Appendix O Yorkshire Electricity Distribution Limited

15.1 Summary

John Curran and Alan Taylor audited YEDL on 22nd to 26th July 2002 at its offices in Leeds. Excellent support was provided by the YEDL team with all questions and queries answered.

YEDL has an excellent GIS and a robust MPAN identification model which together provides very accurate customer numbers for both HV and LV incidents

There were a number of inaccuracies noted in the customer numbers reported both at HV and LV but the connectivity system was not IIP compliant at the time of the particular incidents. It is the audit teams opinion that if the Connectivity Model had been applied the audit would have produced a result with an accuracy of at least 97% for all voltages.

The paper record system in the control room and the lack of automated systems between YEDL incident logs and the NaFIRS reports can and has introduced transcription and start time errors. This could be eliminated by the use of an automated system.

15.2 Introduction

Since the interim audit YEDL and NEDL have merged, with the NEDL organisational structure being implemented throughout the two Distribution Licence companies. The IIP processes and systems within YEDL have however been implemented as planned in the interim report.

Changes to align YEDL to the NEDL processes and practice will take place in the future as hardware is updated and the situation allows.

Both LV and HV unplanned faults are identified by YEDL at the Leeds office either via an alarm in the control centre (CC) (HV faults) or by customer calls to the central call handling centre (CCH). The start of the event is logged as either the time the alarm is received or the time the first customer call is received at CCH to report a loss of supply.

Restoration stages are then organised by the CC (HV faults) or via the Resource Despatch Unit (RDU) (LV faults).

The control engineer records all HV switching operations on a paper log in the control room with automatic and primary/grid switching operations and alarms being registered in the Distribution Management System (DMS). These grid/primary operations and alarm records are then transferred to the paper log.

The LV network is not subject to a central LV control system with operations at this voltage being carried out by field staff who set their own restoration strategy and record the restoration times of each group of customers restored. The field engineer provides details of the location of the restoration stages. The customer numbers are then obtained from the Connectivity Model using this information. The local office staff then complete the NaFIRS reporting documents from the information received from the field engineer.

The NaFIRS report is independent of both the CCH and CC DMS with all entries having to be copied manually rather than downloaded.

All pre-arranged interruptions are initiated using a control sheet. This, depending on voltage, is either passed to the CC for approval/information/control (HV jobs) or to the CCH for information (LV work). NaFIRS reports are then generated as for unplanned interruptions but with the different codes to identify the outage as pre-arranged.

15.3 Audit Process

This section defines the step-by-step progress of the audit.

15.3.1 Resources

The visiting auditors were:

- John Curran of British Power International
- Alan Taylor of Mott MacDonald

The YEDL audit team were:

- Andrew Spencer
- Mark Marshall
- Mike Smith
- Peter Smith
- Stephen Murray
- Marie Hewer

Other YEDL staff, in particular Bob Wells, Lyndsey Cherry, Tony Ingham and Paul Johnson also gave assistance with the audit. YEDL provided sufficient resources and expertise to allow the smooth running of the audit.

15.3.2 Induction

YEDL used the first day of the audit to provide the visiting auditors with a comprehensive induction to the company systems. The information supplied prior to the visit and during the audit allowed the completion of a large proportion of the questionnaires.

The induction began with an overview of the YEDL company structure and management of IIP. Other areas covered during the morning were Customer Connectivity, Interpretation of the RIGs, a discussion on the process for capturing and reporting both HV and LV incidents, the Internal Audit process and IIP training.

In the afternoon the audit team toured the call centre, despatch, and system control areas. Here we were given demonstrations of the CCH system (1st call capture) DMS (incident capture and customer numbers) and how incidents were logged and reported.

The way in which YEDL identifies its different types of customer was explained and the use of the Line Loss Factor as part of the MPAN to identify Primary Trading MPANS as opposed to secondary ones was fully covered. This appears to be a robust system for ensuring that only one MPAN is recognised for each customer. Ofgem agreed this model on the 12th February 2001.

The connectivity model is GIS based with all MPANs being geographically located to the correct address. YEDL has a mature comprehensive service recording system which has allowed it to accurately locate the customer to its supplying feeder in nearly all cases. Multiphase and single phase customers have also been identified which is to a greater level of detail than required by the RIGs. In a few cases there are concerns over the accuracy of the actual phase connections, however, this does not materially affect the accuracy of IIP.

