annually and is therefore considered by PB Power to be accurate to within about ± 1%.

A10.2 Documentation of Policies and Procedures

South Wales indicated that all fault reporting is strictly in accordance with NaFIRS and no additional written procedures or guidance notes are provided to users. This appears to be a shortcoming especially for LV incidents where the reporting procedures require considerable co-ordination between operating units, central despatchers. LV NaFIRS data is manually transcribed onto Time Claim forms, which are not inline with NaFIRS but are reported to reflect the most appropriate fault causes for South Wales. Responsibilities data

flows and checks were not clear with opportunities for inaccuracies and under reporting (See LV scheme below)

Documentation on the CONX system was provided in the form of guidance notes produced at the time of implementation and mainly relates to a description of the screens and operation of CONX and does not relate directly to NaFIRS fault reporting.

Short summary requirements and procedures were available of the GS and OS Standards which are accredited to ISO 9002 and subject to six monthly audit.

Condition 9 reports and quality of supply reports are compiled from the Ofgem requirements with no additional company documentation.

A10.3 EHV and HV Incident Reporting

A10.3.1 Incident Capture

HV NaFIRS reports are initiated at the control centre, normally by the control engineer, with the initial report on customer effects being added by the shift clerk. The initiation and completion of fault reports is not automatically linked to NMS or CONX. There is a reasonable expectation that HV fault reports are all correctly identified and completed, reconciled with a manual list of faults and daily management report. HV fault reporting is therefore considered by South Wales to be accurate to within ± 1% overall and has been stable for a period of five years. South Wales reported that all HV faults are managed under central control with no delegated control for faults or block reporting under storm conditions.

South Wales confirmed that the count of incidents includes transient incidents less than one minute on 132 kV circuits as these are defined incidents within NaFIRS and have not been excluded. Transient interruptions due to automatic switching systems are excluded from the figures but other short interruptions associated with emergency switching e.g. for embargoed switchgear are not excluded.

A10.3.2 Number of customers affected

The control engineer completes the first stage of the PC NaFIRS report taking the number of customers affected from the list within NMS of transformers affected at each stage.

A10.3.3 Incident Duration and Restoration Stages

A NaFIRS fault report pro- forma is completed by the control engineer or shift clerk from information taken from the NMS switching log. The form is then copied and sent to the depot for completion of fault cause and equipment data.

South Wales reports that the NaFIRS HV scheme now allows for a flag to be set to discount repeated interruptions that arise during the restoration stages. South Wales do not use the recently introduced repeat interruption facility, as their practice has always been to count repeat interruptions. If South Wales started to use the repeat interruption facility there would be a discontinuity in data and South Wales would appear to make a step change reduction in the number of interruptions without there being any actual improvement in service delivery to customers. South Wales preference is to continue to count repeat interruptions. South Wales estimate that all companies who count repeat interruptions report between 10% and 15% more interruptions than those companies who do not count repeat interruptions.

A10.3.4 Evaluation of Lost Demand

Load interrupted is reported under HV NaFIRS to a formulae depending on customer type, with a diversity factor for numbers. The information however is not used for internal or external reporting.

A10.3.5 Sample Check

A sample of HV Fault reports were examined and customer numbers which had been derived from NMS and manually input were found to be within ± 1% of the number reported by CONX. It was particularly noted that outage duration accurately reflected the time that customers reported that they were interrupted and not report received time or time of first operations. There was an accurate match between restoration stages on the control log and the CONX system, although some short re-interruptions during restoration were omitted.

A10.4 LV Incident Reporting

A10.4.1 Incident Capture

Low voltage NaFIRS reporting is the responsibility of the four operating units. Time Claim Forms for fault repair work include provision for recording NaFIRS LV data input by the personnel attending the incident. The form includes only a subset of faulted equipment/component data and two stages of restoration only. The form does not make it clear which LV faults should be reported e.g. metered/unmetered services, cut out faults or only customer involved faults and such faults are not separately identified if reported at all. In practice the fault report element of these forms were not completed to a consistent standard and a fault co-ordinator completed uncompleted cards, including input of customer numbers. CONX does not link customers to low voltage circuits and customer numbers reported are considered to be approximate only.

System checks were reported to be in place to ensure that all LV faults are reported by cross reference between the fault number recorded by the centralised fault despatchers issuing the work instructions and the Time Record Cards. Fault Records also need to be complete before overtime payments are made. These checks were not convincing as many completed cards had no customer effects reported or were duplicated for associated work e.g. excavation.

The LV NaFIRS information is input from Time Record Cards into the PRAM project management system which has an automatic transfer to PC NaFIRS. The PRAM fault report screen is not a complete match with NaFIRS and for example only permits three fault restoration stages.

South Wales recognises that LV network performance is not a significant determinant of total CMLs (5.7 CMLs per year compared with a Great Britain average of 11.7 minutes).

A10.5 Prearranged Interruptions

Pre-arranged outages are notified to customers by post from within the CONX system and single figure GS Standards failures each year. However the system appear to be used only where multiple supply interruptions are involved and do not include: meter changes; service alterations; low voltage service replacements etc. Pre-arranged interruptions are therefore accurate to about +1% -10%.

A10.6 Condition 9 Reports

Condition 9 Reports are to the standard format and separately identify low voltage service and mains incidents. (see previous reservations about accuracy.) 18 hour interruptions in Condition 9 do not exclude events which are discounted under GS and OS standards.

A10.7 Future OFGEM Requirements

Quality of Supply Reports are disaggregated by two Regions based on the specific request of the ECC, although South Wales operate five operational units and report to NaFIRS under eight geographical areas.

A10.7.1 Worst Served Customers

South Wales carry out circuit monitoring for each protected section of HV circuit and can therefore distinguish between incidents affecting different zones of a high voltage circuit and use this as a basis for targeting network investment and reporting for worst served customers

South Wales does not therefore currently report worst served customer performance directly. However recent special CONX extractions have been made to identify the number of customers experiencing more than 18 interruptions. (In this exercise the repeated interruptions during HV faults were ignored). However from these initial figures it will be some years before South Wales are able to meet targets based on 99 % of customers having not more than 5 interruptions.

South Wales are of the view that improvements in CONX connectivity links between customers and the low voltage network would not overcome the problem that most customer effects would need to be assessed on site and would not be accurate, taking into account unknown phase data, open circuit faults and partial restorations on low voltage circuits, including use of mobile generators and temporary connections. Lack of information on low voltage incidents would also put uncertainty on any GS or OS standard for worst served customers.

A10.7.2 Transient (Short Term Interruptions)

Transient interruptions of less than one minute are monitored and reported for outgoing circuits only and not downstream reclosers. However it is understood that the standard autoreclose scheme (Engineering Recommendation G54) will cause the source circuit breaker to operate and reclose for al incidents including those beyond downstream reclosers and therefore all transient incidents are measured.

A10.7.3 Telephone response

Distribution no supply calls are currently integrated with the supply business call centre which has a service standard of 80% of calls answered within 30 seconds.

30 lines are dedicated to distribution and no supply calls to South Wales's 980,000 customers which are normally handled by a dedicated team of 7 to 10 persons.

30 lines are available to overflow calls to the supply business which also has 60 incoming lines.

30 lines are available for calls to overflow to the IVR facility which has call line identification (CLI) but limited flexibility for setting up four different messages.

An overflow of up to 2000 lines is available to the BT exchange where one simple message can be left without CLI.

There are plans to separate distribution and supply call centre arrangements and have seen better systems for dealing with distribution only calls in other distribution companies.

A10.7.4 Medium Term Performance Monitoring

On balance, Swalec suggest that the most reliable and valid indicator of the actual serviceability of the network is the number of faults and failures, suitably disaggregated across relevant asset categories. In order to smooth out the random effects of weather, it would be appropriate to use a "rolling average" approach.

