

Appendix H Merseyside & North Wales (SP Manweb)

8.1 Summary

Tony Wright and Simon Critten audited the Merseyside and North Wales licensed area of SP Manweb, part of the ScottishPower Group, between 29th July and 1st August 2002.

The audit team agrees with the company's estimate of its MPAN count accuracy of 99.5%.

The company has a connectivity model at HV/LV transformer level where the attachment of customers to the transformer was achieved by a geographic proximity model and improved during shutdown and fault information during the past three years. The present criterion for identifying customers by LV feeder is to disaggregate this number to individual LV feeders by dividing the total number of customers by the number of LV feeders. Previously the number of customers affected by a LV incident was agreed between field and office staff.

The target completion date of the new LV Connectivity Model has slipped since the interim review due to unforeseen difficulties but the strategy presented then to capture data at LV feeder level is unchanged and has been followed. Having witnessed the present progress in SP South of Scotland it is considered that the March 2003 completion date for SP Manweb is realistic and achievable provided no further unforeseen difficulties arise.

SP Manweb's present estimate of the accuracy of customers connected to its network is 97.5%. This is based on the MPAN accuracy of 99.5% which is discounted by 2% of customers not being linked to a transformer in TroubleCall and therefore not reflected in ICOND. It was not possible to verify the accuracy of the company's new connectivity model as it had not been completed at the time of the audit.

One issue that may cause potential difficulties in accurately reporting individual incidents is the proportion of heavily interconnected networks in the SP Manweb area. However it is acknowledged that the method for the incorporation of these networks has been agreed with Ofgem and that over time the overall accuracy of this will improve.

The audit of LV incidents showed some variances between the audited and reported numbers of customers interrupted (CI). This variance should be reduced with the implementation of the new LV Connectivity Model and completion of all outstanding training programmes. For faults on part of a LV feeder, the dispatcher normally relies on estimates provided by field operatives, which are potentially inaccurate. Reporting of incident start times also proved to be a source of error. The majority of errors associated with TroubleCall/ICOND Incident Log entries occur during increased workload on the personnel, for example during bad weather and other difficulties. The audit highlighted the importance of accurate and, where possible, detailed information being recorded in the incident logs.

The HV incident auditing showed that the variances in customer interruptions and customer minutes lost were primarily due to errors in transferring the respective incident start and end times from the switching logs to the report.

The audit team is of the opinion that SP Manweb has correctly interpreted the RIGs definitions and that the company is operating in accordance with them. Furthermore, the linkages between the pre-

and post-IIP reporting requirements are consistent and information flowing into Ofgem's reporting template is accurate. The only possible issue relates to the 18-hour rule for temporary supplies. SP Manweb implemented a restoration code for temporary supplies late in 2001 to ensure that any time taken to repair the first incident is added to the original incident (provided the re-interruption is within 18 hours). There were, however, some cases found during the audit which suggested that SP PowerSystems personnel may not have used the correct restoration codes (or the incident occurred prior to the implementation of this restoration code). It should be noted here that SP PowerSystems' training is ongoing and expected to be complete for this phase in October 2002.

As reported at the interim review, SP Manweb's in-house contractor, SP PowerSystems Ltd. has a highly motivated and enthusiastic team behind the IIP project. The company's commitment to the project is proven by the extensive training programmes employed, setting up of the Data Capture Bureau at Glenrothes and internal audit team.

8.2 Introduction

SP Transmission and Distribution is responsible for two separate electricity distribution licences – SP Manweb covering the Merseyside and North Wales area and SP Distribution covering the South of Scotland area. Information reporting under the IIP falls within the responsibility of the SP PowerSystems Management Centres (PSMC) - Prenton for the SP Manweb area and Hamilton for the SP Distribution area.

Within SP Manweb, dispatchers are responsible for interrogating ENMAC and for ensuring that incidents are dealt with promptly. During normal office hours dispatchers at either the PSMC Prenton, or a local office at Wrexham have this responsibility. Out of hours all incidents are the responsibility of the PSMC Prenton.

In SP Manweb's operations the Network Management System (NMS) model is used at the 132 kV and EHV level. This system sits above and interfaces with the GE Harris Energy Network Management and Control System (ENMAC) which is used for the HV and LV networks. The Integrated Control Operational Diagram (ICOND) is part of the ENMAC system and contains the HV connectivity, customer numbers attached to HV/LV transformers, creation of HV switching logs as well HV control. TroubleCall is the Electronic Fault Management System, again part of the ENMAC system and records customer incident calls, with linkages to Customer Directory and LV incident management.

This appendix describes the audit of SP Manweb's undertaken between 29th July and 1st August 2002. The audit took place at the SP PowerSystems Office, Prenton.

8.3 Audit Process

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

8.3.1 Resources

The visiting auditors were:

- Tony Wright of British Power International
- Simon Critten of Mott MacDonald

The audit team members representing SP Manweb were all drawn from their in-house contractor SP PowerSystems:

- Phil Bridgwater
- Barry Judd
- Jeremy Blackford
- Stewart Knox
- Alan Kelly
- Alyn Jones
- Val Ward
- Janet Ford

Ofgem personnel:

- Chris Watts

A number of other SP PowerSystems personnel were available during the course of the week. As can be seen, SP Manweb's contractor SP PowerSystems provided a very high level of resources to support the audit.