A data cleansing exercise was carried out in 2001/2002 to facilitate loading MPANs into GIS and to correct errors in connectivity within the GIS. This is continuing whenever any customer number discrepancies become apparent in the connectivity model.

15.3.3 Questionnaires

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

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

Alan Taylor concentrated on the MPANs, Connectivity Model and RIG definitions on day two whilst John Curran concentrated on the audit of HV incidents.

An HV fault occurring on day 2 allowed the visiting audit team to observe at first hand the processes and recordings of actions which occur during the location of the fault and the restoration process.

15.4 Accuracy of Measurement Systems and Reporting Process-

15.4.1 Stage 1 of the Audit Framework - Accuracy of the Measurement Systems

(i) MPANs

Following the merger of NEDL and YEDL the MPAN process is now carried out by NEDL on behalf of YEDL. The NEDL Meter Point Registration Service (MPRS) staff at Penshaw now manage both the NEDL and YEDL MPAN issuing and recording process. The MPAN information for YEDL and NEDL are stored in separate databases.

The MPAN count in the connectivity model is updated monthly with the MPRS data. The MPRS data is interrogated on the 30th September to give the total customer numbers for the reporting year.

Due to the distance between Penshaw and Leeds the process was not witnessed at the Penshaw site but the process used during 2001/2002 was explained in detail by Lyndsey Cherry.

Primary Traded MPANs are identified by deleting from the list of all MPANs any that are associated with other meters. These are MPANs that are associated with another tariff class e.g. off-peak, exporters, or unmetered supplies. The line loss factor is used to identify each type of customer and the codes, which are only used to denote a second tariff, are identified and the associated MPAN is deleted from the customer count process.

The only customers omitted from the MPAN process are those which are unmetered such as street lighting furniture. This is in accordance with the RIGs.

The accuracy of the customer count is clearly dependent on the information provided by suppliers. The only other potential source of error is in the identification of secondary MPANs. The worst case scenario is for all secondary MPANs to be counted as customers (33,700) which would give an error rate of 1.5%. This is clearly unreasonable and even if it were assumed that this error rate was as high as 50% this would still give an overall accuracy level of 99.25%.

The process used by YEDL to update the customer count is as agreed with Ofgem at the time of the interim review.

Four domestic and one commercial premise that were connected during the period under audit were randomly selected and checks were made to ensure that for each address a corresponding MPAN exists. No errors were found.

The processes used for issuing MPANs and the interaction between the supplier, meter operator and DNO was described. It is a well established and automated process. It was not possible to demonstrate issuing MPANs but there is no reason to believe that problems exist in this area.

(ii) Connectivity Model

YEDL's connectivity model is an LV one, which has been developed in association with its GIS systems. Connectivity at higher voltages is based on an addition of the LV customers connected to each distribution substation.

Since the interim review the connectivity model has gone live. This has included the completion of the Address Point to Service Termination cleanse work, the MPAS address to GIS Address Point matching work, implementation of the revised functionality of GIS, initial loading of Primary MPANs onto GIS, identification and rectification of further data issues and the implementation of the MPAN/GIS reconciliation and update process.

Data cleanses have taken place and have ensured that the data on which the connectivity model is based have improved to deliver the requirements of IIP. The tracing facility on GIS has provided error files indicating parallels on the LV network and addresses, and therefore MPANs, where a feeding LV way could not be identified. The causes of the parallels or connectivity breaks have then been identified and rectified. The cleanse is a one off piece of work, however the tracing functionality provides a continual check that parallels are not created on the network and provides error reports which are investigated to ensure that the accuracy of the data is ensured.

At the time of the interim review the company described its proposed connectivity methodology. This has now been followed through to implementation.

YEDL has issued a Code of Practice that describes its expected connectivity accuracy. The predicted accuracy of both the HV and LV model is 96.5% and the system contains internal error checking routines. A 3.5% level of inaccuracy represents MPANs that have not been counted due to problems with connectivity issues within the GIS system. It is estimated that there are also 10,000 MPANs not currently located within the GIS because either there is no known postcode or a clear address match. These represent approximately 0.5% of the total of customers. This figure is being reduced through data cleanse and the monthly reconciliation process.

