Appendix I Northern Electric Distribution Ltd (NEDL)

9.1 Summary

John Woodhouse and John Curran audited Northern Electric Distribution Ltd's (NEDL's) distribution network business between 8th and 12th July 2002. From the questionnaires completed during the audit it was apparent that the customer measurement systems employed by NEDL are intended to be compliant with IIP and the RIGs. The audit of HV incidents showed that time stamping is automatic for all SCADA logged operations and that they are generated from the computer based control log, where manual switching operations take place. Additionally the use of transformer neutral earth fault (fleeting) alarms, brought back through the telecontrol system, allows time stamping of stage 2 and stage 3 (remote) automatic sectionalising, where these are not themselves connected to the telecontrol system. The use of these transformer neutral earth alarms stems originally from the use of Peterson[1] Coils, but this now also provides a very useful time-stamp for remote HV faults. Please note in this report that the term HV applies to the 6.6 kV, 11 kV and 20 kV networks in NEDL.

The audit of LV incidents highlighted the fact that determining customer numbers on incidents that affect only part of an LV feeder can prove difficult for the field operative, as he/she often has to assess the numbers affected by manual count. For the purpose of the audit, a correct transferral of the "as reported" information from the field into the NaFIRS report was considered to be accurate reporting.

NEDL has committed a high level of resources to IIP, including a comprehensive training and internal audit program.

Additionally NEDL has worked hard during the present phase to correct internally generated errors, such as the previous practice of starting the fault report from the second received loss of supply call. This has required a lot of corrective action to ensure that the incident reporting is RIG complaint.

For information an overview of the NEDL network Information Systems (IS Systems) is included at the end of this Appendix as Figure I-1.

9.2 Introduction

Northern Electric is the parent of the electricity distribution companies NEDL, serving the North East of England and North Yorkshire, and YEDL, which serves the rest of Yorkshire and Humberside. NEDL's distribution network delivers electricity to more than 1.5 million premises in its North East of England and North Yorkshire franchise area.

The System Management unit, which manages the day to day operation of the distribution system, is organised on a centralised and functional basis. It also manages the HV Control Centre at Houghton-le-Spring that carries out real-time management of the HV, EHV and 132kV networks. This office also houses the NEDL LV network fault management team and also houses the NEDL Powerline

[1] Peterson Coils are arc suppression coils fitted to a primary or grid transformer's secondary side star point earth. They are not widely used by DNOs in England & Wales (E&W), but are advantageous where a primary or grid substation has long overhead feeders and where the risk of cross country ground faults is higher. CEGB policy in E&W meant that the 132 kV system was solidly neutral earthed and consequently Peterson Coils are not currently used on the E&W 132 kV system.

telephone call centre.

NEDL also uses the HV Network Control Centre to handle routine switching and planned shutdowns which are recorded through the same computer based control log that generates the unplanned interruption data.

Within NEDL, LV fault dispatchers are responsible for interrogating the trouble management system (TMS) and for ensuring that incidents are dealt with promptly. During the hours of 7am to 10pm , the dispatchers at a centralised location have this responsibility. Between the hours of 10pm to 7am, the responsibility is passed to the call centre staff, in the same location.

This Appendix describes the July 2002 audit of NEDL's distribution licence area

9.3 Audit Process

This section defines the step-by-step progress of the 2002 audit.

9.3.1 Resources

The visiting auditors were:

- John Woodhouse of Mott MacDonald
- John Curran of British Power International

The NEDL audit team members were introduced by Gary Flynn, NEDL's Operations Director:

- Ian Punshon
- David Young
- Bill Robson
- Brian Walton

Also in attendance from Regulatory Affairs was Andrew Spencer, who was present at both the NEDL and the YEDL audits.

A number of other NEDL personnel were available during the course of the week. As can be seen, NEDL provided a very high level of resources to support the audit.

9.3.2 Induction

NEDL provided the visiting auditors with a thorough induction to the company systems at its Houghton-le-Spring head office. With the information presented both prior to the visit and during the induction it was possible to complete a large proportion of the audit questionnaires.