8.3.2 Induction

SP PowerSystems provided the visiting auditors with an induction to the company systems at its Prenton Office. With the information presented both prior to this visit (such as that provided during the SP Distribution audit visit) and during the induction it was possible to complete a large proportion of the audit questionnaires.

The induction began with an overview of SP Manweb's Systems and Processes and a tour of the key systems used to create incident reports in SP Manweb. As the systems and processes followed closely those of SP Distribution it was decided that once an overview of the processes and a tour and demonstration of the systems was completed the incident auditing would begin.

Next, the visiting auditors were given an update on the LV customer connectivity project which aimed to accurately reference all MPANs to specific LV feeders from distribution substations and to provide a mechanism for on-going updating. The current status of this project is that it is due to be completed by March 2003 and at the time of this audit no aspect of the LV connectivity model for the SP Manweb area had been completed.

SP Manweb has been very pro-active in its approach to IIP and has established a number of controls to ensure that all IIP information is recognised and reported.

8.3.3 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.

It was a natural split in resources for one visiting auditor to complete the questionnaires while the other focused on the audit of incidents. The questionnaires were completed based largely on the information presented prior to the visit and during the induction. The SP PowerSystems team members checked the initial drafts of the questionnaires for factual accuracy, the result forming an agreed version.

8.4 Accuracy of Measurement Systems and Reporting Process

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

(i) MPANs

The visiting auditors completed this questionnaire with SP PowerSystems' Phil Bridgwater and Barry Judd.

SP Manweb has identified its primary traded MPANs by running the algorithms described in Document IIP-13-001 Issue No. 2.1, on data extracted from the Meter Point Administration System (MPAS). This document received Ofgem approval through a letter dated 18 June 2002 and no deviations from this system were found during the audit.

Multiple MPANs are dealt with by identifying where the same Network Property Link (NPL) exists. The NPL is a SP Manweb generated number that is a unique ID to a single exit point. Once identified the IIP data engine removes all duplicate entries against any NPL.

The company is satisfied that scripts and algorithms accurately account for the primary traded MPANs, hence is very confident in quoting an accuracy of greater than 99.5%. The 0.5% essentially represent work in progress and the company has estimated that of the total customer base for both licensed areas there are 15000 – 16000 customers/connections that are connected but not being traded. This figure represents the present identified number of inaccuracies found in the 60% of exit points in Scotland on a pro rata total customer base. The recently created LV Capture Bureau at Glenrothes identifies missing or inaccurate placement of MPAN information. These are investigated, remedial action taken and then accurately captured under clean up exercises.

In order to update the MPAN count, the company uses scripts and reports on MPAS/TroubleCall/Unmetered Supplies and a reconciliation spreadsheet to track the updated figures month on month. The Data Management Section of SP PowerSystems is part of the MPAN generation process and when the LV connectivity model is complete they will take over data updates currently completed by the Bureau. It is proposed that they become the one-stop-shop for maintenance updates.

Random tests were conducted on the MPAN database through the selection of four new domestic and one commercial premise(s). The visiting auditors were able to witness and confirm that the company handled the request and subsequently the issue of primary traded MPANs for the selected premises as detailed in document BUPR-22-014 issue No.3.

The procedure SP Manweb uses to authorise the connection of the new meter points to the live network and the MPANs becoming traded is outlined in document BUPR-22-014 issue No. 3 – Sub section “Connection and Site Responsibility Agreement System” (CSRAS). Although the precise step-by-step information flow was not audited, all five properties were identified as energised and were both held in the Bureau awaiting attachment to the LV connectivity model and attached to the TroubleCall system for customer number counts in the RIGs reporting process. SP Manweb demonstrated the process of storing MPANs in the system with different statuses including:

- registered for connection
- connected
- energised (as all the sample were)
- de-energised
- disconnected.

While completing the audit the opportunity was taken to witness the disconnection of existing supplies (the procedures of which are included in document BUPR-21-007 Issue 2). A complete physical disconnection was observed with the removal of the MPAN. In addition the archived records of a complete physical disconnection were researched and confirmation found that this had occurred and the MPAN removed.

This further reinforces the evidence that SP Manweb is following the procedures agreed with Ofgem.

(ii) Connectivity Model

The visiting auditors completed this questionnaire with SP PowerSystems’ Phil Bridgwater and Graham Johnston during a visit to the LV Capture Bureau at Glenrothes.

SP Manweb has a connectivity model at transformer level. This is held in the Faults Management system called TroubleCall. The Customer figures held against each transformer in TroubleCall are passed to ICOND (Integrated Control & Operation Network Diagram). The attachment of customers to the HV/LV transformer was achieved by a geographic proximity model and the present criteria for identifying customer numbers by LV feeder is to disaggregate this number to individual LV feeders by dividing the total number of customers by the number of LV feeders.

