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**Appointed examiner's audit of Exceptional Event Claim -
Northern Powergrid (Northeast)
33kV Incident at Scarborough Grid Substation
11 April 2013**



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Glossary

Abbreviation	Meaning
AE	Appointed Examiner
CB	Circuit-breaker
CEGB	Central Electricity Generating Board
CI	Customer Interruptions per 100 connected customers
CML	Customer Minutes Lost per connected customer
DNO	Distribution Network Operator
EHV	Extra High Voltage – all voltages above 20kV up to but excluding 132kV
ep	energypeople
HV	High Voltage – all voltages above 1kV up to and including 20kV
QoS	Quality of Service
RIGs	Regulatory Instructions & Guidance
SCADA	Supervisory Control and Data Acquisition
NPG	Northern Powergrid
NPG(NE)	Northern Powergrid (Northeast)
SLD	Single Line Diagram
SoF	Statement of Facts
ToR	Terms of Reference

Notes:

Within this document:

1. The term “higher voltage” is used to indicate all voltages greater than 1kV.
2. The calculations of CI and CML within this document are adapted from the annual calculations contained in the RIGs to reflect the CI and CML generated by the actual incidents being audited.

They are as follows:

CI: the number of interruptions to supply – the number of customers interrupted per 100 connected customers generated by the incidents being audited.

It is calculated as:

$$CI = \frac{\text{the sum of the number of customers interrupted for incidents being audited} * 100}{\text{the total number of connected customers}}$$

CML: the duration of interruptions to supply – the number of customers interrupted per connected customer generated by the incidents being audited.

It is calculated as:

$$CML = \frac{\text{the sum of the customer minutes lost for all restoration stages for incidents being audited}}{\text{the total number of connected customers}}$$

In both the formulae above, the total number of connected customers is as declared as at 30 September during the relevant reporting year. Any claims that occur and are audited prior to 30 September in the reporting year during which they occur will be audited using the total number of customers declared at 30 September in the previous reporting year.



Summary

1. Ofgem has commissioned energypeople as its Appointed Examiner (AE) to audit the submission made by Northern Powergrid (NPG) under the “one off” exceptional event mechanism that an incident which occurred at its Scarborough Grid Substation at 07:10 on Thursday 11 April 2013 adversely affected the reported performance for its Northeast (NPG(NE)) licensed area for the reporting year 2013/14.
2. The AE has visited NPG to audit the claim against part 1 of the “one-off” exceptional event process and finds that it passes the exceptionality threshold in terms of both CI and CML.
3. The AE concludes that the event falls within the category of an “other event” as defined in paragraph 8.57 of Special Licence Condition CRC 8, including meeting the exceptionality requirements set out in Appendix 3 thereof.
4. The AE therefore proceeded to part 2 of the “one-off” exceptional event process, assessing NPG's performance in mitigating the impact of the event upon its customers.
5. The AE concludes that NPG did all it could to ensure that its number 1 132kV circuit from Osbalwick Grid to Scarborough Grid Substation teed Malton Grid Substation teed Knapton Generation was as free from defects as possible before the outage began on the number 2 circuit.
6. The AE also concludes that NPG acted appropriately in contacting the personnel involved with the outage of the number 2 132kV circuit and in seeking an early return to service of this circuit.
7. The AE considers that NPG's protection operated correctly to clear the incident from its distribution system.
8. The AE commends NPG for its learning point resulting from this incident whereby NPG has adopted a pro-active approach by applying shrouding to the exposed 33kV conductors and 33kV bushings associated with its two 132/33kV Grid Transformers at its Scarborough Grid substation, thus mitigating against the risk of a similar incident in the future.
9. The AE also commends NPG's control engineers for analysing the alarms generated by the incident and for restoring all supplies as quickly as possible.
10. The AE concludes that NPG had met the criteria of Appendix 4 to paragraph 8.58 of Special Licence Condition CRC 8 and that therefore the incident is deemed to be eligible for adjustment in the DNO's reported performance.
11. The AE therefore recommends that an adjustment to NPG(NE)'s 2013/14 reported distribution system performance is made, in line with the part 1 audited CI and CML figures as shown in the following table:

	Audited number	Number above the threshold	Recommended adjustment
CI	2.79	1.19	1.19
CML	1.43	0.13	0.13

Note: these figures are based upon the customer numbers as at 30 September 2013.