The retirement of circuit assets is prioritised on the basis of reliability, i.e. number of failures experienced and of expected safety performance through knowledge of the actual condition and risk assessment of individual assets. Swalec classify the replacement of the majority of plant items to be safety related.

A10.7.5 Other

South Wales does not systematically monitor other aspects of power quality but respond to customers needs, particularly large customers most likely to be sensitive to power quality.

Monitoring has been extended internally to include duration of interruptions of affected customers. This differs from average customer minutes lost as it is averaged only over the customers affected and not over the whole population and may be useful to manage incident duration.

South Wales expressed concern that in future information may not be available from suppliers in a suitable format for fault reporting and identifying the performance for individual customers or groups and classes of customers. For example dummy metering points are included for unmetered services. It is not possible to distinguish domestic and commercial customers. A nationally consistent definition of customer count is required.

A10.8 Audits

South Wales report that the procedures systems relating to GS and OS Standards were accredited to ISO 9002 and were subject to a six month 9002 audit and annual Ofgem probity audit.

No audits have been carried out on NaFIRS, Condition 9 or Quality of Supply Report data.

APPENDIX A11

REVIEW OF MEASUREMENT SYSTEMS

WESTERN POWER DISTRIBUTION (Western)

Western operates a central control and incident management centre at Exeter, which also deals with LV incidents outside normal hours. LV incident management and resource despatch during normal working hours is the responsibility of 10 districts throughout the south-west. Districts also have responsibility for network performance and fault reporting using common IS systems shared with the Control Centre and the SWEB supply call centre which currently provides a call handling service for distribution.

A11.1 Information Systems and Data

Western is in the process of separation of SWEB supply and Western Power Distribution information systems which will be complete later in 2000 at which time Western will have a fully integrated schematic network management and fault management system.

A11.1.1 NaFIRS

Western uses the Electricity Association version of PC NaFIRS as the basis for all internal and external network performance reporting and all data is input into this system manually. The system provides enhanced facilities for enquiries and reports, which are used for daily, weekly and monthly reporting and audits. Western is in the process of consolidating its ENMAC system and considering possible future links to PC NaFIRS.

A11.1.2 Fault Management System (FMS)

The server based ENMAC system is used as a fully integrated NMS system and FMS troublecall system, presenting control engineers, incident/despatch and call centre staff and depots with the same shared information, including graphical presentation of the network and network off supply.

The FMS part of ENMAC includes screens for call takers, despatchers for management of HV LV and pre-arranged incidents, providing facilities for recording cal details, fault information from the field and NMS and restoration stages. ENMAC also monitors network related GS and OS standards.

A11.1.3 Network Management System (NMS)

The Network Management System part of ENMAC is a computer based system which has replaced HV control room wall diagrams and manual switching logs. NMS incorporates network connectivity and maintains a total count of customer numbers on each transformer, which identifies the number of customers affected by an HV incident, including dynamic changes in network configuration during restoration. NMS interfaces dynamically with the new FMS system to identify particular customers affected by high voltage incidents. Phase 3 of ENMAC will incorporate SCADA.

A11.1.4 Plant and Circuit Records

Plant data is taken from the CROWN Asset Management System and Work Management System.

Circuit length is taken from the vectorised CAD mains records system EMU and updated quarterly. Services are defined by equipment specification e.g. size of cable and are excluded from the numbers used in NaFIRS fixed data.

A11.1.5 Customer Numbers

Customers are linked with HV/LV transformers within ENMAC and no supply calls can be associated to determine the extent of an HV outage. Customer numbers can therefore be aggregated for faults on high voltage systems. Numbers of customers affected by low voltage incidents are estimated from the actual numbers of customer on transformer, based on an average taking into account the number of LV circuits on the transformer and the number of phases affected. This is considered to give more accurate information for average customer effects at LV compared with numbers estimated on site. However it does not accurately report customer effects for individual incidents.

Customer information is currently taken from the SWEB supply business customer data base and ENMAC is updated weekly and is based on connected customers, excluding de-energised and disconnected customers. From November 2000 all customer data will come from the Metering Point Registration System (MPRS) system updated from the Data Transfer Network (DTN) network and from the CROWN system in respect of new connections.

A11.2 Documentation of Policies and Procedures

Western indicate that all fault reporting is strictly in accordance with NaFIRS and Engineering Recommendation G43/2 and associated guidance note TR17. Users were also provided with NaFIRS coding sheets and a PC NaFIRS User Guide. HV network performance reporting is carried out in a controlled environment at Exeter Control Centre and for LV incidents and pre-arranged incidents by team support staff at District. Both network performance reporting and GS and OS standards are subject to six monthly audit but systems are not accredited to ISO 9002.

ENMAC implementation was in progress at the time of the visit and staff were newly trained in all aspects of incident management and reporting. The systems were well supported with documentation and training material.

GS and OS Standards are in addition comprehensively documented.

No additional information or guidance is provided for Condition 9 reports or quality of supply reports.

A11.3 EHV and HV Incident Reports

A11.3.1 Incident Capture

HV NaFIRS reports are initiated by the control engineer on notification of a supply interruption from information from Scada and ENMAC. Western have also installed about 200 PODs on a trail basis. The initiation and completion of HV fault reports is not automatically linked to NMS or FMS.

Western confirms that the count of incidents includes transient incidents less than one minute on 132 kV circuits as these are defined incidents within NaFIRS. Transient interruptions are those of less than 1 minute arising from due to automatic switching. Interruptions due to other causes are classified as interruptions regardless of duration..

A monthly audit is carried out on HV NaFIRS and there is a reasonable expectation that HV incidents are correctly identified and reported in the control environment and with the exception of fault causes is considered by Western to be accurate to within ± 1% overall.

A11.3.2 Number of Customers Affected

The control engineer completes the first stage of the PC NaFIRS report taking the number of customers affected from the list within NMS of transformers affected at each stage.

A11.3.3 Incident Duration and Restoration Stages

Incident time is taken from the earliest time the company becomes aware of the interruption. The control engineer completes the first stage of the PC NaFIRS report, taking restoration times from the automatic switching log in NMS as restoration progresses.

The PC NaFIRS system now allows for a flag to be set to discount repeated interruptions that arise during restoration stages of the same incident. Western do not adopt this system but exclude short duration restorations and re-interruptions when reporting in NaFIRS.

A11.3.4 Fault Cause

HV NaFIRS is completed by the control engineer and fault cause data is completed from information provided verbally from the field when available and input direct into the HV NaFIRS. The HV Fault report is checked and completed by depot staff responsible for network performance.

A11.3.5 Evaluation of Lost Demand

Maximum demand interrupted recorded in NaFIRS is calculated from actual demand interrupted indicated by SCADA.

A11.3.6 Sample Check

A sample of HV NaFIRS reports was examined. Fault report 0021 and 0035 had been accurately reported and data reconciled with information in ENMAC NMS switching Log and ENMAC FMS incident log message.

A11.4 LV Incident Reports

A11.4.1 Incident Capture

LV incident management and despatch is carried out at districts during normal working hours from the control and incident centre at Exeter at other times. Districts and teams have full responsibility for network performance and all fault reporting.

The LV NaFIRS report is completed from the information within ENMAC on a daily basis by the experienced team support staff. Low voltage incidents are not subject to the same monthly quality checks as for H V NaFIRS but LV jobs cannot be closed until confirmation of NaFIRS completion has been recorded.

A11.4.2 Number of Customers Affected

Numbers of customers affected by low voltage incidents are estimated from the actual numbers of customers on a particular transformer, taking into account the number of LV circuits on the transformer and the number of phases. Fault causes are also mainly reported from site.

Western report in accordance with NaFIRS instructions and exclude cut out fuse operations and segregate service and mains incidents.

