Appendix C East Midlands Electricity (EME)

3.1 Summary

Gordon Roberts (BPI) and David Holding (Mott MacDonald) undertook the audit of East Midlands Electricity (EME) between 8 and 12 July 2002.

From the questionnaires completed during the audit it was apparent that the customer measurement systems utilised by EME are inherently accurate. The key systems of EME are unchanged from the date of the Interim Review.

During the audits of LV (low voltage) incidents and HV (high voltage) incidents a number of errors in reporting were discovered. For a number of these it was not possible to establish the exact reason for the error despite the differences being significant in some instances. Other errors were largely a result of misinterpretation of notes used when constructing the fault reports. This is being addressed by increased training and auditing, and these measures already appear to be producing improvements in accuracy.

Errors were more significant and more common at LV (low voltage) level reflecting an increased level of manual intervention in the process, and increased complexity of the faults themselves.

Due to a deficiency in information concerning individual customers connected to LV feeders, a degree of judgement is necessary when producing the fault report figures. A similar degree of judgement was needed to audit the incidents.

3.2 Introduction

EME holds a single electricity distribution licence for the East Midlands, covering the region from Chesterfield in the north, to Boston in the East, Milton Keynes in the south, and Derby in the west.

Responsibility for IIP reporting is clearly defined within the EME corporate structure, with reporting links to Asset Development and the System Performance team. Overall responsibility for IIP reporting rests with the Managing Director.

The EME distribution business has its headquarters at Castle Donington where it provides a series of centralised services. These include an Incident Management Centre (IMC), an HV control room and a Customer Contact Management Centre. The IMC and control room dispatch work orders to four geographical operational bases. These are responsible for the 24-hour repair and restoration of supplies. The HV control centre carries out real-time management of the HV, EHV and 132kV networks and the IMC provides a 24-hour power cuts and emergency call centre, rapid dispatch and customer relations service.

Incidents are raised in the Call Logging and Sorting System, (CLASS), following receipt of either an alarm from the Control Room Graphical Operating System (CORGOS), or through a call to the IMC. Details are entered into CLASS manually by IMC staff. Incidents are automatically date and time stamped as they are raised in CLASS. An automatic file transfer ensures that core data is transferred into the PC-NaFIRS reporting system on a daily basis. Each supplied premise is allocated a unique reference number in the Customer Information System (CIS), that is linked to a transformer and associated feeder at LV level (this is the 'connectivity model'). The CLASS system can then access this information for incident management. Fault reports are then adjusted manually by IMC staff using additional information from fault switching schedules (for HV, EHV and 132kV), field operator notes, the CORGOS event log, and the connectivity model. The Geographic Information System (GIS) gives a graphical record of the network and topology within the EME area, and is also used to gain a greater understanding of the structure of the network, particularly useful when looking at more complex faults.

This Appendix describes the audit of the East Midlands distribution licence area undertaken between 8 and 12 July 2002. The entire audit was conducted at Pegasus, Castle Donington.

3.3 Audit Process

This section gives an overview of the audit.

3.3.1 Resources

The visiting auditors were:

- Gordon Roberts of British Power International
- David Holding of Mott MacDonald.

The EME audit team members were:

- Colin Randle, Ian Jacob, Steve Hayward, Ruth Morley and Alan Gay (System Performance)
- Steven Waller and Robert Cooper (Asset Development)
- Rose Craner and Stuart Turner (Customer Operations)

Other EME personnel were available when required during the course of the week. As can be seen, EME provided a very high level of resources to support the audit.

3.3.2 Induction

EME provided the visiting auditors with a thorough induction to the company systems and processes, which lasted for half a day. This consisted of the following:

- organisational structure and how IIP requirements are incorporated .
- the relevant information systems, (CLASS, CIS, CORGOS, GIS, PC-NaFIRS)
- the connectivity model and counts of customers
- training and auditing
- interpretation of the RIGs

The above were discussed against an overall framework of policies and documentation, (Local Management Instructions), with access to all documentation via the Lotus Notes system.

3.3.3 Questionnaires

A set of questionnaires was used to record the progress of the company since the interim review. The four questionnaires covered the following areas:

- MPANs: checking the company's progress in correctly counting MPANs
- Connectivity model: checking the company's progress in accurately locating MPANs on its network
- RIG definitions: checking the company's interpretation of the Ofgem guidelines
- Template: checking the company's routines for providing Ofgem with the information it requires.