1. Audit part 1

1.1 Summary of the main facts

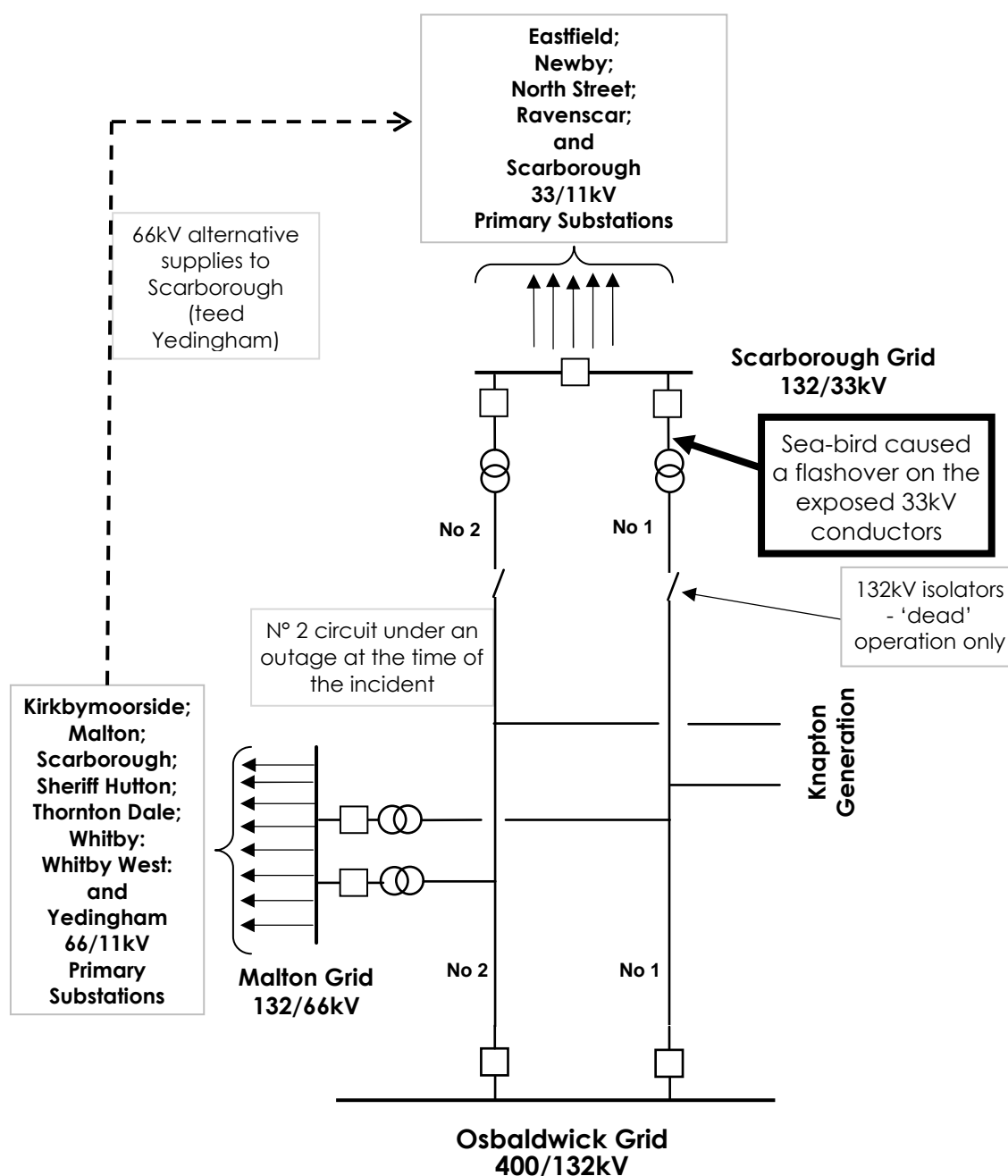
12. The AE's headline information log for this event is set out in Table A-1 at Appendix A. In addition, the following paragraphs summarise the main facts of the event.
13. NPG has provided photographic evidence to support its claim that a sea-bird precipitated a flashover of the 33kV exposed conductors associated with the number 1 132/33kV Grid Transformer at its Scarborough Grid Substation.
14. The flashover, which caused no irreparable damage, resulted in the loss of 33kV infeeds to six of NPG's 33/11kV Primary Substations, interrupting supplies to 43,175 of NPG's customers fed from its 132/33kV Scarborough Grid Substation and 1096 of NPG's customers fed from its 132/66kV Malton Grid Substation – i.e. 44,271 customers in total.
15. NPG's protection operated correctly to clear the incident from its distribution network, tripping the 132kV circuit-breaker at Osbaldwick Grid Substation and, whilst the circuit was de-energised, auto-opening the 132kV isolator on the number 1 132/33kV Grid Transformer at Scarborough Grid Substation, plus auto-reclosing the number 1 132kV circuit-breaker at Osbaldwick Grid Substation, thus restoring supplies to NPG's 132/66kV Malton Grid Substation and to Knapton Generation.
16. A further 41,798 of NPG's customers fed from its 132/66kV Malton Grid Substation experienced a short interruption during the time that the protection took to operate as described above.
17. NPG's 132kV distribution system was running abnormally at the time of the incident due to the number 2 circuit from Osbaldwick Grid to Scarborough Grid Substation feed Malton Grid Substation feed Knapton Generation Substation being under an outage to effect essential, refurbishment and repairs.
18. Due to the above outage NPG's Scarborough Grid Substation was running with a single 132kV infeed.
19. Prior to the outage of the number 2 132kV circuit, NPG had surveyed the number 1 132kV circuit and identified several weaknesses, all of which were repaired before the outage of the number 2 132kV circuit commenced.
20. Aware that NPG personnel were working on the number 2 132kV circuit, NPG's control engineer had to be assured that the incident on the number 1 132kV circuit was unconnected with their activities.
21. Having spoken to the person in charge of the outage of the number 2 132kV circuit and being assured that the work was in no way connected with the incident, the person in charge of the outage was asked to suspend all work and to make ready to re-energise the number 2 132kV infeed as soon as possible as documented in the 'return to service' provisions of NPG's outage planning process.
22. The number 1 66kV circuit-breaker at Malton Grid Substation to Scarborough Primary Substation feed Yedingham Primary Substation tripped at the same time that the number 1 132kV circuit-breaker to Scarborough Grid Substation feed Malton Grid Substation feed Knapton Generation re-closed at Osbaldwick Grid Substation.