Western is of the view that extension of connectivity links between customers and the low voltage network would not overcome the problem that most customer effects would need to be assessed on site and would not be wholly accurate, taking into account unknown phase data, open circuit faults and partial restorations on low voltage circuits, including the use of mobile generation. Lack of information would also put uncertainty on any GS or OS standard for worst served customers.

A11.4.3 Incident Duration and Restoration Stages

Restoration times are reported verbally from site and recorded in ENMAC FMS.

A11.5 Prearranged Interruptions

Pre-arranged interruptions are recorded in the ENMAC system and notices hand distributed to customers. Notices are not provided where the interruption is associated with customer initiated work on single services.

A11.6 Condition 9 Reports

Condition 9 Reports are to the standard format and separately identify low voltage service and mains incidents. 18 hour interruptions reported in Condition 9 do not exclude events which are discounted under GS and OS standards.

A11.7 Future OFGEM Requirements

Quality of Supply Reports are disaggregated into seven geographical areas agreed with the ECC and correspond to the Western's District management structure. Western also reports to the ECC on a two monthly basis.

A11.7.1 Worst served customers

There are no plans currently to extent the customer to network connectivity level to individual LV circuits and phases.

Western does not measure or report on worst served customers directly in terms of number or percentage of customers affected by more than n incidents over a period. Western approach worst served customers by means of a special design team which identifies worst performing circuits from a variety of indicators: more than 4 faults per circuit averaged over 5 years, circuits with more than 2500 customer hours lost, circuits with a high level of complaints or transients. Progress on work on these circuits is reported in the quality of supply report and ECC updates.

A11.7.2 Transient (Short Term Interruptions)

Transient interruptions of less than one minute are monitored and reported for source circuit breakers only.

A11.7.3 Telephone response

SWEB supply call centre currently takes all distribution business no supply calls, although the complete service is currently out for tender.

Automatic messaging is set up for 10 geographic areas. Calls are diverted to these messages from CLI information and customers have the option of talking to an agent. Messages are updated half hourly.

Overspill calls may be diverted to a BT message (1800) lines but this gives no option for customers to talk to a call agent. This is not favoured in severe weather when information about network damage and priority customers are required.

A11.7.4 Medium Term Performance Monitoring

Network performance is routinely analysed as part of the preparation process for capital expenditure. Analysis of poorly performing circuits is carried out and improvement plans created. Additionally, electrical plant is reviewed at the end of its expected life. Its condition is assessed and plans made to replace it, review again at a predetermined interval or to refurbish it.

HV electrical equipment except for overhead conductors and underground cables are recorded on the CROWN database. From this data, together with condition reports recorded at the time of routine maintenance, a planned programme of replacement is created. Information regarding performance is also included in the assessment.

Age profiling is used in order to assess risks in the long term programme.

A11.7.5 Other

Western monitors network performance, daily, weekly and monthly.

In addition to the condition 9 measures, Western also monitors and targets the number of customers restored within one hour for HV faults and this has increased from 55% to over 70% in five years.

Western does not systematically monitor other aspects of power quality but respond to customers needs, particularly large customers most likely to be sensitive to power quality.

Western has declared severe weather exemptions on two occasions in the past ten years. There is no fixed definition but takes into account safety constraints on commencement of repair and restoration work.

A11.8 Audits

Western's centralised operations at Exeter include all aspects of incident management and network performance reporting and associated IT systems and data management. It operates in a quality environment with controls on training and authorisation of staff for operational and administrative processes. Similar standards applied at the depot visited at Taunton. HV NaFIRS reports are reconciled by the business manager on a monthly basis.

Western internal auditors carry out audits on OSs and CGs annually. This work is then the basis upon which Arthur Anderson, in conjunction with their own work, forms an independent external opinion on the Companies compliance with best practice and the associated reported systems.

Details of audits were provided for June 1998 and May 1999 and contained no significant issues for comment.

No audits have been carried out on network performance reporting (unless related to an OS or CG) The audit plan for 1999-2000 includes a network performance audit.

APPENDIX A12

REVIEW OF MEASUREMENT SYSTEMS

YORKSHIRE ELECTRICITY (YE)

YE operates a central Operations Centre and an HV network Control Centre in Leeds. The Operations Centre dispatch Work Orders to several Field Operations Centres who deal with HV & LV switching/repairs to restore supplies. A common Information System networked between the Operations Centre, the Control Centre and the Field Operations Centres is used for network performance and fault reporting.

A12.1 Information Systems

The Distribution Asset Management System (DAMS) and associated integrated applications is the collective name describing the system that support the management and operation of the YE Distribution Business. The five major applications are the Customer Contact Handling (CCH) 0800 Telephony System, Distribution Business Documentation (DBD), Repair Resource Despatching (MAXIMO), Distribution Management System (DMS) and Quality of Service and Event & Fault Reporting (NaFIRS). DAMS is networked throughout the business.

Incoming and outgoing CBs at primary substations are monitored and remotely controlled by the DMS SCADA system. The status of other switching devices on a circuit are manually recorded by control engineers based on information received from field personnel. The DMS diagrams manually dressed by control engineers.

A12.1.1 Plant and Circuit Records

The YE applications use two databases: an object oriented Asset Recording database (AR&V) containing mostly substation and plant type data; and a Geographic Information System (GIS) with all the overhead and underground circuit data.

YE currently use a legacy system to record circuit length information which is based on a historic system survey which is updated monthly with system alterations. YE are nearing completion of data cleansing a GIS system which will enable more accurate records to be obtained. However the improved accuracy provided by GIS is likely to mean a step change in the reporting of circuit length.

Circuit length does not include services. A service is defined as a length of low voltage cable or overhead line supplying a single customer.

A12.1.2 Customer Numbers

YE are currently using legacy systems that are based on a historic survey with adjustments to reflect a best estimate of the total number of customers. This year will see the full introduction of a GIS system which will enable accurate and auditable customer numbers to be obtained. This could produce a step change in the reporting of customer numbers. On the GIS system each customer is identified individually and linked electrically to the service termination. A connectivity trace from the point of interruption will count the number of affected customers.

YE consider that the definition of a “customer” needs to be agreed at a national level to enable a single complete and accurate database for metered and unmetered customers to be produced. The YE GIS system could then be adjusted to provide an accurate value for the customer numbers. Inaccuracies occur in a number of areas such as incorrect service connections, in streets with several cables (especially in ducted systems where services may have been connected in the past to an ambiguous cable)

Customers will be related to the premises as identified in OS AddressPoint, based on the Postal Address File, or surrogate if no postal address. It is assumed in the trace that all linked customers are active (i.e. no idle services). There will be a small overestimation of customer numbers.

Reconciliation of customer numbers with customer databases is being considered as a future enhancement to GIS; the addresses from OS AddressPoint used in the GIS can be matched with MPAS, and the MPANs included in the GIS. Updating of the GIS is carried out continuously as properties are built or demolished. The GIS always reflects the most up to date position and topography of the YE network. As updating is not a

simple task no one database is complete and accurate. YE estimates that the GIS system is currently less than 5% in error, and current data cleansing initiatives will improve this accuracy further.

Phase colour in the GIS record refers to the colour of the live core in the LV main that has been used to connect the service. This is not necessarily the colour of a fuse that has blown, since cross jointing may have occurred. Some localities may have less cross jointing than others and local engineers may have knowledge of areas where data is more trustworthy.

A12.2 Documentation of Policies and Procedures

YE has identified 34 Business Processes in the Distribution Business and the DBD system holds all associated documents in electronic form that are controlled in a managed environment. The documents are available to all staff in a read-only format. There is a comprehensive set of documents dealing with reporting Customer Service Standards of Performance of which NaFIRS data is a subset. There is also a Code of Practice – Guidance on Recording "Events and NaFIRS" information.