Due to the availability of an excellent computer driven back-projected screen in NEDL's emergency management and tactical control room, the audit teams were able to review the bulk of the RIGs related information systems (IS systems) from this location.

At the heart of NEDL's IS system is an Oracle database which contains all the required distribution related data. This IS system, called Central Network Database (CNDB), supports the activities of the other systems.

The Central Network Database is the collective name describing the major applications that support the management of NEDL's distribution network. It contains the elements that constitute the company's connectivity model and the associated network assets to customer links. This database was compiled in a series of stages to cover connectivity of the LV and the HV networks. In conceptual terms NEDL only has one connectivity model. This is due to the HV/LV networks being linked through the distribution substation and LV cables being identified by feeder ways.

The LV representation of the connectivity model was produced in 1996/97. Initially, substation locations were created from plant files and the LV network skeleton was digitised from paper records. Substation locations from LV skeletons were then reconciled with plant file locations. This provided an abstract view of most of the network but the skeletons were not always geographically accurate. The LV feeder circuit model was then built up from the digitised skeletons in the CNDB. At this stage the accuracy of the LV network configurations was very much dependent on that of the source of the skeleton, which covered about two thirds of the populated area and about 97% of the population. The model then employed Ordnance Survey (OS) address points to create the premise to network link using an algorithm. This algorithm dictates that if an address has a grid reference and it is a premise address on the NEDL network, then a link is created if, in the 1km x 1km OS grid square containing the address, or in any of the adjacent grid squares, there is:

- at least one LV feeder;
- at least one service termination;
- at least one pole mounted LV substation; and
- the length of the link would be less than 1 km.

The algorithm also contains a choice mechanism to determine to which of the above items the link is established. This is based on the proximity of the different elements. Finally, a premise address point in the model is matched to the recorded details of the primary traded MPANs, associated with that point, to permit the customers to be counted in accordance with the RIGs definition.

The HV, EHV and 132kV schematic connectivity model is contained in the Network Management System (NMS). This was created by an initial combination of plant data and design system vector model data. The resultant geo-schematic model was manipulated to provide an orthogonal view and substation data in the NMS was then integrated into the CNDB creating a link with the Trouble Management System, which is the main incident management tool. The customer numbers stored in the connectivity model correspond only to the network's normal feeding arrangements at LV. At 132 kV, EHV & HV, the customer numbers represent the dynamic real time connectivity of the network.

During the interim review visit (October 2001) NEDL reported that some difficulties had been encountered in creating the connectivity model. These related mainly to the quality of the data used to establish the location of network assets, address points and premises. Also, there are limitations implicit in the algorithmic assumptions as this is based on a 'connect to nearest' premise. Phasing information is not considered in the model and this is in accordance with the RIGs. During this review NEDL reported that a considerable effort had been put into data cleansing to improve accuracy at the LV feeder level. During the current audit it was possible to compare the improvements made by comparing the two sets of data produced by the old model and the current one.

NEDL's IS system maintains a real time electronic representation of the 132kV, EHV and HV systems. The status of the automatic switching devices at primary substations and above is monitored and automatically updated by the company's Supervisory Control and Data Acquisition (SCADA) and telecontrol systems. The status of HV switches at distribution substations is manually updated by the control engineers following the confirmation of switching operation from field engineers. The affected substations are looked up in the CNDB LV connectivity model to determine the effect on the LV network and hence the customers affected.

During the initial review, the control engineers checked that the CNDB was providing sensible customer counts and amended this if necessary. During this initial review, a number of cases were observed where the customer numbers linked to a substation were zero, which was clearly wrong. NEDL has subsequently used the data cleansing team to improve this situation to ensure IIP compliance.

Temporary running arrangements are not currently tracked in the static LV connectivity model.