To account for permanent changes on the network, a complete reconciliation takes place within GIS each month and an update file of customer numbers by distribution substation is loaded into the DMS for use in counting customers associated with HV incidents. Any temporary changes to the network are the responsibility of the site engineer, who will amend the model if appropriate. Permanent changes being updated within 5 days by issuing change notices to the contractors responsible for maintaining the GIS.

A check was made on the accuracy of the connectivity model. Five LV feeders were chosen initially but the customer numbers for the first one chosen was found to be inaccurate. The reason for this inaccuracy was checked and found to be due to some MPANs not being in the system and connectivity error affecting one customer. YEDL had stated earlier that errors could be expected to occur in clusters and it appears that the audit identified one of these clusters. A sixth LV feeder was then chosen and this was found to be accurate. Overall the accuracy associated with six feeders approached the stated accuracy.

(iii) Conclusions

No deviations were found in the YEDL method of identifying customers by Primary Traded MPAN as approved by Ofgem.

The MPAN method was not witnessed by the Audit Team due to the distances involved between offices. However, based on the checks carried out by the team it is concluded that there is no reason to believe that the MPAN accuracy differs from the accuracy stated by YEDL (better than 99.25%).

Only one inconsistency was found during the audit of the YEDL LV connectivity model. A further LV feeder was investigated and this was found to be accurate. It is the team's conclusion that the accuracy of the model is as stated at 96.5%.

The team concludes that YEDL now has an inherently accurate measurement process in place.

15.4.2 Stage 3 of the Audit Framework - Accuracy of the Reporting Process

(i) Audit of HV Incidents

On the second day of the audit the visiting auditors and the Control room Manager Bob Wells, Peter Smith and Paul Johnson began the audit of the HV incident reports.

The full audit team carried out the audit of the first incident to ensure that everyone understood the process. John Curran then completed the other HV faults selected to be audited.

YEDL had gathered the switching logs, diagrams of the running conditions at the time of the incident, and the data used to calculate the numbers of customers involved for each incident. YEDL had completed the incident auditing workbook from the NaFIRS reports and this has been used to record the findings of the audit.

The YEDL DMS system was then used together with the above data to determine the detail of each HV fault, the numbers of customers involved at the time of the incident, the restoration stages, and times involved.

YEDL's current connectivity model had not been used to determine the numbers of customers connected to each distribution substation during the period under audit (April 2001 to April 2002). Customers numbers at each distribution substation had been estimated using local knowledge, recorded substation maximum demand, or the original legacy data. None were as accurate as the new connectivity model with each providing varying degrees of accuracy.

To determine the number of customers affected by each HV fault the distribution substations involved had to be listed and the corresponding number of customers connected to each, summated. In YEDL this is a manual task carried out by the control engineer on completion of the fault restoration. The DMS system does not do this automatically.

The procedure for obtaining the number of customers involved for higher voltage faults (33kV, 66kV, etc.) is then a case of identifying the distribution substations connected to the primary or grid substation affected by the fault. The numbers of customers connected to each of these distribution substations is then summated to obtain the number of customers affected by the incident.

The YEDL HV system is monitored and controlled using a computer based three-screen system called DMS. This is a live system allowing remote switch operations of all HV switchgear at primary substation and higher voltage switching points. This arrangement is also the case for the monitoring of alarms, voltage and current levels.

The planned or unplanned operation of any switch at a primary or higher voltage substation automatically dresses the network diagram to represent the true position at that time. Operations remote from these substations require the control engineer to redress the control diagram accordingly when he/she is informed either by field operatives, or by customers, through the central call handling (CCH) system.

The control engineer uses a paper log to record all operations, instructions and confirmations for both routine and fault switching operations. These logs together with electronic records of alarms and operations were referred to by the audit team to determine the times of operations (and hence restoration times) for the HV faults being audited.

YEDL had taken a screen print of the network operating arrangements at the time of each HV fault for the period covered by the audit with the exception of the last three months. These prints were found to be very helpful to the audit team.

A total of 10 faults at the higher voltages were audited; eight 11kV, one 33kV and one 132kV. The initial system operating conditions, the protection operations, and the fault restoration activities carried out to restore customers was easily determined from the data supplied by YEDL and the assistance given by Bob Wells and his team.