A12.3 EHV and HV Incident Reporting

All incidents recorded in the Events & NaFIRS system are logged at an asset level within the DAMS asset register. Disaggregation can therefore be carried out on any asset related parameter which is held on the asset register, for example manufacturer, age, location, circuit and voltage.

Non consumer involved incidents are recorded in NaFIRS for voltages at 11kV and above.

A12.3.1 Incident capture

HV incidents are captured at the central Control Centre by changes of state notified by the DMS SCADA system or at the Operations Centre by customers calls notifying that they are off supply. Operations Centre dispatchers issue work instructions to Field Operations using the MAXIMO system. The time of the incident for reporting purpose is either the time taken from the DMS SCADA or the time at which the fault was first reported provided it was subsequently confirmed as a fault. Incident capture is essentially 100%.

A12.3.2 Number of Customers Affected

For HV faults a structured estimate based on knowledge of customers connected to distribution substations is used from information held on a stand alone data base that is updated twice a year. The distribution substations affected by the incident are manually identified by the control engineer and then the number of customers connected to each affected distribution substation are manually summated to provide the total number of customers affected by the incident.

In future YE propose to use the GIS to trace the number of customers affected by an interruption but at present there is no business case for this. The GIS could be used for any type of interruption at any point on the network. Running separate traces will produce the number of customers affected by different restoration stages.

A12.3.3 Incident Duration and Restoration Stages

Control engineers create a "pink" NaFIRS Input Form for each fault from information recorded on the written Control Room Log Sheet. The form includes details of: Fault ID; Interruption Date and Time for each Restoration Stage; Number of Customers Affected at each Stage; and Maximum Demand associated with each Stage.

Where the restoration has been carried out under local control the times reported by Field Operations staff are recorded on the Control Room Log Sheet. For restoration under Control Centre remote control the restoration times are the times from the DMS SCADA system. At HV and above the accuracy of restoration time information is high. This is attributable to the use of SCADA information and also the centralised control of restoration stages.

Repeated interruptions during fault restoration are dealt with by separate restoration stages on the NaFIRS records. The number of interruptions is calculated from the total number of restoration stages and the customers involved in each stage. Short duration restorations, of less than 10 minutes, are not recorded, this results in over reporting of CML.

Incidents where the interruption time is less than 1 minute are excluded from NaFIRS recording. Autoreclose operations are recorded at source circuit breakers to provide a count of transient incidents and information on these transient interruptions is not included within the NaFIRS data. The only autoreclose operations recorded in NaFIRS are at 132kV. All switching for safety and emergency which results in customers being off supply are recorded in NaFIRS.

Transmission and generation failures are recorded in the same way as faults. They are recorded on NaFIRS using the appropriate cause codes.

The block reporting procedure available in G43 for abnormal or severe weather has not been used by YE in the past. The information which is provided by not utilising this reporting procedure provides important detailed information on the performance of the network during severe weather.

A12.3.4 Fault Cause

NaFIRS fault information is manually entered into a NaFIRS input screen by Control Centre staff when the "pink" form is completed as far as possible by the control engineer. The "pink" form is then despatched to the Field Operations depot dealing with the fault for updating by Field Operations staff with the particular NaFIRS codes associated with the nature and cause of the fault. The electronic NaFIRS record is then updated by Field Operations staff and the record is closed.

A12.3.5 Evaluation of lost demand

For HV faults and above the demand lost is taken from the Distribution Management System (DMS) SCADA at the time of fault.

A12.3.6 Sample Check

A historic HV incident was selected at random at the Control Centre and the processes and information trail leading to information entered in the corresponding NaFIRS record were scrutinised and found to be in order.

A12.4 LV Incident Reporting

All incidents are recorded in the Events and NaFIRS system. It is the responsibility of the field engineer on site to record the information in Events and NaFIRS system on return from site.

A12.4.1 Incident capture

LV incidents are captured at the central Operations Centre by customers calls notifying that they are off supply. Dispatchers issue work instructions to Field Operations electronically. The time of the incident for reporting purpose is the time at which the fault was first reported provided it was subsequently confirmed as a fault. Incident capture is considered by PB Power to be essentially 100%.

A12.4.2 Number of Customers Affected

At LV a manual process of relating the customers to the network using mains records is employed. If customer phasing is known then a count of customers per phase is possible. Otherwise this is estimated by dividing the total number of customers by three for a single phase fault. In future YE will use GIS to trace the number of customers affected by an interruption. This can be used for any type of interruption at any point on the network. Running separate traces will produce the number of customers affected by different restoration stages.

A12.4.3 Incident Duration and Restoration Stages

Field Operations staff create a paper based Fault Report for each LV fault that includes details of: Fault ID; Interruption Date and Time for each Restoration Stage; and Number of Customers Affected at each Stage. When restoration/repair is complete the Fault Report is completed with additional NaFIRS fault information. The electronic NaFIRS record is then created by Field Operations staff and the record is closed.

Unmetered service faults are not required to be recorded in NaFIRS. Information on these faults is recorded within YE through normal work recording systems (CCH, MAXIMO). This allows YE to monitor their performance in repairing these faults.

All metered service faults are recorded in NaFIRS. A few cut-out incidents are recorded in NaFIRS following the normal procedure.

Events & NaFIRS records are not created for LV incidents where there is no consumer involved.

YE use the AB boxes for LV faults only. The AB boxes are used to record the LV main equipment involved, the substation number and the number of the LV way. This allows disaggregation of LV faults on a circuit basis.

A12.4.4 Fault Cause

The time elapsed between carrying out extensive fault work on site and returning to the Field Operations office to input data can be considerable. In some instances this can lead to degradation in data quality. This issue will be addressed by the imminent implementation of a Centralised Regional Despatch Unit (RDU). One of the process changes this introduces is that the management of LV faults and the input of data to NaFIRS will be managed centrally. This will raise the quality of information recorded at LV to that of all other voltages.

A12.4.5 Evaluation of lost Demand

For LV faults YE use an empirical approach where the number of customers interrupted is multiplied by the average ADMD (After Diversity Maximum Demand) of a customer. The value of ADMD used is 1.5kW and is consistent with the values used when designing and extending the LV network.

A12.4.6 Sample Check

A visit was made to a Field Operations Depot and a historic LV incident was selected at random. The processes and information trail leading to information entered in the corresponding NaFIRS record were scrutinised and found to be in order.

A12.5 Prearranged Interruptions

All pre-arranged outages where statuary notice has been provided to customers are recorded within the Events & NaFIRS system. Any other customer agreed interruptions are recorded in the Events & NaFIRS system following the Code of Practice “Guidance on recording ‘Events & NaFIRS’ information.

Pre-arranged outages are all subject to statutory notice. The only exception is where a customer is off supply due to a fault and by local agreement remains off supply until the repair can be carried out. For these purposes the time of agreement with the customer becomes the start time of the pre-arranged outage.

The information about faults is recorded in the Events & NaFIRS system. Information on pre-arranged outages is entered by Field Operations staff following the outage. The number of customers affected is based on a count of the number of outage cards delivered.

A12.6 Condition 9 Reports

There are no variations or anomalies between the Condition 9 statement and NaFIRS relating to fault incidents as all of this information is provided from NaFIRS.

The system reliability data in the Condition 9 statement is produced by taking the number of incidents from NaFIRS and dividing this by the total length of the distribution system. YE are in the process of data cleansing their GIS system which will enable them to produce a more accurate statement. This may produce a step change in this reported figure as the accuracy of the length of the distribution system will be enhanced.

A12.7 Future Ofgem Requirements

The fault information presently provided for the QoS Report is provided from NaFIRS data. This consists of number of customer interruptions, the customer minutes lost and the restoration times.

The additional information provided on the number of transient interruptions, verified voltage complaints and capital expenditure information is taken from internal YE records. The present and proposed measurement processes that are applicable to future Ofgem requirements are described below.