Document IIP-13-003, Issue No. 1.3 details the methods by which SP Manweb intends, and indeed currently is for SP Distribution, linking customers to LV feeders and aggregating to HV/LV

substations. This work is being undertaken at a 36 seat Data Capture Bureau built and manned with 50 full time equivalent staff at Glenrothes. The staff are employed by ASA Data Services and their training programme for new recruits was examined and the accuracy audit procedure witnessed. The work involves accurately establishing customer to LV feeder associations. As well as the two stage audit carried out by ASA Data Services, the company carries out its own QA and of the 300 networks checked, the error rate to customer connected was less than 0.001%. This process was witnessed by the visiting auditor during the audit of the SP Distribution area and proved to work correctly when, at the first stage, a team leader in the Bureau found customers attached to the wrong LV feeder.

This programme was intended to be completed by April 2002 but unforeseeable difficulties since the interim review have caused the target completion date to be extended to March 2003 for SP Manweb (September 2002 for SP Distribution). Working practice changes have been introduced to achieve the optimum capture rate consistent with accuracy and revised target dates of March 2003 have been set for the whole company for its two distribution licences.

The current strategy of physical association from existing records by the capture bureau has almost eliminated proximity matching in the SP Distribution network dealt with to date (please note that the SP Manweb connectivity work has yet to commence). It is anticipated that less than 5% of customers will be proximity matched. The initial data capture will provide a step change in accuracy. The long-term trend will be an accuracy and confidence level growth as planned and unplanned incidents arise and the data held (feeder and/or phase details) is confirmed.

One issue of significance regarding the development of the LV connectivity model is the high proportion of heavily interconnected supplies. To investigate further a sample was considered within an interconnected area. Analysis of the operational diagram found that if the system were operating in the way depicted a cluster of houses would have no supply. SP Manweb have procedures in place to resolve such issues as they arise, for example the completion of an on-site audit and the use of local contacts. However, we feel that there currently remains a potential source of inaccuracy associated with this aspect but acknowledge that over time, through the application of the agreed procedures, these potential inaccuracies may be reduced. Due to unforeseen delays in SP Manweb's development of the LV connectivity model the audit team were unable to complete an analysis of the accuracy of the LV connectivity model during this audit.

(iii) Conclusions

The audit discovered no deviations from SP Manweb's method of identifying customers by primary traded MPAN, as approved by Ofgem. In addition no inconsistencies were found in the auditing of SP Manweb's MPAN processes and it can therefore be concluded that the company's estimation of 99.5% for the accuracy of its MPAN count is correct.

The present connectivity model at transformer level has been shown to be inaccurate when disaggregated to LV feeder level and indeed the company could not give a level of accuracy for the model at this level. Given that the company has tried a proximity model previously and concluded that the best way forward was to move to the new process, which they also felt had other advantages, then it can be concluded that the present model does not achieve the accuracy level required. A new, more accurate, LV model is planned for development and scheduled for completion by March 2003. It was not possible to verify the accuracy of the company's new connectivity model during the audit. It should be noted that the analysis of the LV incidents that follows has been completed against the background of the existing inaccurate system.

The target completion date of the LV Connectivity Model has slipped since the interim review but

having witnessed the present progress during the SP Distribution audit it is considered the March 2003 completion date for SP Manweb, is realistic and achievable provided no further unforeseen difficulties arise.

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

In preparation for the audit SP Manweb had prepared complete incident packs for both the HV and LV incidents. The LV packs included printouts of the IIP capture and the TroubleCall information from their Prosper System. In addition to these printouts of the incident log-sheets including the resource management log, telephone calls summary log and the first call log sheet. The information for the HV incidents included printouts of the IIP capture and the ICOND information taken from their Prosper System. In addition copies of the switching log for the incident, details of the restoration stages, TroubleCall information (including first caller details), printout of the SCADA log and marked-up copies of network diagrams were included.

The audit of all the incidents was undertaken with a view to establishing the sequence of events for the incident and repair and the information available regarding who was affected. This approach included consideration of the following:

- the first knowledge that customers were affected by no supply cross checked with first call details (confirmation that there was no supply was looked for in the calls)
- checking the times of the first 'no supply' information and when the incident was resolved in the reporting logs – checking that this tallied with what was contained in the Prosper Sheets (IIP and ICOND/TroubleCall)
- checking the method of restoration of power – if temporary supply was used checking forward in the logs for when the incident was resolved (ensuring that there were no re-interruptions)
- checking the customer numbers involved – by considering what was reported in the logs, the current system customer numbers and conformation of the situation using the GIS (where practical). Note that there was no way to replicate sub-feeder faults on the connectivity model (as it currently stands) so the system numbers in the incident auditing workbook reflect the total customers attached to the feeder or generated through the application of the method outlined in Section H.4.2.(i). As discussed, once completed, the LV connectivity model should allow a more accurate assessment of customer interruptions to occur.

The assumptions applied to each audit have been separated for both LV and HV incidents and are outlined at the beginning of each respective section.