The MPAN and connectivity model questionnaires support Stage 1 of the Audit Framework. The questionnaire used to determine how the company has interpreted the RIG's definitions supports both Stage 1 and Stage 3 of the Audit Framework.

The template questionnaire is designed to check that the company has interrogated its incident data correctly and summated the requisite information before populating the template used to report to Ofgem. The Template questionnaire thus stands apart from the Audit Framework.

The questionnaires were completed jointly by both visiting members of the audit team, to allow information and experience to be shared as much as possible.

3.4 Accuracy of Measurement Systems and Reporting Process

3.4.1 Stage 1 of the Audit Framework – Accuracy of the Measurement Systems

(i) MPANs

EME has agreed its methodology for the identification of its primary traded MPANs with Ofgem. Multiple MPANs have been identified using the Line Loss Factor DuoS code. Both of these processes are well documented within the company's internal systems, and are identical to those highlighted during the Interim Review. No omissions were made from the count.

EME estimates the count to be approaching 100% accurate, and places an extremely high level of confidence in these figures. The potential sources of error in the count are small, and the audit team saw no evidence (including the 'address check' of 5 premises), to conclude that the company's estimate of accuracy was incorrect.

(ii) Connectivity Model

EME has had a connectivity model in place since 1992, and it involved recording all the company's primary substations, HV feeders, secondary substations, distribution transformer and LV feeder ways into the CLASS system using the PC-NaFIRS unique circuit reference number as the identifier.

The low voltage connectivity model links to the high voltage by the association of LV feeder ways to secondary distribution transformers which in turn is allocated to the relevant HV circuit. The premises to network connection was made using the integrated system of mains records and any available service records. Since its inception, management processes have been in place to update the model including permanent network changes and those arising from on-line use of the model. The model in place is the same as the one reviewed in the Interim Review.

The model is supported by an ongoing training and auditing programme, so that accuracy of the model is continually improving.

For a variety of reasons it has not been possible to allocate 20,000 MPANs to the connectivity model. This equates to 0.8% of total MPANs. This has reduced from 1.3% identified at the Interim Review, and should continue to reduce as additional information enables MPANs to be assigned to their correct place within the model.

In addition to the above, a further 25,000 MPANs, (1% approximately), are assigned to the model at HV level but are not attached to an LV feeder. These are assigned to a default LV feeder in the model, but will not be included in counts of customers affected by faults on LV feeders. Again, these are assigned when additional information becomes available. It was discussed whether accuracy of reporting would be increased or reduced if this 25,000 were allocated to LV feeders on a 'best available knowledge' basis.

The main source of error appears to be manual input of feeder details into the system.

In terms of how accurately MPANs are recorded onto the connectivity model, the company estimates this accuracy to be greater than 95%. The audit found nothing to contradict this estimate, although the nature of the connectivity model and the dynamic environment in which it operates makes it impossible to establish 'exact' connectivity at LV level.

At present 'accuracy' of the assignment of MPANs to the model is not measured. It was discussed that a measure could be obtained by using an analysis of customers ringing in to report faults. For each customer who phones in to report a fault, they would be checked to see if the feeder they were assigned to at LV level was the same as the feeder affected by the fault.

(iii) Conclusions

No deviations from EME's method of identifying customers by primary traded MPAN, as approved by Ofgem, were found during the audit visit.

No inconsistencies have been found in the auditing of EME's MPAN processes and it can therefore be concluded that the company's estimation of approaching 100% for the accuracy of its MPAN count is correct.

No inconsistencies were found during the audit of the EME's connectivity model and it can therefore be concluded that the company's estimation of greater than 95% for the accuracy of its model is correct.

We can therefore conclude that EME has inherently accurate measurement systems in place.

3.4.2 Stage 3 of the Audit Framework – Accuracy of the Reporting Process

(i) Audit of HV Incidents

Methodology

During the afternoon of Day 1 the visiting auditors and two members of the EME audit team began auditing the HV incident reports. This work took approximately 1.5 days, with the audit team working together on all incidents.

EME had printed out a schematic diagram of each HV incident, with the other information available on-line through the various systems as it was required. This information included connectivity model information, CLASS information (including field notes), and information from the fault schedules. This was checked against the PC-NaFIRS system to ensure information had been calculated and transcribed correctly.

By working through the notes in CLASS it was possible to 'replicate' the incident on the printout to identify sections of the network affected by each restoration stage. The connectivity model was then used to equate these sections affected to numbers of customers affected. One problem that was discussed was that the connectivity model is a dynamic tool and reflects the state of the network as it stands at any particular point in time. Thus, trying to equate numbers of customers affected by an incident to the number of customers on the network 'now' was a difficult exercise. Small differences could be attributed to customer 'churn' but larger differences were more difficult to account for without some sort of tracking mechanism.