A12.7.1 Worst Served Customers

The YE definition used to identify 'worst served' customers is a customer experiencing an average of four HV faults per year over the last four years. These circuits are identified from analysis of the NaFIRS information recorded in the Events & NaFIRS system.

YE is not planning to enhance their GIS system to link faults to customer numbers connected at LV, although this would be possible.

A12.7.2 Transient (Short Term Interruptions)

The number of transient interruptions reported is a count of the number of autoreclose operations at the source circuit breakers and is obtained from the DMS. YE have the ability to monitor power quality at all of their primary substations by the use of the substation fault recorder. Currently the recorders are set up to make measurements to assist in condition monitoring of the circuit breakers.

YE plan to use the Events & NaFIRS recording system to record circuit breaker autoreclose operations. This will provide a true reflection of the total number of transient interruptions experienced on the network. This information will be recorded internally in the Events system and will not be available in NaFIRS.

Voltage dips are only monitored as a result of customer complaints. The information included in the QoS report is the number of verified steady state voltage complaints during the year and the number which are rectified within the allotted 6 month time period.

A12.7.3 Telephone response

The YE Operations Centre is supported by a high capacity telephony messaging system on the BT telephone network, which can split the YE region into 150 separate geographic areas. This facility has 15 desks available 24 hours a day, with an internal company overflow available to the Supply call centres at Bradford and Sheffield, which is only used in extreme circumstances. This overflow provision has not been required to date.

The current telephone voice messaging system is based on the BT intelligent call routing platform. Customers dial the YE fault 0800 number and they are detected as calling from a particular geographical area. This message is updated with a description of the area affected and time of fault with an estimated restoration time, as the information becomes available. Customers are given another 0800 freephone number at the end of the message to call back into the Operations Centre if they have any information about the fault or need to speak to an agent.

The distribution call centre responds to approximately 1200 calls on a normal day. This may rise to somewhere between 10,000 and 20,000 depending upon the type and number of faults. In all cases customers receive an immediate response. The messaging system can be activated within two minutes for faults identified on the HV system, as this is monitored by Control Engineers using the DMS SCADA system. When faults occur on the unmonitored LV network, the Operations Centre relies upon calls from customers to identify the fault. The computer system monitors the BT platform and if more than three calls are received from the same zone, any further calls are routed to a default message. This message informs the caller that a fault has been detected in their area and to phone back later if they require updated information. During extreme circumstances, such as adverse weather conditions, the messaging system would be used to answer customer calls by informing them that YE were aware of a major problem in the area. During the initial period, where it may not be possible to immediately send teams out to repair the faults because of the weather conditions, YE would look to establish a larger agent call answering capacity. This would ensure that important customer information could be received and logged to assist the location of faults to be established as quickly as possible.

Call answering response is measured by using statistics from BT and YE internal Automatic Call Distribution (ACD) systems. BT RAW call data is delivered from BT every week on CD, providing continual Operations Centre performance information. This year YE are changing the telephony computer platform, which will give the opportunity to develop the call monitoring system further with the introduction of soft ACD. This software ACD will allow YE to configure and collect the statistical information required at any time. YE are also currently trialing an interactive voice response (IVR) system in order to deal with the increasing number of mobile and other service provider calls that cannot be picked up by the BT platform.

Call blocking is not applied to the Yorkshire Electricity telephony system. Call blocking would only be adopted by BT to protect their network during times of extreme stress. This would be an extremely rare occurrence.

Messages are provided at BT exchange level so the number of telephone lines available into the company does not limit the capacity of the messaging. Also it ensures the lines into the company remain free to receive other calls from priority lines (such as numbers given to cable contractors etc) to ensure they can still talk to the call centre as they may have information which will allow the faster restoration of supplies.

A12.7.4 Medium Term Performance Monitoring

The performance of the asset base is monitored using data obtained from the Events/NaFIRS reporting system and the condition point monitoring of the asset from inspection, maintenance, and remedial work. Asset management tools, such as Failure Modes and Effects Analysis (FMEA), are used to analyse and then document the way in which the asset base performs, or fails to perform. Profiles of asset failure modes have been developed, and specific data on these is collected via the Events/NaFIRS reporting system. The asset base performance with respect to specific business issues such as quality of supply can then be determined. In this way, the impact of asset failures on key outputs, such as CML or CI, are quantified and the most appropriate investment decisions can then be made.

The YE method of evaluating asset performance allows for quantified assessment of risk associated with 'slow moving' customer service issues. YE use this approach to balance the needs of addressing immediate QoS measures against the need to protect customers against risk exposure to the low probability, high consequence failures of the type observed in Auckland in recent years.

YE has aided and sponsored the development of some sophisticated decision making tools. These tools are now used by YE asset managers to assess the asset base performance and develop asset management regimes for it which optimise the cost/risk trade off. YE are able to more rigorously evaluate the business risk cost associated with asset failure and the cost of mitigation. By doing this in a quantified way, YE can evaluate the optimum maintenance, inspection, repair and asset replacement regimes.

A12.8 Audits

Auditing of the 'Events & NaFIRS' system is scheduled to be carried out on an annual basis in accordance the working procedure for auditing of Events & NaFIRS data. Previously this was audited externally.

When notification of an interruption is received by the YE Operations Centre, a work instruction is issued electronically to Field Operations via the CCH and MAXIMO systems. By comparison of the data in these systems with the NaFIRS database, YE can cross check that number of reported incidents.

APPENDIX A13

REVIEW OF MEASUREMENT SYSTEMS

SCOTTISH HYDRO-ELECTRIC (SHE)

SHE operates a Service Management Centre in Perth and an HV Network Control Centre in Pitlochry. The Network Control Centre dispatches instructions to 7 District Operations Centres who deal with HV switching/repairs to restore supplies. The Service Management Centre dispatch Work Orders to 10 District Operations Centres who deal with LV switching/repairs to restore supplies. A common Information System networked between the Service Management Centre, the Control Centre and the District Operations Centres is used for network performance and fault reporting.

A13.1 Information Systems and Data

Service Management Centre (SMC) agents take calls and input information into the Supply Management Information System (SIMS) which has a call association function that identifies calls from the same locality. This function is used to pinpoint faults on HV circuits.

The SMC is integrated with SIMS and on confirmation of a customer off supply the SIMS dispatchers create an incident which automatically generates HV and LV NaFIRS forms for subsequent completion.

A SCADA system extending to all primary substations is integrated with the Energy Network Management and Control System (ENMAC). Incoming and outgoing CBs at primary substations are monitored and remotely controlled by the SCADA system. The status of other switching devices on a circuit are manually recorded by control engineers based on information received from field personnel. The ENMAC diagrams manually dressed by control engineers.

A13.1.1 Plant and Circuit Records

Plant and circuit data is stored in PLACAR which essentially covers substation equipment. Circuit data is held on GIS which will be up to date by the end of 2000.

A13.1.2 Customer Numbers

Customer numbers are identified by the number of metered supply points. The PES Registration system is liked to SIMS. Customers and network are linked down to LV feeder level. The SIMS database is updated on a daily basis with customer information.

A13.2 Documentation of Policies and Procedures

SIMS procedures are fully documented covering: HV and LV NaFIRS; plant identification numbering covering primary substations, HV feeders, transformers, LV feeders; and customer details.

Procedures for GS and OS Standards procedures documents are accredited to ISO 9002 and subject to QA audit.

A13.3 EHV and HV Incident Reporting

The NaFIRS report is completed in the control centre and entered manually into the SIMS system. SHE reports to NaFIRS and disaggregates data into ten districts. SHE also reports under NaFIRS Table 8 which provides a more detailed breakdown of HV interruption duration.