(i) Audit of LV Incidents

The audit of the incidents started in the afternoon of Day 1. It had been agreed that the LV incidents would be audited first due to potential LV staff constraints later in the week. The entire audit team worked through the first incidents to check and understand the process. Then the resources were divided and one auditor returned to the questionnaires while the other began the audit of the LV incidents with members of SP PowerSystems personnel.

Training in the procedures for reporting CI and CML occurs during comprehensive training programmes with reference material in the "Prosper Guidance Folder" issued to its dispatchers and field staff. However due to the unforeseen difficulties between November 2001 and February 2002,

the training programmes were delayed and hence for the Incident Audit Year between 1 April 2001 and 31 March 2002, the Prosper reporting guidelines were not strictly followed. Furthermore the completion date of the LV Connectivity Model was extended to March 2003 due to unforeseen difficulties and hence not applied during the Incident Audit Year as discussed in Section H.4.1. It should therefore be noted that the audit, therefore the results, have taken place against this background.

The following methodology was applied when auditing each LV incident:

- Where incidents involved a single premise(s) on the same service cable, the system customers were taken to be that reported by the field operative. This information is deemed accurate, as potential errors in the number of customers affected are small.
- Where incidents involved blown or removed fuses on an outgoing feeder of a HV/LV substation, the system customers were obtained by dividing the customer numbers on a transformer by the number of feeders to get the number of customers per feeder. This is then further divided by three to get the number of customers per phase. This process is in line with SP PowerSystems's Prosper Guidance Folder. The number of feeders was obtained from GND and the number of customers attached to the transformers from the current ICOND model. This approach was taken to obtain a consistent audit on the number of Customer Interruptions unless additional information was available to disprove the use of the formula, such as information obtained from the GIS or the presence of interconnected networks.
- Where incidents occurred partway along a feeder, unless there is additional information available which suggested the figure should have been otherwise, there is no viable method of confirming the customers numbers involved. In this situation the estimate given by the field operative to dispatcher as recorded in the Incident Log was taken to be correct.
- Where incidents occurred in a potentially interconnected network consideration was given to all the information such as the network configuration (i.e. normally open points, link box locations etc.), type of fault, location, time of day, numbers of calls and if no information existed to suggest inaccuracy in the figure reported that figure was assumed to be correct.
- Where a customer reported that they had no supply and requested that no work be completed until a specified time the incident clock did not start until that time was reached. This was assumed on the condition that the fault affected nobody else, if it did then the first report was taken as the start-time.
- In the situation when people consent to remain off supply after repairs have been halted by a third party (i.e. unable to gain access to the required property) then the incident clock was stopped until work resumed when it was restarted as a continuation of the same incident.

Due to the delays in completing the LV connectivity model, at feeder level, this audit occurred prior to the operation of the LV feeder connectivity model.

It is understood that once the LV Connectivity Model is completed, it will be interfaced with TroubleCall and dispatchers will have access to the number of customers on each LV feeder from the HV/LV substations. When the dispatchers are given access to the LV Connectivity Model, they will be able verify the number of customers estimated by the field operatives when network links are removed or any alternative feeding arrangements utilised. This would be deemed more accurate and consistent than the current methods employed for establishing the numbers of customers affected.

Single premise incidents were generally straightforward and contained few errors. It was difficult to assess the number of customers affected by incidents occurring partway along a feeder as the

dispatcher relied on the estimate provided by the field operative. Further the simple calculation method outlined above to generate the current customer numbers also gave only approximate numbers. Therefore with no details of the location of the break an accurate assessment of the numbers of customers affected is very difficult. It is anticipated that with the completion of the LV connectivity model a more accurate assessment of customer numbers will be possible.

There is inherent difficulty in reporting accurate numbers for the majority of non-single premise incidents because the LV Connectivity Model is not available to verify the numbers at feeder level and there is no consideration of the sub-feeder level in the current connectivity model. It is very unlikely that the feeders are equally populated, however, to achieve consistency the methods used by SP Manweb, outlined earlier, were applied.

It therefore follows that the larger and more complex the incident the more room for errors in the customer numbers exists, especially if the incident occurred part way along a feeder. This trend was demonstrated with larger variances for incidents that affected a wider area and/or a greater number of customers.

In a few of the audited incidents, checking the customers numbers connected to the affected feeder against the current customer count on the system highlighted large variances between the reported customers and the system customers. Further investigation revealed that in many cases the reported customers had to be assumed to be correct due to the level of detail in the report and the high level of interconnected networks in the respective areas. Interconnected networks effectively mean that a sub-station can be lost yet generally no, and at worst only a few, customers lose power. Consideration of the network diagrams enabled the auditors to determine if the network could be interconnected but other than working out that it is possible for the power to flow around it was not possible to determine definitively whether the network was interconnected and therefore accurately determine which customers, if any, were affected. In these situations other members of the audit team or SP PowerSystems personnel were called in to confirm the likely engineering methods used to maintain customer supply and to aid a decision on customer interruptions and customer minutes lost.