23. Consequently, the 1,096 customers supplied from NPG's 132/66kV Malton Grid Substation via NPG's 66/11kV Yedingham Primary Substation were not restored within the short interruption that affected the other customers supplied from Malton Grid Substation.
24. The number 1 66kV circuit-breaker at Malton Grid Substation to Scarborough Primary Substation feed Yedingham Primary Substation was reclosed by tele-controlled switching at 07:22; resulting in a supply interruption of 12 minutes duration.
25. During the time it took NPG personnel to reach Scarborough Grid Substation, NPG's control engineer began restoring supplies via alternative 11kV supplies.
26. During restoration it became apparent that the alternative supplies would be inadequate to meet the demand.
27. Therefore, upon receipt of the report from NPG's Scarborough Grid Substation that a dead sea-bird had been found below the 33kV exposed conductors of the number 1 132/33kV Grid Transformer and no permanent damage had been caused to NPG's equipment, it was decided to re-energise the number 1 132kV infeed to Scarborough Grid Substation.
28. To effect this restoration, it was necessary to de-energise the number 1 132kV circuit from Osbaldwick Grid Substation to the incoming side of the 132kV isolator on the number 1 132/33kV Grid Transformer at Scarborough Grid Substation as this isolator is of a type that can only be operated in the de-energised ('dead') state.
29. In order to minimise the number of NPG's customers who would experience a second short interruption whilst the above operation was carried-out, NPG's control engineer used tele-controlled switching to connect 12,457 customers normally fed from NPG's Malton Grid Substation to alternative supplies.
30. At 08:20, the number 1 132kV circuit-breaker to Scarborough Grid Substation feed Malton Grid Substation feed Knapton Generation circuit at Osbaldwick Grid Substation was opened via tele-control; the 132kV isolator on the number 1 132/33kV Grid Transformer at Scarborough Grid Substation was closed 'dead'; and the whole circuit re-energised 49 seconds later by closing the number 1 132kV circuit-breaker to Scarborough Grid Substation feed Malton Grid Substation feed Knapton Generation circuit-breaker at Osbaldwick Grid Substation via tele-control.
31. The above short interruption affected supplies to 49,390 of NPG's customers.
32. Subsequent tele-controlled switching then restored all remaining supplies, the last ones being restored at 08:33.
33. With the restoration of the number 1 132kV infeed to Scarborough Grid Substation, the request to bring back to service the number 2 132kV circuit was cancelled and the outage continued as planned.
34. Apart from the above on-going outage, NPG's network was restored to normal running.
35. A simplified view of the sections of NPG's 132/66/33kV networks affected by this event is shown in Figure 1.



Figure 1 – Simplified Network Diagram of NPG's 132/66/33kV distribution networks affected by the incident



Notes:

1. Only the salient items of switchgear are shown.
2. NPG's network was running abnormally at the time of the incident, the number 2 132kV infeed to Scarborough Grid Substation was under an outage.
3. The outgoing 33kV feeders from Scarborough Grid Substation are shown schematically.
4. Following inspection of the exposed 33kV conductors by NPG's personnel, supplies were restored by tele-controlled switching.



2. Exceptionality requirements

2.1 Does the event qualify for exclusion

36. The AE considers that the event falls within the category of an “other event” as defined in paragraph 8.57 of Special Licence Condition CRC 8, and meets the exceptionality requirements set out in Appendix 3 thereof.
37. The AE therefore considers that, subject to satisfying the requirements of Appendix 4 to CRC 8, the event qualifies for possible exclusion under the “one-off” exceptional events process.

2.2 Exceptionality test results

38. The number of incidents attributed to the event is shown in Table 1.

Table 1 – The number of incidents attributed to the event

Number of incidents attributed to the event	Claimed number	Audited number
132kV	0	0
EHV	1	1
HV	0	0
LV	0	0
Total	1	1

39. The results calculated by the AE to test this claim against Ofgem's exceptionality criteria are shown in Appendix A. A summary of the results is shown in Table 2.

Table 2 – Summary of exceptionality test results

Test	Threshold	Claimed number	Audited number	Pass / Fail	Amount above threshold
CI exceptionality	1.60	2.79	2.79	Pass	1.19
CML exceptionality	1.30	1.43	1.43	Pass	0.13

Notes:

1. These figures are based on the customer numbers as at 30 September 2013 whereas the NPG's SoF used the customer numbers as at 30 September 2012.
2. Ofgem's CI and CML exceptionality criteria are set out in the AE's ToR¹.
3. The audited CI and CML used in the exceptionality test have been determined from the number of incidents attributed to the event.
4. Where the event passes either or both the exceptionality thresholds, the amount(s) above the threshold(s) is/are carried forward into the Audit part 2 assessment of DNO performance.
5. In accordance with guidance from Ofgem, the AE's calculations use the threshold values contained in the current Distribution Price Control and the number of customers connected to the DNO's network relevant to the date on which the incident occurred.

¹ Audits of Electricity Distribution Network Operators' one-off Exceptional Events Claims for 2012/13 to 2014/15