A13.3.1 Incident Capture

HV NaFIRS fault reports are initiated automatically at the control centre by SIMS. The actual times of occurrence of incidents are based on the time of first call received by the SMC or the change of state recorded by the SCADA system. The incident count includes transient incidents less than one minute for 132 kV and 275 kV circuits as these are defined incidents within NaFIRS. Transient interruptions of less than one minute from any other cause are excluded from the figures.

Written switching logs are maintained by control engineers that includes short term close/trip interruptions during fault restoration. NaFIRS report input forms are automatically created by SIMS for each incident and capture is considered by PB Power to be essentially 100%. SHE report that all HV faults are normally

managed under central control but with some delegated control to the districts for faults under storm conditions.

A13.3.2 Number of Customers Affected

Number of customers affected by an incident is based on manual interrogation of SIMS connectivity model to identifying the transformers (which includes the number of customers connected) that are off supply for each stage of restoration. The SIMS connectivity model is dynamically updated as the network topology changes.

A13.3.3 Incident Duration and Restoration Stages

Switching logs for HV incidents manually recorded on paper forms by control engineers based on field and NMAC information. The time of occurrence of an incident is taken from the time of the first call taken by the SMC as recorded on SIMS or the time of the change of state recorded by the SCADA system.

The HV NaFIRS scheme now allows for a flag to be set to discount repeated interruptions that arise during the restoration stages. SHE does not use this facility.

A13.3.4 Fault Cause

HV incident information manually transcribed by control room staff from the written switching log to SIMS HV NaFIRS input screens. Faulted equipment and fault cause data is captured from a number of sources.

A13.3.5 Evaluation of Lost Demand

For HV faults the control engineer records demand restored in kW taken as taken from SCADA data.

A13.3.6 Sample Check

A historic HV incident was selected at random at the Control Centre and the processes and information trail leading to information entered in the corresponding NaFIRS record were scrutinised. There was an accurate correlation between restoration stages on the written switching log and the SIMS NaFIRS fault report, although some short time close/trip re-interruption stages of less than one minute were omitted.

A13.4 LV Incident Reporting

Low voltage NaFIRS reporting is the responsibility of the ten districts.

A13.4.1 Incident Capture

LV NaFIRS fault report input screens are automatically created by SIMS at the Service Management Centre and access to SIMS is available at District level. A written log of the LV incident is maintained by District personnel and NaFIRS information is manually transcribed into the SIMS NaFIRS screen form. SHE report all LV incidents including all single service interruptions and cut out faults, but not cut out fuse operations. Incident capture is considered by PB Power to be essentially 100%.

A13.4.2 Number of Customers Affected

SIMS has links to LV circuits and this provides a reasonable level of accuracy of reporting the number of LV customers affected. For partial LV faults the customers affected are identified from plans and confirmed on site.

A13.4.3 Incident Duration and Restoration Stages

Switching logs for LV incidents are created and recorded on paper forms at district/field level. The process does not always take account of re-interruptions or temporary restorations. There will therefore always be a level of inaccuracy in LV reporting which will have an impact on the identification of worst served customers, both individually and in aggregate.

A13.4.4 Fault Cause

LV incident information is manually transcribed by district staff from written switching log to SIMS LV NaFIRS input screen.

A13.4.5 Evaluation of Lost Demand

For LV faults SHE estimate the customer demand lost based on tariff information in SIMS. SHE recognise that this may now be a business separation issue.

A13.4.6 Sample Check

A visit was made to the Perth District Office and a sample LV NaFIRS forms completed at by District Staff were completed to a reasonable standard and were reconciled with the Service Management Centre Report and the SIMS record.

A13.5 Prearranged Interruptions

Pre-arranged outages are notified to customers [by post] from within SIMS system for all [single] and multiple customer outages. There is a documented procedure in the SIMS manual covering this process.

A13.6 Condition 7 Reports

Condition 7 reports and quality of supply reports are compiled from the Ofgem requirements and separately identify low voltage service and mains incidents.

A13.7 Future OFGEM Requirements

Quality of Supply Reports are disaggregated into East, Highlands and Island regions.

A13.7.1 Worst Served Customers

SHE does not report on worst served customers in the Quality of Supply Report but reports on lowest performing circuits. The SHE SIMS and NaFIRS data bases contain the information to determine the worst served LV circuits and associated customers, but a search tool to extract this information will need to be developed.

A13.7.2 Transients (Short Term Interruptions)

Transient interruptions of less than one minute are reported based on operations of source and downstream auto reclosing devices and manual count of certain downstream reclosers. SHE has identified potential anomalies in counting reclosures due to repeated shots taken by some devices on the same fault clearance ie within the one minute period.

A13.7.3 Telephone Response

SHE Call Centre services are provided in-house and SHE has no plans to change this part of the organisation. The Call Centre has 120 incoming lines corresponding 0.18 lines per customer.

Under normal conditions SHE receive 330 emergency calls per day. During storms that can increase to 11,500 calls per day where the increase is dealt with using a combination of: overflow into SHE Customer Service Centres; Interactive Voice Recording (IVR) real time messaging; and back-up standby arrangements. SHE have no plans for significant change.

IVR messaging is provided by a BT platform where meaningful messages are recorded and updated in real time and directed to respond to the specific STD codes (where this is available) of the incoming calls.

Telephone response is monitored in real time by wall board displays which indicate calls waiting / staff available, etc. Management reports are generated from the ‘call management system’. SHE has the capability for producing reports on average time to answer and other measures down to console level, but no details were provided on performance and no standards are currently reported.

A13.7.4 Medium Term Performance Monitoring

The data that SHE use to monitor the medium term network performance includes: age (group profile, asset age, component age, date last refurbished); performance (fault per unit, causes, using NaFIRS); supply quality effects (CMLs - by asset group, asset, causes); load-related considerations - load surveys (overloading), security, fault levels; and Condition monitoring (Reliability Centred Maintenance).

A13.8 Audits

SHE employ external auditors, Marketing Quality Assurance (MQA), to undertake a qualitative assessment of the ENMAC and SIMS procedures on an annual basis. The Audit Report for 1999 was reviewed and found to contain no adverse comment.

APPENDIX A14

REVIEW OF MEASUREMENT SYSTEMS

SCOTTISH POWER

Scottish Power (SP) operate a Call Centre in Glasgow which is linked to three regional daytime 11/6.6kV Control and Dispatch Centres plus a Central Control Room that is responsible for the 33kV system that takes over responsibility for the rest of the distribution system at night. The Distribution Control and Despatch Centres co-ordinate the activities of five Regional Depots.

The information systems described below are networked between Call Centres, Control Room, Regional Depots and Emergency Control Centres.

A14.1 Information Systems and Data

The major information systems employed by SP are:

- Resource, Despatch, Update Customer Messages (TroubleCall)
- Integrated Control Network Diagram (ICOND)
- Distribution Automation Project (DAP) for telecontrol (SCADA)
- Graphical Decision Support System (GODESS)
- PoweR System PErformance Reporting (PROSPER) which is an enhancement of NaFIRS. Information for NaFIRS reports is extracted from Prosper. When the Prosper system was introduced in April 1997 there was a 22% increase in Customer Minutes Lost and a larger increase in the number of customer interruptions, due to the fact that there was no limit on restoration stages reportable and therefore a more accurate count of re-interruptions during fault switching.

Incident reports are created in Troublecall & ICOND by the relevant dispatcher or Control Engineer, with reference to the incident or switching log and the dynamic system and customer connectivity model that supports both ICOND and Troublecall.

A14.1.1 Plant and Circuit Records

Plant data is extracted from the Plant and Circuits database (UdB) which is common to Scottish Power and Manweb. The UdB is continually updated as plant and circuit information is validated when required using the SP asset inspection systems.

Circuit lengths are collected manually from the SP regions. The UdB will be populated through GIS in the future when vectorisation has been put in place. All new entries have been vectorised for the past few years.

Circuit length excludes services which are defined as the low voltage cable between the mains cable breach joint and the cable head cut out.