For each HV incident, the audited customers and incident durations were entered into the Incident Auditing Workbook for comparison with the reported figures. Where large variances were encountered between the reported customer numbers and the current system numbers for the same part of the network, further investigation was carried out to establish the cause.

During the course of the HV incident audit, we did not encounter any incidents that were too complex to resolve, partly due to EME's desire to resolve all possible issues and the ability of the EME staff to access the relevant information. Therefore the spare HV incidents were not audited by the team.

Results

The majority of the HV incidents were completed by the end of Day 2. The following results and key conclusions can be drawn from the HV incident auditing:

- Of the 20 HV incidents audited, the reported customers affected figures reconciled exactly to the audited figures for nine incidents, with a further two incidents being within what we considered to be acceptable 'customer churn'. Of the nine incidents with material differences, four were attributed to misinterpretation of field notes, (including two restoration stages missed), and for five incidents the reason could not be agreed, although the most likely reason was thought to be operator error.

- Errors in the CML were largely the result of errors arising in relation to the number of customers affected, discussed above.

- Measurement of time is automatic on the telecontrol HV system and semi-automatic for manual switching operations so the chance of error is low. However, transfer of information into NaFIRS requires manual intervention and the possibility of transcription error exists.

(ii) Audit of LV Incidents

Methodology

The process adopted for the audit of LV incidents was slightly different to the HV audit. To establish the process, the first five incidents were completed by the whole audit team. The remainder of the LV incidents were audited by the visiting auditors and EME staff working in parallel. This aspect of the work took approximately 2 days

The audit consisted of checking the figures submitted through PC-NaFIRS, back to each individual incident. The information used to support this process consisted of information from the CLASS system (including incident notes), GIS information and the connectivity model.

Results

The majority of the LV incidents were completed by the end of Day 4. The following results and key conclusions can be drawn from the LV incident auditing:

- Out of a total of 100 incidents audited it was found that the reported number of customers interrupted for 69 of the incidents exactly reconciled to the audited figures. A further eight incidents were within the range of 'acceptable customer churn'.

- Of the 23 incidents identified with significant errors, it was not possible to verify the cause of 13 of these. It was thought likely that these were the result of operator input error. During the audit we tried to ascertain whether these may have been the cause of network changes during the period, but information was not found to support this.

- In four of the incidents it was possible to identify the cause of the operator error, for example transposition of figures.

- Four incidents had restoration stages missed and this obviously had a significant 'knock-on' effect on CML. This was caused by failure to interpret the notes correctly although the restoration stage was clearly identified.
- Where an incident was identified to have occurred on a single phase, some errors were noted in the calculation of customer numbers on the fault reports. The most common error was to assume that the fault affected all three phases hence the figures were over reported. This occurred in at least two incidents.
- Where there was an open circuit incident that occurred part way along an LV feeder it was very difficult to estimate the number of customers affected by an interruption. In some cases it was possible to identify the source of the break, but only retrospectively, where for example new cable had been identified and was recorded on the system. Otherwise it was difficult to establish a consistent methodology for calculating numbers although if no other information was available we assumed half the number of customers on an LV feeder had been affected. Where instances of this were discovered it was generally the case that the operator had used total customers on the feeder to estimate this number, resulting in an over reporting of customer numbers.
- The durations of incidents were generally well reported. The most significant error was due to

the issues highlighted above relating to missed restoration stages, which contributed to an over reporting of CML. The other problem highlighted in the audit was that the incident start time was recorded incorrectly in several of the audited incidents. This was due to the operator using the time reported by the customer rather than the time that the company first became aware of the incident (e.g the time of the customer call).

- It was discussed that new auditing procedures and training programmes had been developed in recent months that would reduce the errors caused by operator error. It was indeed noted that there appeared to be an improvement in the fault reporting process in the last quarter of the year, with fewer discrepancies being identified.

(iii) Interpretation and implementation of the definitions and guidance from the RIGs

EME has devoted a significant amount of resources to produce systems and implement training programmes to ensure that all appropriate staff have a thorough understanding of the RIGs. The audit team reviewed the methodologies and systems used in recording start and completion of an incident, short interruptions, and restoration stages. Differences between HV and LV systems were investigated.

The audit concludes that there is a high level of confidence that EME has correctly incorporated the RIG definitions into its systems.