3. NPG's views of its performance

3.1 Dealing with the incident

40. NPG's 132/33kV Scarborough Grid Substation is normally supplied via a dual circuit 132kV tower line from National Grid's Osbaldwick Grid Supply Substation.
41. Both of these 132kV circuits have two feed connections: one to provide the 132kV infeeds to NPG's 132/66kV Malton Grid Substation; and one to provide the connections to the Knapton Generation site.
42. The 132kV infeeds to Scarborough Grid Substation run as 'transformer feeders' with no local 132kV interconnection between them.
43. Each 132/33kV Grid Transformer at Scarborough Grid Substation is equipped with a 132kV isolator which can only be operated with the 132kV system de-energised (i.e. 'dead operation only' also known as a 'category 3' device).
44. At the time of the incident, the number 2 132kV circuit was under an outage to effect essential refurbishment and repairs.
45. Prior to this outage, under its pre-outage process, NPG had carried-out a detailed survey of the number 1 132kV circuit and had repaired the defects found.
46. NPG therefore considers that it did all it could to ensure that the number 1 circuit was free from defects during the outage on the number 2 circuit.
47. At Scarborough Grid Substation, the 132kV and the 33kV connections to the two 132/33kV Grid Transformers are via exposed overhead conductors.
48. Scarborough Grid Substation is equipped with indoor 33kV switchgear and supplies 5 of NPG's 33/11kV Primary Substations via underground cables.
49. Scarborough Grid Substation was commissioned in 1970 by the then Central Electricity Generating Board (CEGB). Since then, NPG uprated the two 132/33kV Grid Transformers to their present 120 MVA capacity in 2008.
50. Prior to the commissioning of Scarborough Grid Substation the area was supplied via a dual 66kV circuit from NPG's 132/66kV Malton Grid Substation to NPG's 66/11kV Scarborough Primary Substation. One of these 66kV circuits is feed to Yedingham 66/11kV Primary Substation.
51. It was from these alternative 66kV supplies that NPG's control engineer began restoring supplies until the number 1 132kV infeed to Scarborough Grid Substation was re-energised.
52. At 07:10 on 11 April 2013, a flashover on the exposed 33kV conductors associated with the number 1 132/33kV Grid Transformer at Scarborough Grid Substation resulted in the tripping of the controlling circuit-breaker at Osbaldwick Grid Substation, the auto-opening of the 132kV isolator associated with the number 1 132/33kV Grid Transformer at Scarborough Grid Substation and the auto-reclosing of the controlling circuit-breaker at Osbaldwick grid Substation, restoring the number 1 132kV infeeds to Malton Grid Substation and to Knapton Generation within a short interruption.
53. NPG considers that its protection operated correctly to clear the incident from the system.
54. The number 1 66kV circuit-breaker to Scarborough Primary Substation feed Yedingham Primary substation tripped at the same time that the number 1 132kV infeed was restored to Malton Grid Substation.



55. At the request of the AE, NPG has carried-out further detailed investigations to determine the reason why the above 66kV circuit-breaker tripped. The investigations confirmed that the protection scheme applied to this 66kV circuit-breaker operated correctly for the configuration of NPG's network during the restoration process.
56. Scarborough Grid Substation is located in an industrial area some distance from the coast and NPG has no record of previous incidents of this nature having occurred.
57. NPG's control engineer contacted the person in charge of the work on the number 2 132kV circuit, requested a suspension of the work and an early return to service.
58. Meanwhile, personnel were dispatched to Scarborough Grid Substation and NPG's control engineer began restoration of supplies via 66kV and 11kV alternatives.
59. Upon investigating at Scarborough Grid Substation, NPG personnel reported the cause of the incident to be a sea-bird precipitating a flashover on the exposed 33kV connections of the number 1 132/33kV Grid Transformer and that there was no permanent damage to NPG's equipment.
60. Realising that the alternative supplies were inadequate to support the demand on the system, NPG's control engineer took the appropriate steps to re-energise the number 1 132kV infeed to Scarborough Grid Substation.
61. NPG considers that its duty control engineer reacted well in assessing the alarms generated by the event, contacting the personnel connected with the outage of the number 2 132kV circuit, and commencing tele-controlled switching of alternative supplies.
62. NPG also considers that its control engineer did well in re-energising the number 1 132kV infeed to Scarborough Grid Substation, thereby enabling the restoration of the remaining customers who had lost supply and also maximising the security of supplies to NPG's customers.

3.2 NPG's answers to questions on its performance

63. Within the last three years, the AE has reviewed NPG's design standards, construction methods and maintenance procedures during previous visits to audit exceptional event claims and found them fit for purpose.
64. The AE confirms that NPG's emergency procedures provide for the type of event being examined here.
65. To aid understanding of the background to NPG's Statement of Facts (SoF), the AE prepared a list of initial questions regarding this incident. These questions were used as the basis for the examination of NPG's claim.
66. The initial questions were discussed during the AE's visit to NPG's Penshaw Control Centre on 12 September 2014, when the records of NPG's SCADA system, the incident report and other information were made available.
67. NPG has provided answers to the AE's initial list of questions. For ease of reference, the AE's questions are printed in bold font with NPG's answers being printed in normal font.



Q1. What, if any, changes has NPG made to its emergency plans and procedures since the Appointed Examiner (AE) last visited to audit the exceptional event claim concerning the extreme weather event that occurred during September 2012 which affected NPG's customers in its north-east licensed area?

A1. Constant reviews take place following a major incident and any learning is used to update our major incident management plan (MIMP) where required. The main updates to the plan since September 2012 are as a result of the DECC and Ofgem reviews that were carried out following the Christmas 2013 storm period. The following amendments are available and were successfully tested in an exercise on 23rd September 2014. They will be activated in response to a 'real' event as and when required.

- The business changed from a five zone to a nine zone operating structure in June 2014 as part of a localisation programme to improve the company's fault restoration response times and customer satisfaction scores.
- The Strategic Management Centre (SMC) has increased in size due to the addition of further Zone Management Centres (ZMCs) to support the new nine zone structure. In addition, representatives for social media, communications and a strategic customer service overview role were appointed.
- Best Practice guides from the Secretary of State's report have contributed to the change agenda and our processes reviewed and aligned where necessary.
- A non-operational MIMP support project has been initiated to identify additional roles during a MIMP for staff who have not traditionally been able to offer support (e.g. increase the volume of staff trained and equipped to handle power cut 'overflow' calls from customers).
- The incident reports used during a MIMP have also been reviewed and developed further to ensure consistent information is published not only within Northern Powergrid, but to our customers and external stakeholders.
- The operational management system (OMS) has been updated to allow generic 'storm settings' to be applied. Estimated times of restoration (ETRs) will now be applied in MIMP scenarios with longer lead times than for 'business as usual', with the option to turn the 'storm settings' off and apply more granular ETRs by incident type as the event unfolds. This will have the benefit of improving the quality and accuracy of information provided to our customers and external stakeholders.
- We now have 24-hour dispatch operating from our two control centres at Penshaw in the Northeast and Leeds in Yorkshire, ensuring skilled dispatching resource is present 24/7, 365 days a year.