Permanent changes to the network are recorded by field teams and by drawing office staff. At the initial review this was predominantly a paper based process but is now mostly captured on the computer system. Changes are then channelled to the network data maintenance sections who update the model by direct manipulation of graphical and form-based software tools. Changes to the LV network model are made, post-event, using records taken from site measurements.

NEDL reconciles CNDB and MPAN information on a quarterly basis by comparing both systems to check discrepancies and rectify inaccuracies. MPAN changes will be used to update the connectivity model for changes in the number of customers connected. Because premise to network connectivity is included as an integral part of the connectivity model, any delay in updating the model will be reflected in the number of customers affected. New connection MPANs are reconciled on a daily basis between the New Connections System (NCAS) and the MPAS.

NEDL has worked very hard to get the various data sets coordinated in order that the correct reports can be produced. In addition, as part of an ongoing review of the connectivity model, NEDL has further reduced the number of incorrect LV feeder connections within the model, by using a process called "snapping". The feeder is an LV feeder-way[2] off a particular distribution substation and this forms the basis of the LV and also the HV connectivity data. In the first iteration of the connectivity model algorithms were used to snap buildings with a valid MPAN to the nearest LV feeder. Subsequently unattached MPANs were reviewed with the objective of locating them on the LV connectivity model. During the period since the Interim Review NEDL has been extensively reviewing its LV connectivity model to both account for unknown connections and to improve the accuracy of connections where more than one circuit runs close to a property.

All of the above were demonstrated to the visiting auditors.

9.3.3 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:

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[2] An "LV feeder-way" is a discreet fused LV circuit originating at a distribution substation transformer. It is the basis of the LV connectivity model, since it tells NEDL how many service connection points are affected by an LV feeder-way fuse operation/removal.

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

The questionnaires were completed in parallel with the review of the chosen fault incidents.

9.4 Accuracy of Measurement and Reporting Systems

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

(i) MPANs

In accordance with Ofgem's reporting requirements, NEDL is required to hold details of the number of traded MPANs on each LV feeder-way and also link these feeder ways to their associated HV transformer. 132 kV, EHV and HV metered MPAN's are linked to a 132 kV/EHV/HV "HV" network node point which is on its correct section of HV cable or overhead line. It is the primary traded MPAN that forms the basis of incident report CI and CML. An MPAN has two parts. The first part is known as the core MPAN and is allocated by the DNO. The second part relates to the supplier and is added to the core MPAN to complete the primary-traded MPAN.

Since the Interim Review NEDL has carried out internal review audits of its MPAN system. Where inconsistencies have been found, non-compliance reports have been issued to NEDL's senior management. These have been followed through by the internal audit team to make sure appropriate action is taken. The over-riding objective has been to ensure that the MPAN count and association with the connectivity model is RIG compliant by April 2002.

MPANs are created in NEDL when connection contractors (currently IUS) notify the MPAS section in writing that new connections are being made within the NEDL geographic area.

The information given must be sufficient for NEDL to determine the geographic location of the new connection and other information such as number of phases, power requirement and if there is a requirement for two meters to be fitted.

The New Connections team produces the MPAN number based on information provided by the Connections Contractor. All 13 digit MPAN numbers within NEDL start with 15.

The NEDL software generates MPAN numbers such that no two numbers are the same. The first two digits are still 15 but the others are generated by the new connections software package.

There can only be one Primary Traded MPAN in NEDL per property with the emphasis being placed on the premises rather than the individuals.

On receiving the request for an MPAN from the connections contractor the details are entered into the New Connections Database where all details are recorded and the MPAN number allocated. This is then downloaded to the Central Network Database (CNDB) each day.

The CNDB then sends the information to the MPRS system where it resides whilst awaiting confirmation that the customer has signed up with the Supplier and the connection is now to be treated as a customer of NEDL.

Changes of supplier or resident make no difference to the MPAN as the properties remain "customers" until the service (wires) are removed.

The company assesses the accuracy of the MPAN system as being greater than 99% accurate.