The processes remain unchanged since the Interim Review although this is now supported by an increase in internal auditing and additional training.

(iv) Stage 3 Conclusions

The following general conclusions can be drawn from the HV incident auditing:

- Measurement of time is largely automatic on the HV system, and therefore the chance of error is low. However, manual intervention and interpretation of faults caused the majority of errors found.

- The system did not facilitate a definite answer on several faults, and differences here were attributed either to customer 'churn' or input error.

The following general conclusions can be drawn from the LV incident auditing:

- Manual intervention is a major source of inaccuracy - this will be addressed by improvements to training programmes that are currently being introduced. In addition, increasing automation of the process by the introduction of the Network Management System will reduce the potential for operator error.
- The inability of the system to track changes to the network makes the audit process increasingly subjective. The company is considering ways of addressing this issue. The company suggested smaller, more frequent audits as one way of reducing the impact that this time lag has on the auditing process.

3.5 Overall Impressions

EME has assigned a high level of resources and demonstrates a high level of commitment to IIP. The systems appear robust, but despite this the level of manual intervention required in the reporting process means that a significant number of errors were discovered.

It was largely due to the level and expertise of resources provided by EME that enabled us jointly to draw the conclusions outlined in this report. The audit was carried out very much in a co-operative way, and all discussions that took place were constructive in their nature. This will ensure that the process of continuous improvement already evident throughout EME with regards to IIP will be built upon using the findings of this report.

3.6 Conclusions

Table C-1 presents the results of the 2002 audit of the EME East Midlands licence area in-line with the auditing framework. Under- and over-reporting are indicated in the table. The overall accuracy results have been determined by extrapolating the audit sample variances to estimated variances in the annual total figures reported to Ofgem and then summing the LV and HV estimated variances to give an estimated overall variance, which is then used to determine accuracy against overall reported figures.

Table C-1

Stage	Item	Accuracy
Stage 1	MPAN Measurement	100%
Stage 1	LV Connectivity Model	95.0 to 98.2%
Stage 1	HV Connectivity Model	95.0 to 99.2%
Stage 3	LV Incident Reporting Accuracy – CI	99% (over)
Stage 3	LV Incident Reporting Accuracy – CML	95% (over)
Stage 3	HV Incident Reporting Accuracy – CI	100%
Stage 3	HV Incident Reporting Accuracy – CML	99% (under)*
Stage 3	Overall Incident Reporting Accuracy – CI	99% (under)
Stage 3	Overall Incident Reporting Accuracy – CML	99% (under)

* The figure in the table above excludes the results of incident 23-196. This was a very complex incident, that involved significant changes to the network since the time of the fault. Including this incident in the audit results would have distorted the results, as it is an outlier.

Although the figures above indicate high levels of accuracy this partly hides the fact that a significant number of incidents were found with ‘over’ / ‘under’ reporting. These errors have tended to offset each other, leading to the high levels of accuracy reported. Further work is now ongoing to look in greater detail at ‘accuracy’ of reporting.

3.7 Reporting to Ofgem’s information Template

The process for reporting under IIP is built into the protocol of the NaFIRS / IIP reporting template. There is a high degree of confidence that the transfer of information from NaFIRS to the IIP template is accurate. No information was uncovered to raise any doubts as to the validity of this process.

3.8 Recommendations

The following points were identified by the audit team as areas for further improvement:

- More attention needs to be paid to ensuring any manual intervention is as accurate as possible. This includes interpretation of notes, understanding of RIGs and methodologies for calculating numbers of customers affected by particular types of fault. This process is ongoing through auditing and training procedures already in place combined with proposals for increased automation of the system.
- EME to review system for tracking changes to the network during the course of the year. This will aid audit of faults.
- More detailed audit trail required for planned interruptions.
- EME to implement a measure of accuracy for customers assigned correctly to the connectivity model.

3.9 Learning Points

The following points were identified by the joint audit team as learning points for the audit process:

- It was found that the use by EME of robust IT systems, that were immediately accessible during the audit, enabled the amount of paperwork to be kept to a minimum. This helped greatly with the audit process.
- Due to the dynamic environment in which the systems operate, and the unavailability of information relating to connectivity at service level, a high level of judgement was necessary to agree on some of the results. This did not present a problem during this audit as the 'spirit' of co-operation between the visiting auditors and EME was strong.
- Induction to EME systems and the on site report back to the company ½ manday (audit staff time)
- The 20 HV incidents took approximately 3 mandays (audit staff time).
- 100 LV incidents took approximately 4 mandays (audit staff time).