Identifying the number of customers affected for each fault and restoration stage was less easy as the numbers recorded in the NaFIRS reports had been obtained from local knowledge, ratios of customers to maximum demands on substations or numbers recorded from a legacy system. These methods were found to be inaccurate in comparison to the connectivity model now in use throughout the company.

The control engineer managing the fault restoration has the responsibility for the completion of the NaFIRS information and he/she is required to complete the documentation within a few days of each incident.

YEDL does not operate an LV control system. If restoration of supplies to customers, following an HV fault, required low voltage backfeeds to be established, the control engineer would issue an instruction to the field operator to do this. The control engineer does not have access to the LV network diagrams and cannot instruct or monitor any LV network operations. On completion of any restoration of supplies to customers using LV backfeeds the field engineer will inform the control engineer of the restoration time.

One of the incidents, the one at 132kV, was the largest single fault that YEDL had ever experienced and involved a number of 132kV substations with over 150,000 customers affected.

(ii) Audit of LV Incidents

In a similar way to the HV incident audit all of the audit team were involved with the first incidents audited. Following the examination of the first two LV incidents the audit team then split into two to examine the rest of the 103 incidents specified for audit.

The audit of the LV faults selected commenced on the morning of the 23rd July and was completed on the afternoon of the 24th.

YEDL has a comprehensive GIS system, which is populated with all mains cables and overhead lines. In addition, services have been included such that all services whose detail is definitely known are drawn on the diagrams in a solid line. Details of all assumed positions are drawn in a broken line. These diagrams are kept up to date with all new services and changes being recorded within a few days.

All joints are also recorded with details such as the date of installation, joint type, and jointers name being available from a drop down menu by clicking on the joint. By checking joints in the vicinity of each fault it was relatively easy to determine the position of the fault and restoration strategy employed.

The connectivity model has now been fully incorporated into the GIS system and the numbers of customers involved in each restoration stage could easily be determined by running a trace programme to count them automatically.

For the period under audit the connectivity model was not available and other methods were employed to determine the customer numbers. These methods included actual property counts by field staff on site, assumed connections from drawings and the use of address codes. All of these had varying degrees of accuracy compared with the connectivity model. The connectivity model was introduced on 1 April 2002 for fault reporting.

Unlike HV faults, where reporting is carried out by one office, the LV fault reports are initiated through CCH at Leeds but the three depots complete the final reports before being sent to Leeds. Some variation in the quality of the reports was noted.

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

YEDL has introduced a policy document to ensure that IIP reporting is carried out correctly. This is used in conjunction with the Interpretation of the RIGs document issued by Ofgem. Coupled with these, targeted training has been provided to all field staff responsible for recording site information, to staff responsible for entering NaFIRS data, to control engineers and support staff, and to call centre staff. The training covers the connectivity model, the audit process, and the RIG definitions and process. As part of the monthly team briefings IIP issues are raised in order to inform staff of the programme and ensure they are aware of the financial risks associated with it.

During the visit the company demonstrated the following:

- When a telephone call is received the company's CCH operators record the time the call is received. Subsequent calls are recorded but the first call is taken as the incident start time.
- For HV faults generating alarms the DMS system time is recorded as the incident start time. For faults, which do not generate alarms, the CCH route is used.

YEDL is operating in accordance with the RIG requirements that start time is the time that the company first becomes aware of an incident by any means. An incident is recorded when an interruption to supply occurs affecting one or more customers for 3 minutes or more. The following are not considered as interruptions: pre-arranged interruptions affecting only one customer for the prescribed reasons; cut-out fuse operation; unmetered supply interruptions.

Start times for HV incidents are usually recorded from SCADA information, or alternatively from engineers' reports; for LV incidents start times are recorded in the Customer Call Handling (CCH) system by the automatic date stamping of incoming telephone calls. For HV incidents the completion time is recorded in the control log by the control engineer, the time is the time that the energising device is closed, if this is telemetered it is obtained from DMS; at LV the time is obtained from field reports.

All short duration incidents occurring on the 11 kV network cause the source breaker to operate, which results in all short duration incidents (interruptions lasting less than 3 minutes) being captured by the switch trip alarm at the substation. LV short duration events are not recorded.