Four domestic properties and one commercial premise were chosen at random and the MPANs were checked against the addresses. Additionally NEDL demonstrated its processes for:

- handling the receipt of a request for a core MPAN
- the issuing of a core MPAN for the above
- authorising the connection of a new meter point to its network
- holding the core MPANs prior to them being traded.

No inconsistencies were found in the process, which has remained materially unchanged since the Interim Review. We therefore have no reason to disagree with NEDL's estimate of 99% accuracy for the MPAN system.

(ii) Connectivity Model

The LV connectivity model is based upon the link between a property (as physically located in space against a map or code reference) and an LV feeder-way (as represented by a cable or overhead line plus service overlaid on the map base. This model is derived from the original LV Skeletons that the company held as scaled drawings. These have now been scanned against a digitally mapped background.

The connectivity model is logically based on the proximity of a property to an LV main. It is assumed (unless there is information to the contrary) that each property will be connected to its nearest LV (cable/overhead) main. The operational configurations of the LV mains are then assessed to determine the number of properties on each LV feeder-way originating from each distribution substation. The number of mains circuits are then assessed to determine the total number of properties connected to each distribution substation. The position on the network of each HV/LV substation (and hence the number of properties) is then assessed to determine the numbers of substations on each HV circuit emanating from each Primary Substation up to the normal open points on the network.

The NEDL geographic area was divided into 1 kilometre square areas and, using property address details, all maps were selected on which there was at least one property address. The average number of properties per selected map was calculated. This resulting figure was chosen as the sample size in each band and a table was then produced (utilising a BS 6001 sampling regime) for a confidence level of 90%, for property-to-LV feeder-way connection and 95% for property-to-substation connection. Sample sizes for each band were then chosen. The required number of samples in each band were then selected randomly and a detailed analysis carried out to check the accuracy of the process. Any band which fell below the accuracy requirements was then revisited and special attention paid to those that fell short of the standards required. A completely fresh review was then undertaken of the connectivity model substation and feeder-way to premises link.

During the foot and mouth restrictions of 2001 linesmen and other craftsmen were used to check service connection accuracies and the connectivity model was modified and updated with the accurate information supplied from the field staff. Any call from customers or other intelligence gained regarding the circuit that services are connected to is captured and fed into the model. There are currently between 500,000 and 700,000 service cards remaining, which need to be reviewed, and where appropriate, used to update the connectivity model's original estimate at the property-to-LV feeder-way connection.

The work by the linesmen and others has reduced the number of inconsistencies and this is seen as a continual improvement process, with the information received being used to improve the connectivity model. At present the accuracy of a property to the correct LV feeder-way is stated to be 93% with the property-to-substation accuracy being 96%.

An average NEDL feeder-way has 34 customers connected to it and a level of accuracy of 93% would represent plus or minus 3 properties. The average substation has 102 customers connected to it and an accuracy of 96% would represent plus or minus 4 properties.

Inconsistencies in the logical connectivity methodology were found where:

- a new LV main (on a different feeder-way) has been laid nearer to the premises than the original feeder that in fact supplies the property
- more than one main, on a different LV feeder-way, runs in close vicinity to the property (this normally occurs where a property is close to the substation or at major urban road junctions)
- the LV network operating arrangements are different to the planned running regime.

The areas most likely to be affected are densely populated areas where there are more than one LV feeder running down a road or where there are a number of substations very close together. These can introduce inaccuracies in the order of up to 20% and 9% respectfully.

NEDL updates the connectivity model with verified data as this is received, through the use of its "Graphic Tools" system and the drawing office from site visits and information from connection contractors. All new connections are marked on the model.

Five LV feeders were chosen in different geographic locations. Those feeders with only one cable in the street and with substations not too close together were very accurate. Those with more than one cable in a street were less accurate. Of the five LV feeders checked, four were found to be accurate with one feeder checked found to have one property connected to the wrong feeder. Despite this, we are satisfied with the company's stated accuracy for HV and LV connectivity models.