Q2. Paragraph 16 of NPG's SoF states its company's policy regarding risk assessments that must be carried-out before single-circuit security is put in place. What specific action was taken to ensure the number 1 132kV feeder from Osbaldwick Grid Substation to Malton Grid Substation feed Scarborough Grid Substation feed Knapton Generation was free of defects before the number 2 feeder was taken out of service?



A2. Details of communications regarding pre-outage checks are contained in NPG's documents as copied to the AE following the audit visit.

- In December 2012, initial preparations were made for the system outages that would be required to carry out refurbishment work of the tower line section comprising the Osbaldwick to Malton Grid No. 1 and No. 2 132kV feeders, as part of our ongoing investment plan commitment and refurbishment of the 132kV system.
- The proposed refurbishment included the replacement of fittings, insulators and identification plates together with tower repainting.
- The work was planned to commence in spring 2013 with the circuits being switched out in turn, each for approximately 8 weeks.
- Investigation of any outstanding issues associated with the above feeders that could potentially affect their reliability was made so that they could all be rectified prior to the outages.
- Helicopter patrols were carried out on the circuits to identify any issues including required vegetation management work. Thirteen locations were identified by the patrols and the necessary vegetation management work was carried out prior to the outage period.
- An infrared survey identified a hot joint at tower 37 on the Osbaldwick to Malton grid 132kV feeder. This had remedial works carried out prior to the outage period.
- Ductor testing was not deemed necessary as it had recently been carried out.

[AE's note: NPG's documents clearly show the thorough way in which NPG's pre-outage process was invoked for the number 1 circuit and the remedial measures taken to rectify defects prior to the start of the outage on the number 2 circuit].

Q3. What protection is fitted to the Osbaldwick Grid Substation to Malton Grid Substation feed Scarborough Grid Substation feed Knapton Generation 132kV feeder?

A3. The protection fitted to the Osbaldwick Grid Substation to Malton Grid Substation feed Scarborough Grid Substation feed Knapton Generation 132kV feeders is summarised in the table below:

Name of panel and capacity of apparatus	Type(s) of protection
Osbaldwick Osbaldwick - Malton - Scarborough - Knapton No. 1 and No. 2 132kV feeders	Distance impedance High set overcurrent Inverse time overcurrent Instantaneous earth fault Inverse time earth fault
Scarborough Grid Grid Transformers No. 1 and No. 2 132/33kV 120MVA	Biased differential protection 132kV high set differential overcurrent 132kV high set overcurrent 132kV balanced earth fault 33kV restricted earth fault 132kV IDMT overcurrent 132kV IDMT earth fault



Name of panel and capacity of apparatus	Type(s) of protection
Malton Grid Grid Transformers No. 1 and No. 2 132kV/66kV 75MVA	HV restricted earth fault Overcurrent LV restricted earth fault Directional overcurrent Standby earth fault

[AE's note: NPG has also made available the details of the protection relays themselves and the settings applied].

Q4. What protection operated to clear the incident from NPG's system?

A4. Following the bridging of two exposed 33kV busbars on the top of Grid Transformer No. 1 at Scarborough Grid substation, creating a phase to phase fault, 33kV overcurrent protection operated at Scarborough Grid (as noted in items 33 and 68 in the associated NMS Fault Log), initiating both an auto-reclose sequence of the 132kV feeder at Osbaldwick and auto-isolation of Grid Transformer No. 1 at Scarborough Grid. *[AE's note: NPG has provided a copy of its NMS fault log which confirms the above sequence of events].*

Q5. At the time of the circuit-breaker operation described in paragraph 17 of NPG's SoF, the AE assumes that the 41,798 customers mentioned in paragraph 3 of the SoF as having experienced a short interruption are fed from NPG's Malton Grid Substation. Is this correct?

A5. Yes this is correct. These customers were interrupted during the auto-reclose time of the 132kV breaker at Osbaldwick. Customers interrupted for the first short duration were all the customers normally supplied from Malton Grid (via Kirkbymoorside, Malton, Sheriff Hutton, Thornton Dale, Whitby, Whitby West and Yedingham). Note that customers fed from the Whitby and Whitby West primary substations are normally split between Malton Grid and Scarborough Grid and auto-transfer due to parallel operation on the 11kV busbars at each substation. Note also that those customers supplied from Yedingham substation experienced a longer interruption as the Scarborough No. 1 66kV circuit breaker tripped when the 132kV feeder from Osbaldwick re-energised (see Q6(a)) and was closed 12 minutes later by remote control. *[AE's note: NPG's documentation confirms this sequence of events].*

Q6(a). Why did the Scarborough Primary Substation feed Yedingham Primary Substation 66kV circuit-breaker at Malton Grid Substation trip?

A6(a). The feeder trip was initiated by the Malton to Scarborough feed Yedingham 66kV distance protection operating on its switch on to fault (SOTF) tripping feature which is designed to quickly detect faults on the entire feeder in the absence of a corresponding voltage reference. It is possible to inhibit the SOTF feature for a defined period to avoid the situation where inrush and cold load pickup currents in a circuit can be sufficient to initiate the SOTF tripping feature, however the use of the inhibit feature can delay the protection scheme's response to a genuine fault. So selecting the appropriate inhibit time is a balance between being able to quickly detect a feeder fault and the potential operation due to inrush and cold load pickup currents.



The protection scheme is configured with a 0.2 second inhibit of the SOFT tripping feature so that it is enabled during an auto-reclose sequence so it would appear that, on this occasion, the inrush and cold load pickup currents on the circuit were sufficient to operate the level detectors and result in a protection trip.

The protection scheme settings applied for the Scarborough Primary Substation feed Yedingham Primary Substation 66kV feeder are in line with company practice and the relay manufacturer's recommendations; selected as such to provide a balance between stability and the sensitivity of a scheme.