Reporting of the customer numbers in some cases closely corresponded to the number of calls made into the system. Where this was the case it was suggested that due to the lack of information from the logs the person completing the incident report may simply have taken the number of calls as the customer numbers. In this situation the audit team considered the information available including network diagrams, calls (addresses of caller), time of incident, system customer numbers etc. in order to reach a decision regarding the customer numbers for the incident. As noted before, the completion of the LV connectivity model should lead to an improvement of accuracy in this area.

It was noted during the audit that where customer numbers and key decisions/events were entered into the logs there is no explanation or indication where this figure or opinion came from. For example, if the customer numbers are estimated from the field then this should be recorded in the log with the figure. This would then enable someone revisiting the report/log to see where the figure was generated from and may prompt a more thorough investigation of the customer numbers.

The majority of errors associated with TroubleCall/ICOND Incident Log entries occurred during periods of increased workload on the personnel – for example during bad weather or industrial action the completeness and level of detail contained in the incident logs fluctuated. However, the normal audit routines should identify most errors. For example, duplicate incident reporting would be picked up as multiple entries of similar transformer tags at the same date and time. There were, however, a few systematic errors that were identified in the audit sample.

In some incidents, where the customer refuses a temporary connection or agrees to remain off supply SP Manweb assumes that the customer has its supply back on and the CML count is halted under Prosper to meet Guaranteed Standards. SP Manweb has interpreted this to be compliant with Section 2.12 (3) of the RIGs. However, in these cases, when work on the fault restarted the additional work was usually accounted for under a separate incident. As the power was only restored for Prosper purposes and was not physically restored for the customer this additional repair time should be added to the original incident and not raised as a new incident. PowerSystems both acknowledged this problem and advised us, during the audit, that they had discovered this problem with their IIP reporting during 2001. Their investigation of the problem showed it resulted from a software code error in their new IIP Prosper computer system. We understand that this error was corrected during the first quarter of 2002, and that PowerSystems believe that similar reporting will correctly comply with the RIGs for the whole 2002/3 fault-reporting year.

There were a few cases in the audit sample where a customer was re-interrupted within 18 hours of a temporary restoration. In these cases a new incident was raised, however, this should have been viewed as a re-interruption and the additional time added to the original incident. PowerSystems realised that this was a potential problem and in late 2001 introduced a separate restoration code for temporary restoration. This code essentially ensured that if there were any re-interruptions the additional time for the re-interrupted customer would be added to the original incident. It is possible that either the implementation of this code at the time of the audit was not 100% or that the incidents in question occurred prior to the introduction of this code.

Where a temporary connection has been made to restore power such as via an abnormal feeding arrangement or a back feed supply, it is important that the incident logs contain details of when the original connection is restored. This information is useful both in order to keep an accurate 'live' working network of the LV Connectivity Model and to aid future audit processes.

Reporting of incident start time also proved to be a source of error. In a number of situations the dispatchers used the time that the incident was first created in TroubleCall as the start time rather than the time that the company first became aware of the fault, such as the first customer call reporting no supply as recorded in TroubleCall. In other cases the first call had been missed, especially if the link between the call and the incident had been forced at a later date. This is when a manual link of the call to an incident has been 'forced' as they were not automatically linked by the system at the time of the call.

In some incidents, where the customer called in to report a problem other than a loss of supply (e.g. flickering lights), the time of their call was used as the incident start time. However, it was apparent upon examination of the incident logs that the customers were only interrupted when the field operatives arrived at site and cut the supply to allow them to fix the problem.

The audit of LV incidents was completed by the end of Day 2.

(ii) Audit of HV Incidents

During the afternoon of Day 2 of the audit, The visiting auditors and SP PowerSystem personnel began auditing the 20 HV incident reports for the period between April 2001 and March 2002.

The following methodology was applied when auditing each HV incident:

- first the switching logs were considered in order to understand the cause of the incident and verify the start times from either TroubleCall records or the alarm lists

- next analysis of the network occurred to verify the reported customer numbers. This was done in two ways:
 - the section of the ICOND network relating to that particular incident would be called up from the archive data. In addition to this SP Manweb had recorded (and reproduced for the audit) a list of the transformers affected with related customer numbers at the time the incident occurred
 - using the restoration logs available (and a dummy incident) the incident could be replicated on the current live system effectively isolating just the part of the network where problems had occurred
- the current system and archived system numbers were then compared with the numbers provided at the time of the incident.

For the majority of cases the current system numbers differed from the reported numbers which made accurate audit numbers difficult to confirm. This was due to the exact network model for the particular incident date not being available, however where possible SP Manweb had attempted to provide evidence of abnormal feeding arrangements at the time. The numbers obtained from the live system and archived system models were, on-the-whole, able to provide satisfactory confirmation where the number of customers interrupted stated by the control engineers were accurate.

The smaller variations in the numbers of customers interrupted between the system and reported customers can mainly be accounted for through new customer connections to or customer removals from the relevant HV/LV substations. Where, larger variations occurred, this was generally shown to be primarily due to system changes such as reconfiguration of the network, for example, network connection changes or abnormal operating conditions at time of incident.