(iii) Conclusions

NEDL has worked very hard to ensure it is RIG compliant. The improvements in the connectivity model since the Initial Review are clear to see. This is seen as a positive sign for the accuracy of the reported results, derived from the connectivity model, for the 2002 / 03 reporting period.

No inconsistencies were found in the MPAN process, which has remained materially unchanged since the Interim Review. We therefore have no reason to disagree with NEDL's estimate of 99% accuracy for the MPAN system.

From the random check of five LV feeders, we are satisfied that despite potential inaccuracies where multiple cables exist in the same street, the company's stated accuracy levels for HV and LV connectivity models are reasonable.

9.4.2 Audit of Incidents

(i) HV Incidents

The HV incidents audited were well documented. This was helped by the use of a large back-projected "incident window" which allowed the computer generated images to be viewed by all comfortably sitting in the emergency coordination room. It also allowed a real time HV fault to be monitored by the audit team with minimum disturbance to the Network control staff.

The HV control centre covers the whole of NEDL's franchise area. Apart from inconsistencies caused by the incomplete LV connectivity model and a free standing telecontrol system that did not communicate with the NMS system, all of which have now been rectified, there were no outstanding issues.

When carrying out the audit of HV incidents, it was clear that the completion of the new LV connectivity model was affecting the accuracy of the customer numbers. The audit found that following a major incident, when supplies were lost from the NGC system, the numbers reported did not match the numbers that were counted when the incident was re-traced. These findings lead the auditors to conclude that the use of the new connectivity model makes for a more reliable reporting regime.

The times recorded in the HV reports showed no major cause for concern. One incident had a five-minute error in its agreed (audit) time and reported time, but all other incidents had no time variance.

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

- Measurement of time is automatic on the NMS (SCADA) system where circuit breakers have telecontrol links back to the NMS system. It is recorded by the control engineer on the NMS computer, for manual switching operations, when the field operative reports that the operation was done and telecontrol is not available. It should be noted that, in line with industry practice, three times are recorded for each switching operation. One is when the instruction was given, the second is when it was completed and the third is when it was reported. This means that field operations are also adequately recorded. Field staff are also familiar with the need to record times accurately from this requirement, which pre-dates privatisation.
- Measurement of customer numbers (MPANs) is also automatic but recognising re-interruptions is a manual process that could lead to over-reporting errors in the final CI count. Some form of automation or warning when customers are re-interrupted would help remove this potential source of inaccuracy.
- There is an established phraseology that is in place between field staff and control staff and this ensures that each knows what the other is instructing or doing. This is not present at LV and the need for such a phraseology system is clear.

(ii) LV Incidents

For the LV incidents, NEDL was able to access all records electronically in the emergency incident room to enable the incidents to be confirmed and tracked. This had the advantage that it was possible to drill down to a high level of detail, when required. For example, in one LV fault the auditors were not able to confirm the numbers purely from the IRIS (Incident Reporting & Information Systems) LV incident report and this required a step by step restoration of the incident from the report. Using the NEDL systems this was possible to do. It also highlighted where the field staff were not correctly reporting the restoration. In this particular LV incident the field staff appeared to have confused the office staff who had entered the stages incorrectly.

When carrying out the audit of LV incidents, some incidents were found to have combined restoration stages. In one incident the stages were mixed up in the reporting and this resulted in this incident also having to be recreated to then determine the correct customers and duration.

In another incident a re-interruption stage was missed out altogether.

Apart from omitted stages, a number of variances were caused by the differences in the old LV connectivity model and the current model. This problem existed across all the LV incident reports audited.

In a number of LV incidents, it was found that the location and or nature of the damage or fault were not given. This caused difficulties when trying to confirm the actual numbers affected by the fault/damage. In one incident where the actual fault was not given, it was only when this information was unearthed by one of the NEDL staff that it was possible to verify the customer numbers involved as reasonable. It should be noted that for most LV faults that involve a damaged/faulted cable or line that is remote from the substation, then to ascertain the customers affected requires that the location of the damage/fault is known and the actual component affected is recorded.