[AE's note: NPG has also made available the details of the protection scheme and its designed mode of operation confirming the above].

Q6(b). What protection operated to trip this 66kV feeder?

A6(b). The NMS Alarm log identifies that at Malton Grid the distance protection (SOFT feature) operated on the Scarborough 1 66kV feeder at 07:11:06 co-incident with tripping of the 66kV CB and 5s after the 132kV CB reclosed at Osbaldwick. This is confirmed by item 156 in the NMS Fault log.

[AE's note: NPG's NMS log confirms the above].

Q6(c). Why does NPG consider this circuit-breaker trip to be part of the one-off exception event?

A6(c). The protection settings applied and the SOFT feature on the distance relay were in line with current company practice and manufacturer's recommendation. Northern Powergrid therefore considers that this circuit-breaker trip should be considered as part of the exceptional event as it was not caused by protection mal-operation, rather as a result of the system conditions relating to the event.

[AE's note: Prior to the discussion of the protection scheme applied to this circuit-breaker, it was not clear if a mal-operation had occurred. Following the discussions during the audit visit, NPG has thoroughly investigated this matter, the above answer confirming that the protection operated correctly during this particular incident and therefore to be considered as an integral part of the exceptional event claim].

Q7. What was the reasoning behind transferring the Kirkbymoorside and Sherriff Hutton Primary Substation infeeds off the Osbaldwick Grid to Malton Grid Substation 132kV feeder?

A7. The reasoning behind transferring the Kirkbymoorside and Sherriff Hutton Primary Substation infeeds off the Osbaldwick Grid and onto to Malton Grid Substation 132kV feeder was a precaution to safeguard supplies to 12,457 premises during subsequent switching activities.

[AE's note: This matter was discussed during the audit visit when it became clear that these customers were safeguarded from a second short interruption].

Q8. The AE infers that the above load transfer utilised the 132/66kV transformer at Sherriff Hutton and the 66kV feeders from there to Malton Grid Substation feed Kirkbymoorside Primary Substation. Why were more Primary Substation loads not also taken off Malton Grid Substation via the 66kV feeders to Scarborough, Thornton Dale, Whitby and Whitby West?



A8. In normal running, Scarborough substation is fed by the twin 33kV feeders from Scarborough Grid substation, the alternative twin 66kV feeders emanating from Malton Grid substation being available to Scarborough substation via normally open circuit breakers. The transfer of further primary substations via the 66kV feeders to Scarborough was therefore not possible. To transfer further primary substations off the Malton Grid would have required load transfer via the green 66kV bus bar at Malton Grid onto the Ferrybridge system.

However, the capacity to support demand from the green 66kV bus bar is limited to 23MVA by the feeder protection relay settings. There would also be a balance between the times to transfer further substations (subsequently delaying the restoration time of customers already off supply) against the number of customers who would suffer a second (short) interruption while Scarborough Grid Transformer No. 1 was de-isolated. In order not to delay restoration it was therefore decided not to transfer further primary substations onto the Ferrybridge system.

[AE's note: This matter was discussed during the audit visit and it was clear that the delay inherent in arranging for these protection settings to be adjusted would be unacceptable for restoring supply to NPG's remaining customers].

Q9. Paragraph 39 of the SoF states that there is no history of wildlife interference at Scarborough Grid Substation. Over what period of time does this refer?

A9. Incident reports in the Trouble Management System (TMS) dating back to April 2000 have been examined and no incidents were found at Scarborough Grid substation relating to wildlife interference.

Q10. What is the location of Scarborough Grid Substation?

A10. Scarborough grid substation is located to the south of Scarborough, just off the A64 on Queen Margaret's Industrial Estate, North Yorkshire YO11 2YH (adjacent to the ambulance station) at grid reference TA0337386618.

Q11. Paragraph 39 of the SoF only refers to non-damage faults. What if this incident had resulted in irreparable damage to, say, one of the bushings on the 132/33kV transformer, rendering it unfit to return to service without repair?

A11. Following the incident, insulated shrouds were fitted to Grid Transformer No. 2 33kV bus bars and bushings on April 25, 2013 and to Grid Transformer No. 1 on July 5, 2013 to minimise the risk of flashover causing either a non-damage or a damage fault at this substation. *[AE's note: See NPG's photographs 4 and 5].*

Q12. From the sequence of events, the AE infers that there is no auto-changeover to the alternative 66kV infeeds at Scarborough, Whitby and Whitby West Primary Substation. What are NPG's reasons for the absence of such equipment?

A12. Changeover at Scarborough is currently achieved by remote control via the SCADA system which is currently deemed to be sufficient, with changeover being achieved within 16 minutes of the loss of supplies at Scarborough during this incident. Currently there are no plans to install auto-changeover equipment at Scarborough. This will be reviewed as part of Northern Powergrid's routine ongoing system planning activities.



At Whitby and Whitby West Primary Substations, the 33kV and 66kV feeds (from both Scarborough Grid and Malton Grid via Thornton Dale respectively) operate in parallel via the 11kV busbars (as noted in A5. above) therefore the customers at Whitby and Whitby West were restored after the auto-reclose operation at Osbaldwick.

Q13. The SoF states that the 132kV transformer isolators at NPG's Scarborough Grid Substation are category 3 and dead operation only. What are NPG's plans to replace these with modern types?