There were a couple of cases where the system audit highlighted errors that existed in the connectivity model at the time of the incident. These errors were where substations (therefore customer numbers) had not been picked up during traces completed at the time. It was agreed that these missing substation customer numbers should have been included in the original incident. It should be noted that these connectivity errors had already been identified and fixed in the HV connectivity model prior to the audit.

There was one case where an error in the customer numbers attached to one transformer at the time of the incident led to an over-calculation of the customer numbers affected by the incident. In this case over 350 customers had been assigned to a 50 kVa transformer. Since the incident this error had been identified in the connectivity model and the customers redefined to less than 90. The reported customer numbers associated with this incident, it was agreed, should be adjusted accordingly.

The variances in incident durations were primarily due to errors made in transferring the respective incident start and end times from the switching logs to the report.

The manual transfer of information from the Transmission Report (covering 33kV, 132kV or NGC supply failures) to the Prosper Report is a potential source of error. Another potential source of error is that the current connectivity model counts the numbers of customers attached to transformers. As a result, at the current time, the customers connected at HV level are not picked up during a trace and have to be added manually at the end of a count. It is acknowledged that the potential for inaccuracies is very small, as there are only just over 700 HV customers on the system compared with more than 1.4 million LV customers. SP Manweb is aware of this problem and is in the process of getting the

software upgraded with one of the resultant effects being that the system will recognise and count customers connected at the HV level automatically.

The audit of the HV incidents was completed by the end of Day 3.

During the course of the HV incident audit, we did not encounter any incidents that were too complex to resolve, partly due to SP Manweb's extensive preparation for the audit, the desire to resolve all possible issues and the ability of the SP PowerSystems staff to interrogate the system and find answers. The spare HV incidents were therefore not required.

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

The information required for this questionnaire was obtained during the audit of SP Distribution and information provided at Prenton during the SP Manweb audit.

SP Manweb has included detailed definitions and guidance on the RIGs application in the following internal documentation:

- Prosper HV User Guide (Draft form at the Prenton Control Centre)
- Prosper Guidance Folder, Doc – 00 – 270 (issued to appropriate staff) containing:
 - LV Troubleshooting Guide, IIP – 14 – 016
 - HV Troubleshooting Guide, IIP – 14 – 017
 - IIP Rules Guide, IIP – 14 – 018.

The start of an HV incident generally occurs automatically as HV incidents are picked up by the tele-control system and ICOND date stamps the time at which the incident starts. With incidents such as a first visit from a no supply TroubleCall report which turns out to be an HV incident with no telemetry indication, the start time is obtained manually by the control engineer from the original report in TroubleCall and entered into the incident report. An electronic link between TroubleCall and ICOND would overcome the possibility of any human errors. In SP Manweb the NMS (Network Management System) model is used at 132kV and EHV. This does not link directly with ICOND. NMS is used to establish the primary substation affected by the incident and this information is manually transferred to ICOND where network tracing is carried out to establish customer numbers. As with TroubleCall an electronic link between NMS and ICOND would reduce the risk of human error.

The start of LV incidents is the time at which the first "no supply" call is received. An incident log is then created with the start time manually entered by the dispatcher once confirmed by a field operative. The number of customers affected by an LV incident is estimated by the on-site resource and the dispatcher assisting by indicating the total customers supplied by the secondary transformer which supplies the affected network and application of standard criteria (dependant on incident type).

An incident is complete when supplies are restored to all customers involved in the incident and all the equipment involved in the incident is returned to service where this occurs within three hours of the final customer restoration; times are entered manually into the system.

As part of the ISO accredited process which is operated by the Systems Performance Analysts in the control centres (Prenton & Hamilton), a monthly audit of incidents is carried out. This audit picks a day at random during the month and examines every incident that occurred. In addition to the ISO

audit an internal audit of 5% HV and 1% LV incidents has been carried out monthly. This is being brought into the ISO process. This audit concentrates on customer interruptions and customer minutes lost accuracy for HV and correct allocation of reports for LV incidents. From these audits a series of Reporting Accuracy Key Performance Indicators (KPIs) has been produced in the form of a "Prosper Issues Register" which identifies problem areas and attaches ownership for correction. This information is fed back formally into the management chain for corrective action.

All operational and support staff received roadshows on IIP requirements followed by 450 staff receiving specific training. Comprehensive training course details were provided to the visiting auditors and included typical fault scenarios, which were supplemented by a multiple choice questionnaire to confirm understanding. Any queries that cannot be answered during the course are collated, answers obtained and a feedback document produced so that no question goes unanswered.

Due to unforeseen difficulties experienced across the business for a period of 4 months (November 2001 to February 2002), approximately 60% of staff have received the appropriate training. Outstanding training is currently being reviewed with follow on courses and e-learning being planned – completion is programmed for October 2002. In addition, staff are also able to access the company intranet site where they can obtain a process map and step-by-step information on the relevant part of the process.

During the visit to SP Manweb the audit team were able to see document IIP-16-01 which details the methods employed to capture and process short interruptions.