Accurate measurement of the number of customers associated with a restoration stage is derived by a trace on the model. For LV customer numbers the connectivity model is used by allocating primary MPANs to appropriate feeders. For single phase incidents the customer numbers associated with all 3 phase supplies are counted and those associated with single phase supplies divided by three before being added to the customer count. For HV incidents the number of customers per HV substation is derived from the Distribution Management System (DMS) The customer numbers per distribution substation are loaded into DMS from the GIS connectivity model every month. Single phase HV faults count all three phase customers and two thirds of LV customers. The substations affected are identified by DMS on a real-time basis, by recognising the position of network open points.

The number of customers re-interrupted at all voltage levels is derived from YEDL's "Events & NaFIRS process" since a re-interruption flag is used to identify an interruption stage that affects the same customers to ensure that CI are correctly recorded. The customer numbers entered in Events & NaFIRS for re-interruptions are obtained from the connectivity model as described above.

All unplanned incidents are recorded because YEDL has an audit procedure in place to check that all appropriate incidents have a corresponding completed NaFIRS report. An automated check of NaFIRS and CCH is carried out to ensure that CCH numbers that are not represented in NaFIRS are valid non-incident events. This check is carried out on a 10% sample basis for LV and a 5% sample basis for HV, in accordance with BS 6001 guidelines, to ensure an acceptable confidence level. Pre-arranged incidents are audited in a similar manner.

Incidents on other systems, HV and LV incidents, and incidents at different voltage levels are entered into NaFIRS associated with different codes. Individual group reports can then readily be produced.

Since the Interim Review the automatic count of customer numbers has been introduced to the GIS system; also the method of recording the effects of re-interruptions has been added to the Events & NaFIRS recording process.

Following the Interim Review an internal audit was carried out of all IIP reporting processes, which led to additional training and further communicating of the IIP requirements. Also a joint audit was undertaken in February 2002 with NEDL to assess the state of readiness prior to the 1st April 2002 requirements. This involved NEDL staff auditing YEDL systems and procedures and vice versa. Additionally an IIP Audit Manager has been appointed to carry out spot and routine audits, as well as checks on the accuracy of the connectivity model, checks that all incidents have been reported and to check the data quality input to NaFIRS.

(iv) Conclusions

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

- The methods used by YEDL during 2001/2 to determine the numbers of customers involved with each restoration stage did not produce accurate results in comparison to the connectivity model now in use throughout the company. The use of the connectivity model will greatly improve the accuracy.
- The paper system used by YEDL to record times for restoration stages has the potential for transcription errors in the NaFIRS reporting, as witnessed in one of the 26 stages audited.
- Incorrect start times were observed in four of the 26 restoration stages audited, indicating a potential source of reporting error.

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

- The numbers of customers affected in each restoration stage was incorrect in a number of cases, in comparison with the connectivity model now available. This was mainly due to the procedures available at the time of the incident rather than any mistakes made by YEDL staff. Use of the new connectivity model would have greatly improved the accuracy of the count of customer numbers and it is anticipated that future numbers will be more accurate.
- Incident start times are manually recorded and a potential source of reporting error, as observed in five of the 118 restoration stages audited.

15.5 Overall Impressions

YEDL is committed to providing a reporting system that is accurate and which is well within the limits of accuracy set by Ofgem. Very good progress has been made with MPANs, connectivity and training and there should be no reason why the accuracy levels required by Ofgem should not be met if the company's procedures are followed.

YEDL has an excellent recording and retention process for services and joints and the recording of such on its GIS systems has resulted in a very accurate connectivity model. The accuracy of the connectivity model is maintained via a robust update process. The system is updated via an external contract with QCData. This contract is managed through Service Level Agreements (SLAs) which ensure the timeliness accuracy of all updates to the system.

The comprehensive and versatile YEDL GIS system provides extensive information to both field and office based staff allowing them to complete NaFIRS returns easily and accurately as well as aiding field operations at the time of the incident.

The manual recording of times and numbers can introduce errors which an automated system would eliminate.

15.6 Conclusions

Table O-1 presents the results of the 2002 audit of the YEDL 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 O-1

Stage	Item	Accuracy
Stage 1	MPAN Measurement	99.3%
Stage 1	LV Connectivity Model	96.5%
Stage 1	HV Connectivity Model	96.5%
Stage 3	LV Incident Reporting Accuracy – CI	98% (under)
Stage 3	LV Incident Reporting Accuracy – CML	95% (over)
Stage 3	HV Incident Reporting Accuracy – CI	92% (under)
Stage 3	HV Incident Reporting Accuracy – CML	92% (under)
Stage 3	Overall Incident Reporting Accuracy – CI	93% (under)
Stage 3	Overall Incident Reporting Accuracy – CML	96%(under)

15.7 Reporting to Ofgem's information Template

YEDL uses the EA NaFIRS system to record and report incidents on its distribution networks.