A14.1.2 Customer Numbers

In the vast majority of cases, customer numbers relate to the number of active services. The two exceptions to this are firstly some instances where a two-metered property has identical billing tariffs for both services - in these cases, it is deemed as just one customer; secondly, at any given time there are a small number of empty/derelict properties which are recognised by the Troublecall system as still being active and these premises are each regarded as the equivalent of one customer. The numbers involved in these exceptions are so small that there would be a negligible difference to the reported performance.

The accumulated effect over the last few years of such things as bulk data loads relating to new system implementations, occasional interface failures, some IT system logic flaws etc has resulted in a degree of 'data drift' between the Customer Directory and the Troublecall systems. However, a full-scale reconciliation programme, started in January 2000, is now nearing completion and will ensure a high degree of data consistency between these systems.

The Customer Directory is updated on a daily basis by data interfaces from a number of billing systems, customer capture systems and manual input of Data Transfer Network (DTN) information about lost supply customers. The Customer Directory in turn updates Troublecall also on a daily basis with all relevant changes to names, addresses, telephone numbers, new services, closed services etc. The data content of

these systems is continuously monitored and reviewed without there necessarily being any specific checkpoints.

A14.2 Documentation of Policies and Procedures

Procedures for GS and OAS Standards are accredited to ISO 9002 and are documented accordingly.

Incident reports are created using, TroubleCall, ICOND and PROSPER and user guides are available for these systems.

A14.3 EHV and HV Incident Reporting

The progress of HV incidents is managed by the control room system ICOND (NB resource allocation and information relevant to customer calls is managed by Troublecall system in a similar manner to LV incidents). The current status of the network connectivity is maintained in the ICOND system. Completion of the supply restoration stages includes an electronic trace of the section of HV network affected, this captures a list of the secondary transformers and calculates the number of customers affected by each restoration stage. Full details of the incident are transferred to the Prosper database by a batch process run twice per day.

A14.3.1 Incident Capture

All switching actions relating to a particular incident are recorded as the incident progresses in an electronic switching log within the ICOND system. At an appropriate time when the Control Engineer is not otherwise engaged, the Control Engineer, using the switching log as a guide completes the fault report and supply restoration stages. The time of the incident for reporting purposes is either the time taken from the SCADA system or the time at which the fault was first reported provided it was subsequently confirmed as a fault. Incident capture is considered by PB Power to be essentially 100%.

There are no automatic links to ICOND or Prosper for control information relating to 132kV. Reports on such incidents are initiated by the control engineer. However, such incidents are relatively few in number.

A14.3.2 Number of Customers Affected

For customer interruptions caused by faults at HV and above, each restoration stage is supported by a trace of the dynamic network connectivity model in ICOND which identifies both the secondary transformers affected and the total number of customers connected to these transformers. The computer system linking customers utilises a dynamic network model which reflects feeding arrangement.

A14.3.3 Incident Duration and Restoration Stages

The control engineer ensures that the interruption time corresponds to the time that the company "became aware of the fault" and inputs the time of restoration stages. Some discretion is used in deciding whether to disregard very short periods of supply restoration. Although the SP now uses the latest NaFIRS input arrangements the approach of individual control engineers has been conditioned by an earlier need to amalgamate restoration stages where the number exceeded eight. Typically, a control engineer may disregard a restoration that lasted less than say 5 (or even 15) minutes. Scottish Power does not currently have the tick box facility to discount repeated interruptions in the same incident which is available within PC NaFIRS but could achieve this by other means within PROSPER.

A14.3.4 Fault Cause

Information of the cause of a fault and on equipment affected is obtained from site staff.

A14.4 LV Incident Reporting

LV Incidents are managed in the Troublecall system by dedicated Dispatchers. As the incident progresses the Dispatchers make entries in the incident log relating to the progress of the incident (staff dispatched, estimated time of arrival, arrival on site, customers off, estimated time of repair, customers on, etc.). This information is available in real time to the call takers in the customer call centre to update customers who call in. On completion of the incident the Dispatcher completes the incident report by adding information, such as the incident cause and equipment affected, which is provided by the staff on site. Full details of the incident are transferred to the Prosper database by a batch process run twice per day.

A14.4.1 Incident Capture

LV incident reports are raised in Troublecall. LV Dispatchers are responsible for the input of information relating to LV incidents. The time of the incident for reporting purposes is the time at which the fault was first reported provided it was subsequently confirmed as a fault. Incident capture is considered by PB Power to be essentially 100%.

A14.4.2 Number of Customers Affected

The number of customers affected by an LV incident is estimated by the on-site resource and the Dispatcher with the system assisting by indicating the total customers supplied by the secondary transformer which supplies the affected network. This is a Structured estimate based on total customers connected to transformer and knowledge of number of feeders/phases affected. Any records regarding the phase of connection of individual customers are not reliable.

A14.4.3 Incident Duration and Restoration Stages

Calls are received by the call centre and logged in Troublecall. Troublecall has an in-built delay of five minutes in relaying individual no supply calls to the dispatchers to allow time for a more accurate view of incidents to be formed. Should three related calls be received within the five minutes the call details are relayed immediately to the dispatcher. The Troublecall log contains all details of the incident such as time of first call, time of dispatch of staff, time of arrival on site and time of confirmation of the incident by field staff. Once the extent of the incident is confirmed by field staff, the dispatcher makes an entry in the log confirming the number of customers off supply and adjusting the time off (the default is the current time) to reflect the time of first call first or other appropriate time reported by the field staff in the case of manual disconnection of supplies. Similar entries are made for each and every further disconnection or restoration of supplies. The number of supply restorations must equal the number of interruptions before an incident can be closed.

For LV incidents the dispatchers have no discretion in the creation of restoration stages. Troublecall produces the restoration stages on the fault report from every supply interruption confirmed from site and restoration recorded in the Troublecall log.

A14.4.4 Fault Cause

LV dispatchers obtain information on "fault cause" and "equipment/component affected" from site staff.

A14.5 Prearranged Interruptions

Pre-arranged outages are reported in a similar manner to faults i.e. LV via Troublecall and HV via ICOND. Pre-arranged interruptions reported in NaFIRS include only those where statutory notice has been provided. Emergency disconnections without the statutory notice are reported as faults.

A14.6 Condition 7 Reports

Condition 7 statements produced by SP conform to the Ofgem standards. The main enhancement is the inclusion of tables to show the underlying system performance following removal of the impact of periods of extreme weather. This is done by excluding "extreme days" that are defined as days on which the number of reported HV fault incidents is greater than the average plus 3 standard deviations (approximately 50/day) and where the vast majority of incidents are weather related.

A14.7 Future OFGEM Requirements

Scottish Power Quality of Supply reports contain data on Targets, Company & Regional Performance, Investment to benefit worst served customers, Capital Investment and Major Projects. The present and proposed measurement processes that are applicable to future Ofgem requirements are described below.

A14.7.1 Worst Served Customers

SP Quality of Supply reports provide a list of worst performing circuits and indicate the work SP propose to undertake on these circuits to improve performance in the coming year. Historically the circuits in this list have been selected based upon CML. However from this year, 2000/01, locations will be selected based upon the number of supply interruptions due to high voltage faults experienced by customers in the area. Each area will be identified by the circuit which provides supply.

The SP reporting systems capture the secondary transformers affected by HV and above incidents with a high degree of accuracy. SP also record the secondary transformer which supplies the network affected by

every LV incident. Whilst this is insufficient to identify individual worst served customers it will support the identification of worst served customers due to HV incidents and also the LV networks experiencing high numbers of faults. SP consider this represents a cost effective compromise to the required level of reporting.

A14.7.2 Transient (Short Term Interruptions)

SP currently have no comprehensive monitoring facilities for transient interruptions and do not report transients in the QOS reports.