Once a call has been logged in either SP Manweb's TroubleCall or ICOND system it cannot be lost or erased. Only four specifically authorised people have access privileges that allow them to amend any database records. Such amendments are very infrequent and always leave an audit trail.

All incidents which interrupt customer supplies generally have associated customer calls and/or system generated alarms (in SP Manweb NMS sits above ICOND for system generated alarms). Processes and procedures are in place to ensure that this information is captured and incidents generated in TroubleCall. As the incident progresses TroubleCall/ICOND is progressively updated through to incident closure.

(iv) Conclusions

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

- For complete feeder outages, SP Manweb's present guideline states that the number of customers interrupted were obtained by dividing the customer number of a transformer with the number of feeders (one third for one phase etc). This approach was taken to obtain a consistent audit on the number of customer interruptions. Since unforeseen difficulties delayed the progress in the LV connectivity model, the audit results do not assess changes in the accuracy of the new LV connectivity system. Difficulties have also occurred with regards to interconnected networks. It is anticipated that these networks will also cause difficulties related to the LV connectivity model under development.
- For faults affecting only part of a LV feeder or service cables the dispatcher normally relies on estimates provided by field operatives. This may lead to inaccurate reporting. With the LV Connectivity Model completed, the dispatcher should be much better able to independently verify the customer numbers quoted by the field operative.

- Where a customer refuses a temporary connection or agrees to remain off supply, SP Manweb's assumes its supply is back on for Prosper purposes. SP Manweb has interpreted this to be compliant with Section 2.12 (3) of the RIGs. However, in these cases, when work on the fault restarted the additional work was usually recorded under a separate incident. As the supply was only restored for Prosper purposes and was not physically restored for the customer, this additional repair time should be added to the original incident and not raised as a new incident.
- Where a customer has power restored through a temporary connection further emphasis on existing processes needs to ensure that if that customer is restored through temporary supplies the correct restoration code is used. This will ensure that if the customer is interrupted again within 18 hours of the temporary restoration this second interruption is treated as a re-interruption and not a new incident.
- The majority of errors associated with TroubleCall/ICOND Incident Log entries occur during increased work load on the personnel – bad weather and other unforeseen difficulties.
- Reporting of incident start times also proved to be a source of error with dispatchers using the time that the incident was first created in TroubleCall as the start time rather than the time that the company first became aware of the fault.

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

- While there is a degree of automation in incident recording, transposing of the information into incident reports is manual which creates the potential for and has led to errors. There is also a potential source of error with the manual transfer of information from the Transmission Report(s) to the Prosper Report.
- Measurement of customers is also automatic using the system traces. Recognising errors in customer numbers at each transformer is a manual and on-going process. These errors are being picked up through auditing processes and field experience and will reduce over time as the feedback processes in place improve the knowledge and understanding of the system.

The audit team is of the opinion that SP Manweb has generally interpreted the RIGs definitions correctly and that the company is operating in accordance to them. The only potential issue relates to the 18-hour rule where SP Manweb documents and procedures contain the correct definition and there appear to have been cases of misapplication of the rule. It should be noted that IIP training for staff is not expected to finish until October 2002.

8.5 Overall Impressions

SP Manweb, through their in-house contractor SP PowerSystems, has a highly motivated and enthusiastic team behind the IIP project. The SP PowerSystems commitment to the project is proven by the extensive training programmes employed, setting up of the Data Capture Bureau at Glenrothes and the internal audit team.

It is in the opinion of the audit team that the accuracy of the MPAN count methodology, RIGs interpretation/implementation and the company's linkages to Ofgem reporting template are sound. The process of developing the new LV Connectivity model is also sound.

8.6 Conclusions

Table H-1 presents the results of the 2002 audit of the SP Manweb 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 H-1

Stage	Item	Accuracy
Stage 1	MPAN Measurement	99.5%
Stage 1	HV Connectivity Model	
Stage 1	LV Connectivity Model	
Stage 3	LV Incident Reporting Accuracy – CI	96% (under) ^ξ
Stage 3	LV Incident Reporting Accuracy – CML	96% (under) ^ξ
Stage 3	HV Incident Reporting Accuracy – CI	99% (over) ^ξ
Stage 3	HV Incident Reporting Accuracy – CML	98% (under) ^ξ
Stage 3	Overall Incident Reporting Accuracy – CI	100% ^ξ
Stage 3	Overall Incident Reporting Accuracy – CML	98% (under) ^ξ

^ξ Note that incidents have been audited against the systems in place at the time of the audit as the new connectivity model had not been completed at that time.

The audit team agrees with the company's estimate of accuracy of its MPAN count. It was not possible to verify the accuracy of the company's new connectivity model as it had not been completed at the time of the audit.

The Stage 3 HV and LV Incident Reporting Accuracy was derived by the audit team based on the 100 LV Incident and 20 HV Incident samples audited. It is again emphasised that when considering the above LV Incident Audit results, that the LV Connectivity Model at feeder level was not completed for the incident audit year and the company's Prosper Guidelines were not fully implemented. The LV incident reporting results are based on information provided, in the main, by the field operatives

It should be noted that the stage 3 results for both SP Distribution and SP Manweb differ from other companies since the incidents have been audited using the existing connectivity model rather than a connectivity model by LV feeder.