A13. There are currently no plans to replace the category 3 switches at Scarborough Grid (or those at Malton Grid) with modern types, although this will be reviewed on a case-by-case basis as part of Northern Powergrid's ongoing system planning activities. *[AE's note: This matter was discussed at the audit visit when NPG reported the fitting of the shrouding as detailed in A11. above. However, dependent upon the individual circumstances, the AE mentioned that the audit of any subsequent exceptional event claims could be affected by NPG's continuing use of these Category 3 132kV isolators].*

Q14. NPG's SoF includes a photograph of the exposed 132kV connections to a 132/33kV transformer. Whilst the AE understands that no permanent damage occurred in this case; it is usual to see traces of flash-marks caused by electromagnetic arcing. To enable the AE to better understand the incident, can NPG please explain where the flashover is deemed to have occurred?

A14. NPG's photographs show the gull at the base of Grid Transformer No.1 directly below the exposed 33kV bus bars which are situated above labels 'a' and 'b'. From the available evidence it was surmised that the gull bridged the two 33kV busbars with no resultant traces of flash-marks caused by electromagnetic arcing. *[AE's note: The sequence of events is consistent with the sea-bird having caused a flash-over – the lack of charring on the carcass tends to indicate that the bird had only slight contact with the exposed conductors before NPG's protection operated to clear the incident from its distribution system].*

Q15. What further learning points should be considered as a result of the application of the current one-off Exceptional Event Claims process?

A15. The use of this process, including the preparation of a statement of facts and the subsequent independent audit, encourages systematic analysis of the exceptional event and the consideration of learning points. Continued use of this methodology, where appropriate, is therefore recommended.

It is also recommended that all exceptional event claims should be assessed and agreed in a timely manner prior to the end of the regulatory reporting year.

68. During the discussion of this claim it was concluded that a visit to NPG's Scarborough Grid Substation would be unnecessary; the AE was satisfied with NPG's date-stamped audit trail and NPG's photographic evidence. Also, "Google Maps" provided sufficient site information to enable the AE to make a judgement on the location and layout of NPG's Scarborough Grid Substation.

69. NPG also provided further information both during and subsequent to the audit visit. This includes:



- Information to show that the affected section of NPG's network is P2/6 compliant;
- Information to show that; prior to the current incident, NPG's Scarborough Grid Substation has been free from incidents due to this cause;
- NPG's photographs of the dead sea-bird and the general layout of its Scarborough Grid Substation;
- NPG's control room log for this incident;
- NPG's incident report from which it calculated the CI and CML attributed to this incident;
- The details of NPG's SCADA alarms received during this incident;
- A representation of the incident on NPG's SCADA system;
- Copies of NPG's protection schemes and associated relay settings for its 132kV and 33kV feeders affected by this event; and
- A discussion of NPG's learning points following this incident, including any subsequent preventative measures applied to its system.



4. Audit part 2

4.1 NPG's performance in preventing the event

70. In viewing NPG's performance in preventing this Incident, the AE has considered what more NPG could have reasonably been expected to have done to ensure that its 33kV equipment at Scarborough Grid Substation was safeguarded from the effects of third party interference and such things as the larger sizes of birds and windborne materials.
71. This is particularly relevant as NPG has no records of a similar incident having occurred previously.
72. The AE has discussed NPG's policy on its preventative measures and considers that the measures applied at the time of the incident were in accordance with good UK practice
73. Subsequent to the incident, NPG has taken additional measures to prevent a reoccurrence,
74. Images from "Google Maps" dating before the incident show NPG's Scarborough Grid Substation to be surrounded by an 'unclimbable' palisade fence in accordance with accepted UK practice for this type of substation. The fence is in good condition and carries statutory warning notices.
75. Augmenting the information from "Google Maps" with NPG's post-incident photographs shows that additional shrouding has been applied to the 33kV bushings and the exposed 33kV conductors associated with NPG's 132/33kV Grid Transformers to mitigate against a similar incident in the future.
76. NPG's recent photographs also show that the existing 'unclimbable' palisade fencing surrounding the 132/33kV compound at Scarborough Grid Substation has been fitted with an electrified fence along its top in accordance with NPG's on-going enhanced security measures at its various operational sites.
77. NPG's photographs 1 and 2, taken at the time of the incident shows the dead sea-bird below the 33kV exposed conductors of the number 1 132/33kV Grid Transformer at its Scarborough Grid Substation.
78. NPG's photograph 3, also taken at the time of the incident, shows the exposed 33kV conductors associated with the number 1 132/33kV Grid Transformer at its Scarborough Grid Substation.
79. NPG's photograph 4 shows an up-to-date view of its 132/33kV Scarborough Grid Substation with the post-incident shrouding applied to the 33kV transformer bushings and the exposed 33kV conductors.
80. NPG's photograph 5 is an up-to-date close-up view of the perimeter fencing at its 132/33kV Scarborough Grid Substation showing the addition of the electrified fencing above the 'unclimbable' palisade palings.
81. NPG's photograph 6 is a general view of its 132/33kV Scarborough Grid Substation.
82. NPG's measurement systems clearly show the tripping of the number 1 132kV Scarborough Grid Substation feed Malton Grid Substation feed Knapton Generation circuit-breaker at Osbaldwick Grid Substation at 07:10 on 11 April 2014
83. NPG's measurement systems also show the restoration of the Osbaldwick Grid Substation to Malton Grid Substation section of the above 132kV circuit within a short interruption.



84. NPG's measurement systems also show the simultaneous tripping of the number 1 66kV Scarborough Primary Substation feed Yedingham Primary Substation circuit-breaker at Malton Grid Substation.
85. An examination of NPG's measurement systems and a SCADA representation of its distribution network confirm that NPG did all it could to restore supplies as expeditiously as possible.
86. The AE concludes that, prior to this incident occurring, NPG had done all it could reasonably have been expected to do in considering that its outdoor 33kV equipment at its 132/33kV Scarborough Grid Substation was protected from the effects of third party interference, windborne material and large birds in accordance with accepted good practice within the UK electricity supply industry.