SP has the ability, via the SCADA system, to monitor transient interruptions that result from the operation of circuit breakers at Primary substations. However, the majority of transient interruptions result from the operation of pole mounted reclosers situated at remote locations on the overhead line network and SP currently have no monitoring facilities for these devices. SP has undertaken trials of Power Fail Monitors but have concluded that this technology gives spurious indications, is unreliable and is costly to maintain. SP has also explored the use of disturbance monitors situated at Primary substations, and whilst this technology has the potential to report transient interruptions with an accuracy around 70%, SP consider that the cost of such equipment cannot be justified by the need to measure transient interruptions alone. SP are reviewing the economics of a process based on manual readings from the counters on pole mounted reclosers to meet Ofgem's requirement for the reporting of transients.

A14.7.3 Telephone response

Call Centre Services are provided by Scottish Power Customer Services. This is currently being re-organised to provide dedicated agents providing distribution services only, but with overflow to other agents for abnormal call volumes. These arrangements are detailed in a Service Level Agreement.

Scottish Power's call centres have connections with the BT network and with the network of Scottish Power's telecom company, Thus.. The call centre in Scotland is situated Glasgow and in Manweb at Warrington and Wrexham (with a satellite at Caernarfon which has a strong Welsh speaking capability). The Manweb facilities supports the Scottish call centre at times of heavy demand and vice versa.

The range of daily call volumes for SP in normal conditions is 1000-1550 per day.. The options available to handle an increase in call volume are to distribute calls between distribution call centre sites, utilise IVR messaging facilities where appropriate, overflow calls to customer services (during normal working hours) and utilise standby processes to bring in additional staff and managers.

The Customer Contact telephony systems have been designed to utilise Call Line Identity (CLI) to recognise the customers line location to link the customer to the TroubleCall fault logging system via an automated Fault Call Handling system that utilises Interactive Voice Response (IVR) equipment. The automated system aims to:

- Quickly provide customers with appropriate available voice messages regarding the situation.
- Provide the facility for customers to speak to agents if desired or necessary.
- Provide the facility for automated fault logging.
- Provide the ability to prioritise callers with critical information about the fault or personal special needs.
- Enable multiple call centres to handle calls from any location and deliver consistent messages and service to these customers.
- Provide IVR messages at different levels - Zone, District or incident.

The Virtual call centre operation can distribute calls to all SP call centres. This aims to maximise the utilisation of lines and staff and provide a high quality service for customers. The telephony systems are designed to take over 200,000 calls per hour through 1350 lines routed into the call centres and 1200 lines on Mass Calling Platform. This is equivalent to 0.82 lines per 1000 customers.

A 1200 line Thus telecom Mass Calling Platform (MCP) is in place to cope with customer calls in the event that the Call Centres cannot cope with customer demand. The message system is granulated to the level of district messages, so that callers can hear area specific messages or a general message designed for all callers. Over 200,000 messages per hour, assuming a message of 15 seconds, can be handled by MCP. Procedures are in place that BT will inform SP if call gapping is needed and adopted to protect the BT network.

Management Information Systems are an integrated part of the telephony design. Data is available on-line and historically as printed reports. Performance is monitored for individuals, call types and as a total service.

The service provision and Key Performance Indicators will be monitored and reported as defined within the Service Level Agreement.

A14.7.4 Medium Term Performance Monitoring

SP has an approach to asset management which ensures the long term sustainability of network and asset performance whilst prioritising asset investment in an optimal manner.

Long term (5-20 years) investment planning is based on decision support tools which utilise statistical data such as asset age profiles, reliability indices etc. In the medium term (2-5 years), the SP investment plans are further refined by reference to known type / operational defects, worst asset league tables etc. A fully prioritised, detailed short term (0-2 years) work programme is developed using information from the asset inspection and performance assessment systems.

The severe weather events of recent years have raised awareness regarding rural network performance and the asset investment plans include initiatives which will in the longer term make the network more resilient to such abnormal conditions. Examples of this improvement programme include replacement, on a tapered basis, of post-war light construction standard (BS1320) overhead lines with a more robust design and clearance of trees to falling distance on strategic circuits.

SP are progressively improving the availability and quality of data within asset information systems. A good example is the recent programme of work to inspect all of the overhead line network and update the line defect database and wood pole position information within the GIS system. This initiative will ensure that future maintenance and condition assessments are accurately recorded within the asset database.

SP are currently implementing a new asset inspection system using portable data capture devices. SP consider this will improve the management and control of inspection activities, ensure full compliance with statutory requirements and enhance quality of data capture. An important element of this development has been the preparation of a comprehensive and fully documented asset data standard which defines the information necessary to support asset management decisions.

A14.8 Audits

Under ISO quality accreditation periodic audits are undertaken to compare the information in Troublecall and ICOND with that held in Prosper. The audit examines all incidents handled in a 24 hour period. Under the SP internal audit programme each operational location is visited at least twice per year to check on numbers being reported against Guaranteed and Overall Standards. Audit reports are available for the past two years, and samples were provided for inspection.

APPENDIX B

PB POWER WORKPLAN

INFORMATION AND INCENTIVES PROJECT
INITIAL WORKPLAN FOR PB POWER

Introduction

Set out below is an initial workplan for one area of work on the IIP. This details the high level requirements from the workstream, the key deliverables and the dates for completion and a detailed specification of what the consultants will be expected to cover.

Workstream A:

IIP commitments

The consultants are being asked to carry out a detailed review of Distribution Businesses existing measurement systems for collating a range of output measures. The output measures which the consultants are required to investigate are:

- number of outages;
- the duration of outages;
- and therefore Customer Minutes Lost (CMLs)
- customer satisfaction;
- voltage depressions; and
- transient interruptions.

The consultants will need to:

- show how each PES presently defines and measures output measures and whether there have been any changes to definition that has led to changes in the level of the outputs reported to Ofgem. The consultants will also need to identify any material changes that have been made by PESs to the measurement systems and the impact that this has had with respect to the accuracy/automation/auditability of output measures. This will need to cover the period from the beginning of the last distribution price control – April 1995 – to April 2000.

- assess the degree of accuracy/automation/auditability of the system that is used to collect the information. For example, the consultants will be expected to identify the detail to which the companies have mapped individual customers' premises on to the distribution network – for example at single-phase low voltage levels, - the extent to which the collection of information is automated and whether the information is readily open to audit. The consultants will be expected to identify the level of consistency both across companies and over time and under different circumstances, for example severe weather.

- identify the extent to which companies presently collect information on output measures at a sub-PES level, for example on different asset types such as overhead line and underground cable or between different areas such as urban/rural/sparse. The consultants will be expected to provide an initial view as to the accuracy of any information on output measures collected at a sub-PES level;

- develop proposals for common, auditable systems for measuring each output measure, taking into account PESs existing systems and the likely changes to systems which are expected to be made during the next two years;

- provide an initial assessment of the cost and lead times associated with the implementation of revised measurement systems;

- provide an assessment of how companies monitor the medium term performance of the network and the approach to asset management, for example are assets replaced on an age related basis or are companies employing more sophisticated asset management models. The consultants will also need to consider what would constitute appropriate measures for monitoring the medium term performance of the network.

Price Control Review Commitments

The final proposals for the distribution price control review made reference to a number of specific tasks, some of which are reflected in the points above. For the sake of completeness, Ofgem would like the consultants to explicitly address the following points:

- review PESs' progress on implementing the necessary systems to measure transient interruptions and whether other companies will have systems operational by April 2001;

- review PESs' progress on installing systems such that their telephone systems are capable of answering 90 per cent of calls within 15 seconds in normal circumstances and 80 per cent of calls within 30 seconds in exceptional circumstances; and

- review PESs' progress on installing systems such that they are able to make penalty payments automatically to customers for failure to meet GS 2.