8.7 Reporting to Ofgem's information Template

All incidents when transferred from ICOND or TroubleCall are processed by a piece of software written by Calanais to SP Manweb's specification. This piece of software applies and ensures compliance with the IIP Rules. Population of the IIP information template occurs using SP Manweb's Business Objects reporting tool and reports written against the Prosper database. Six example incidents were examined and the movement of reporting information between the pre and post IIP requirements were found to be accurate for the re-interruptions requirement. Further examination of the information provided by the company confirmed the correct transfer of pre- and post-IIP

requirements.

The following summarises the template data audited for SP Manweb's distribution area:

- The number of customers, confirmed by the IIP project LV connectivity manager, for the twelve months ended 30th September 2001 was 1,433,917 and is the figure included in the reporting Template for SP Manweb.
- HV circuits in SP Manweb are identified by a five digit code – 3 digits defining the bus bar and 2 digits identifying the feeder reference.
- For SP Manweb the number of HV circuits affected box and the number of rows in the template both equal 1051
- Three HV circuits were chosen at random from those contained in the Ofgem template. Using the Business Objects enquiry system the number of CI and CML reported as a consequence of the total number of incidents affecting each of these circuits was calculated. These numbers were then compared to those contained in the Ofgem template. In all three cases, the numbers of CI and CML agreed, shown in Table H-2:

Table H-2

Manweb (SP) Circuit Reference	CI from Prosper	CI from Ofgem template	CML from Prosper	CML from Ofgem template
A00303	123	123	24140	24140
A27505	1257	1257	21273	21273
A48706	1018	1018	180949	180949

8.8 Recommendations

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

- At present ICOND models of the HV network are archived once annually. It is understood that in the future SP Manweb is considering archiving its ICOND models of the entire HV network and LV Connectivity models once a month (subject to the appropriate software being available and the costs not outweighing the benefits). This monthly archiving should be implemented as it would confirm any major changes in network configurations and would aid in the audit trail.
- When temporary connections are provided to customers via a back-feed supply or an abnormal feeding arrangement, there have been cases where the incident logs fail to state clearly that the original connection was restored. This information is useful in order to keep an accurate 'live' working network of the LV Connectivity Model and for demonstrating what has occurred during an audit. Hence through the appropriate training, the field operatives and dispatchers should work together to ensure that the incident logs be detailed with appropriate information and that this information is transferred to the respective departments responsible for maintaining the LV Connectivity model.
- Some form of automated warning of re-interruptions would improve reporting accuracy.
- It is important that as much information as possible is included in the incident logs as this information will help make both the completion of the incident reports easier but also will provide evidence for subsequent audits about what has been done. For example where

customer numbers have been entered into the log a short statement (or code) relating to where this figure is from may be useful i.e. if it is a field estimate or is the number of calls then a statement to say so should be recorded.

- Communication between site and dispatcher is critical to the accuracy of LV incident reporting.
- In general, it would be useful to reduce the requirements for manual data/information entries to avoid potential human errors, although it is acknowledged that a balance between costs and benefits of any such system has to be achieved. The areas identified for possible electronic/automatic linkages are:
 - At present, dispatchers would sieve through TroubleCall records to identify the first “no supply” call, an automatic algorithm could be produced to pick up this start time.
 - Where HV incidents occur with no switching device telemetry indication, the start time is obtained manually by the control engineer either from the original report in TroubleCall, or where HV network earth fault alarms, and entered into the ICOND incident report. An electronic link could be developed to transfer the start time from the Trouble Call logs to the ICOND incident logs.
 - Where HV incidents are caused by a 33kV, 132kV or a Transmission operation, this involves a manual transfer of information (e.g. start time) from NMS and the Transmission Report to the Prosper Report. An electronic link could be developed to automate this process.
- It is hoped that SP Manweb will fully utilise all available resources to ensure that the LV Connectivity Model is completed by the stated date.

8.9 Learning Points

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

- Preparation is vital to a smooth audit. Having all incident reports printed out with their associated supporting information allowed this audit to progress quickly. It was useful to have a diagram of the area affected by the fault to see what is going on. The time taken to prepare this and information for the audits was extensive hence SP Manweb would appreciate earlier notification of incidents to be audited when it comes to the completion of future audits.
- For consistency and time saving the same two auditors should in future be attached to both SP Distribution and SP Manweb audits.
- Statistical distribution of variances requires further statistical analysis as many single premise(s) faults in a sample may act to skew any results as the potential for errors is greatly reduced.
- Inaccuracies are contained in individual restoration stages. There may, therefore, be a case for using the number of restoration stages to determine audit sample size.
- Seeing is believing, witnessing a process for real is invaluable in demonstrating the accuracy of the systems.
- Accuracies are based on ‘net’ variances therefore there is the potential for under- and over-reporting to cancel one another out once netted together. Perhaps a figure with some assessment of the level of variance both under and over may be possible.