The total number of customers reported is the number connected on the 30th September 2001, as defined by the number of primary traded MPANs.

Each HV circuit has a unique Circuit Monitoring Number (CMN). An interruption has a relevant CMN recorded against it in NaFIRS and an MIS search of the database identified that there were 853 HV circuits affected by incidents, which matches the number reported in the totals box within the Ofgem reporting template. There are no apparent inconsistencies in the way circuits are identified and counted.

The number of customers interrupted (CI) in unplanned interruptions is derived by using NaFIRS and summating the number of customers affected in each stage of each incident (excluding re-interruptions) that do not fall into the embedded generation, NGC, other systems, and pre-arranged outage categories. The CI number in this category is artificially increased for YEDL in the 2001/02 submission because re-interruptions were counted as interruptions for part of the year. A flag was included in November 2001/02 in NaFIRS (see below) to correct this error.

The customer minutes lost (CML) figure is derived by summating from NaFIRS the CML of each stage of incidents that do not fall into the embedded generation, NGC, other systems, and pre-arranged outage categories.

The total number of re-interruptions is derived by using the re-interruption flag in the NaFIRS input fields to indicate any restoration stages that involve re-interruptions to customers. An MIS search is used to identify the total number of re-interrupted customers. This number is then entered into the reporting template.

The re-interruption flag was brought into use in the NaFIRS database input on 1 November 2001. Before this date there was no means of determining the number of customer re-interruptions and therefore in the reported data for the first part of 2001/02 all interruptions were counted and reported as CI, thus artificially increasing YEDL's CI count. CML reported numbers were, however, correct. For 2002/03 data reported numbers for CI will be correct because of the inclusion of the flag for the whole year.

Data relating to incidents are entered into NaFIRS together with identification codes that indicate to which Ofgem reporting category the incident relates i.e. planned or pre-arranged interruptions; NGC, embedded generator, other connected systems; short interruptions by category; and at the various voltage levels. Specific searches of the database can then be used to readily identify CI and CML numbers relating to the different categories.

The data included in the IIP submission for 2001/02 was not IIP compliant because the Primary Traded MPAN counts were not available until 1 April 2002. Customer numbers were based on address counts for LV incidents and on local knowledge, ratios of customers to maximum demands on substations or numbers from a legacy system for HV incidents. This methodology had the potential to over-count customers as secondary MPANs were included, however the impact is considered to be very small. In fact, the results of the audit of incident reporting highlighted under-reporting of customers on aggregate for the entire audit sample at both HV and LV, which suggests that the impact of the counting methodology was outweighed by incident reporting errors.

YEDL's CI counts were artificially high in the 2001/02 submission because the re-interruptions flag was not included in the NaFIRS data input process until 1 November 2002. Until this date re-interruptions were counted as interruptions and the CI count increased accordingly, however the magnitude of over-reporting was very small. These non-compliances have now been resolved and from the discussions held with YEDL and the records examined it is concluded that YEDL is now accurately reporting incident data to Ofgem via the IIP template.

15.8 Recommendations

The following points were identified as areas for further improvement:

- The connectivity model must be used to measure both HV and LV customers rather than connection addresses, local knowledge or numbers based on maximum demand figures. This model is now in use throughout the company.

- Given the manual nature of the YEDL incident reporting process, care must be taken to eliminate transcription errors.
- Introduction of an automatic logging system system will eliminate transcription and start time errors for HV faults
- For LV faults, attention is required to getting the incident start times correct

15.9 Learning Points

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

- If the distribution system is being operated in an abnormal manner (open point changes etc) this should be noted on the fault report to aid the audit process.
- For LV incidents, sufficient information needs to be recorded on the incident log to enable the audit team to identify where the fault was and what actions were taken (and where) during the restoration stages. This should include details of the system operating abnormally where appropriate.
- The greater the information available on an incident, the quicker and more accurate can be the audit conclusions.