Other LV incidents involving LV fuses operating at the substation were not such a problem where no partial restoration (by sectionalising) took place. However, on one incident NEDL reported all three phases as operating, but from the notes to the report it was clear that only one fuse had actually operated. This reduced the audited duration for this incident by a third.

The report for another incident had missing restoration stages resulting in an incorrect duration being reported. This was in addition to those cases where the incident customer counts reported varied against the agreed audit number, due to the fact that the LV connectivity model was still being completed during this reporting period.

In one LV incident it was observed that the manual count of customers was wrong, to the extent that the field staff had missed out a cul-de-sac that was off supply.

One incident audited did not give the location of the fault. This made it difficult to determine the customers affected for one of the stages (as this was a partial interruption due to an open circuit on a cable). Another incident did not record that the fuses had operated. It appeared as if nothing had operated but after checking with NEDL staff it was confirmed that one fuse had blown and had been replaced in a link box.

With one incident the times were not given for one of the restoration stages (which was missed out probably due to this). This had to be estimated.

Apart from the differences in the customer numbers affected by an incident, caused by the introduction of the improved connectivity model, the timing of the LV faults was generally well reported for the majority of incidents.

(iii) Interpretation and Implementation of the Definitions and Guidance from the RIGs

NEDL has worked hard to train its staff in the RIGs requirements and definitions. It has also built the rules into the IS systems. For LV reporting this is the Incident Reporting & Information system (IRIS). Any reportable incident is automatically captured within IRIS. This is determined by the fault type, as captured within the Trouble Management System (TMS). The user is then required to complete the IRIS report before the fault can be closed down. The Restoration Area Manager can also view these outstanding reports, and can highlight any late reports to the dispatcher for completion.

An incident is captured when either:

- a planned or unplanned interruption to supply occurs for 3 or more minutes, or
- a circuit or item of equipment is prevented from carrying normal load.

In general the last item does not lead to CI or CML being reported unless supplies are interrupted. The main purpose of NEDL's IRIS system is to try to ensure that all RIG required processes are followed.

To ensure accuracy of reporting, the person receiving the first phone call will start an incident report in IRIS. This comes from the telephone call handling centre. Once the initial report has been raised it is passed to a dispatcher who is then responsible for seeing that the incident is dealt with promptly and that all the required data for IIP reporting is recorded on the IRIS system.

HV reporting (including 132 kV incidents) is recorded automatically on the NMS system. This is synchronised to the BBC's time-signals through the Rugby transmitter. In general the control engineers in the HV control centre are already used to ensuring that correct times are recorded to ensure RIG compliance since this was also required under NaFIRS. With the new system it is now possible to correctly record the different stages, as the previous NaFIRS system limited the number of interruption stages that could be reported.

(iv) Conclusions

NEDL has worked hard since the Interim Review to improve the accuracy of its reporting. It has conducted in-house reviews of the accuracy of its LV connectivity model and believes it is meeting the accuracy requirements of the RIGs. In addition it regards this work to be part of a continual improvement philosophy and has identified areas where it now needs to improve things.

NEDL is to be congratulated for achieving the level of consistency it has with its time recording and reporting. HV customer numbers are also reported with a high level of accuracy.

LV reporting needs to be standardised. This does not require a structural fix but instead requires an agreed phraseology that field and dispatch all recognise. Additionally an audit trail is required for each incident that permits the incident to be recreated to verify the number of premises involved and the number of traded MPANs.

9.5 Overall Impressions

The audit of LV incidents presented a challenge as it was difficult to recreate the incident from the data available. In general LV incidents suffer from a lack of standard terminology between field staff and the reporting centre. This is reflected in the degree of confusion, in some LV fault reports, as to what actually happened.

NEDL is committed to IIP and has worked hard to correct internally generated errors related to historical practices, such as using the second customer call time as the incident start time.

9.6 Conclusions

Table I-1 presents the results of the 2002 audit of NEDL's 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 I-1

Stage	Item	Accuracy
Stage 1	MPAN Measurement	99%
Stage 1	LV Connectivity Model	93%
Stage 1	HV Connectivity Model	96%
Stage 3	LV Incident Reporting Accuracy – CI	90% (under)
Stage 3	LV Incident Reporting Accuracy – CML	89% (under)
Stage 3	HV Incident Reporting Accuracy – CI	99% (over)
Stage 3	HV Incident Reporting Accuracy – CML	100%
Stage 3	Overall Incident Reporting Accuracy – CI	99% (under)
Stage 3	Overall Incident Reporting Accuracy – CML	97% (under)

It is important to note when considering the above audit results that the LV connectivity model was introduced part way through the year and the LV incident reporting results are therefore based on a combination of pre- and post-IIP compliant incident reports. In addition NEDL's HV faults derive the customer numbers from the underlying substation connectivity model and errors in this affect the HV count as well.

NEDL has been monitoring the progress of data cleansing using a methodology that is derived from BS 6001 but is not actually complaint with the full rigour of this Standard. This has enabled NEDL to determine the sample groups where they are not achieving the required compliance and to target these groups. The foot and mouth outbreak freed a resource that would otherwise have been working to look into areas where connectivity data was suspect.

Five LV feeders were chosen in varying types of environment. As predicted, the levels of accuracy where only one LV feeder exists and with distribution substations not too close together were very accurate. Those with more than one LV feeder present were less so.

9.7 Reporting to Ofgem's Information Template

All HV circuits are automatically monitored at each Primary or Grid Substation using switch trip alarms. All LV substations have customer numbers fed from them identified and all HV feeders from primary substations have their HV to LV substations allocated to them. HV protection zones are based on a Parent/Child arrangement. After each fault an IRIS report is automatically generated.

The connectivity model is used to determine the number of customers connected to each substation and the number of prearranged incidents is obtained automatically from the HV switching log. IRIS has a separate sheet to identify pre-arranged from unplanned incidents.

IRIS is used to automatically register faults, which are then passed to PC NaFIRS each month. All HV faults are captured and each feeder has substations allocated to it, with each substation also having the number of customers connected to it. For HV incidents, this provides for the extraction of customer numbers from the LV connectivity data.

For HV incidents the start time is captured via an automatic link with the control Network Management System (NMS). The start time is captured from the time that an alarm is received, the first customer call or when staff on site interrupt supplies (whichever is the earliest). The end of an incident is captured from the NMS system.

For LV incidents the start time is captured from the time that the first customer call is received or staff on site interrupt supplies. The end time is captured via verbal reports from the field. These are then returned as hard copy reports to a central location for input/verification.

Note that, for all voltages, a new incident is created if supplies are interrupted after 3 hours of permanent restoration by normal feeding or alternative/backfeed source; or 18 hours (Temporary restoration). Prompts have been built into the IRIS system to remind users of the 3 / 18 hour rule

9.8 Recommendations

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

- NEDL should undertake its quality control checks fully utilising the BS 6001 methodology to confirm the accuracy of the model. Ideally this should be undertaken independently
- LV fault reporting must include the basics details of the fault (what, where, how and when). This would allow the audit team to retrace the fault and verify the correctness of the incident report. It would also allow NEDL's own internal audit and quality procedures to pick up reporting errors
- A standard terminology is needed for LV incidents so that field and office staff are clear as to what is being communicated.
- Attention is required to getting all the incident stages correct at LV
- Certain inaccuracies were contained in individual restoration stages. These need to be fully handled as part of the NEDL internal audit.
- Some form of automated warning of re-interruptions would improve reporting accuracy.

9.9 Learning Points

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

- Having a fully documented audit trail is essential for the successful verification of the reporting.
- Being able to follow through the incident report on the "incident window" to demonstrate that everything is in order is an excellent auditing tool and NEDL is to be commended for making this available.

Figure I-1: Overview of NEDL's IS Systems