4.2 NPG's performance in mitigating the effects of the event

87. The dead sea-bird found below the exposed 33kV conductors is consistent with an electric arc having occurred and with the operation of overcurrent relays that detected a flashover of the 33kV conductors within the protection zone of the 132/33kV Grid Transformer.
88. This is also consistent with NPG's protection scheme operating to inter-trip the incoming 132kV circuit, auto-open the 132kV Grid Transformer isolator at Scarborough Grid Substation before auto-reclosing the 132kV controlling circuit-breaker at Osbaldwick Grid Substation.
89. Examination of the protection scheme applied to the number 1 66kV Scarborough Primary Substation feed Yedingham Primary Substation circuit-breaker at Malton Grid Substation confirms that this operated
90. The AE has studied the running arrangements of NPG's 132/66/33kV distribution network affected by this incident and concludes that NPG's protection systems worked correctly to clear the incident from NPG's distribution system.
91. The AE commends NPG's control engineers for analysing the situation, contacting NPG's person in charge of the outage on the number 2 circuit and for restoring supplies as rapidly as possible, thereby minimising the duration of the interruption.

4.3 Recommended performance adjustments

92. The AE's recommendations to Ofgem are shown in Table 3.

Table 3 – Recommended performance adjustments

	Amount above threshold	Audit part 2 recommendation
CI	1.19	1.19
CML	0.13	0.13

4.4 Detailed justification

93. In reaching a judgement on a recommendation, the AE has firstly considered whether or not NPG could have reasonably taken any different course of action that would have prevented the sea-bird from precipitating a 33kV flashover at NPG's Scarborough Grid Substation.



94. In viewing NPG's performance in preventing this event, the AE has taken into account his personal knowledge of the United Kingdom's distribution system practice and that of his colleagues who have considerable operational experience of incidents due to many causes.
95. In commending NPG for applying additional mitigating measures since this incident, the AE notes that NPG has no previous records of incidents of this type at its Scarborough Grid Substation and that it therefore had no cause to consider any additional preventative measures other than those consistent with good UK practice.
96. The AE considers that the preventative measures employed by NPG on its 33kV outdoor switchgear at its Scarborough Grid Substation at the time of the incident were in accordance with the industry standard and prevented damage due to third party interference, larger birds and windborne objects.
97. The AE is satisfied that NPG took all reasonable steps to ensure its number 1 132kV circuit between Osbaldwick Grid Substation and Scarborough Grid Substation feed Malton Grid Substation feed Knapton Generation was as free from defects as possible before the outage began on the number 2 circuit.
98. In considering NPG's restoration strategy, the AE is conscious that NPG's duty control engineer acted with commendable skill and speed in analysing the SCADA alarms and indications generated by this incident, contacting NPG's personnel on site and restoring supplies as rapidly as possible.
99. The AE is satisfied that NPG's distribution network at Scarborough Grid Substation complies with the requirements of Security of Supply Standard P2/6 (85.57 MVA firm demand).
100. The AE therefore concludes that NPG's claim is justified and recommends to Ofgem that the amounts of CI and CML above the threshold values should be excluded from NPG's performance for reporting year 2013/14.
101. The AE has discussed NPG's learning from this incident and is pleased that NPG has applied additional measures to mitigate against a recurrence of incidents of this type.
102. In the light of the conversation at the audit visit regarding question 13 above, the AE is also pleased that NPG undertook a thorough engineering review of the use of category 3 ('dead operation only') 132kV isolators.
103. However, the AE is obliged to record that, should a subsequent incident arise where the limitations associated with a category 3 132kV isolator inhibits speedy supply restoration; NPG's deliberations and conclusions would have to be considered in any recommendation made for an adjustment in the company's annual IIS / QoS performance.



Appendix A - Record of Audit part 1

Table A-1: Appointed Examiner's Information Log

"One-Off" Exceptional Event	Reporting Year 2013/14
Licensed Area	NPG(Northeast)
Date of event	11 April 2013
Cause	Flashover of exposed 33kV conductors
Notification to Ofgem	23 April 2013
SoF received	29 July 2013
SoF information	<ul style="list-style-type: none"> • The n° 2 132kV circuit from Osbaldwick Grid to Scarborough Grid feed Malton Grid feed Knapton Generation was under an outage for essential refurbishment and repairs; • Prior to this outage the n° 1 circuit had been surveyed and weaknesses repaired; • Thus at the time of the incident Scarborough Grid, Malton Grid and Knapton Generation were on a single 132kV circuit infeed; • At 07:10 on Thursday 11 April 2013 the 132kV circuit-breaker at Osbaldwick Grid on the n° 1 Scarborough Grid feed Malton Grid feed Knapton Generation tripped; • The n° 1 132kV Grid Transformer isolator at Scarborough Grid is a category 3 ('dead' operation only) type and auto-opened during the time that the 132kV circuit was de-energised; • The 132kV circuit-breaker at Osbaldwick auto-reclosed restoring Malton Grid and Knapton Generation – an SI (41,798 customers) apart from Yedingham Primary - see below); • The n° 1 Scarborough Primary feed Yedingham Primary 66kV circuit-breaker at Malton Grid tripped at the time the 132kV circuit-breaker at Osbaldwick Grid re-closed. It was closed via tele-control at 07:22 (1,096 customers supplied from Yedingham Primary were affected); • Supplies to 5 of NPG's 33/11kV Primary Substations fed from Scarborough Grid were interrupted (43,175 customers); • Tele-controlled switching commenced to restore supplies from 66kV and 11kV alternatives; • NPG personnel were sent to Scarborough Grid and reported a dead sea-bird on the ground below the exposed 33kV connections of the n° 1 132/33kV Grid Transformer; • NPG's personnel also confirmed no permanent damage - the Grid Transformer was safe to re-energise; • To minimise interference, 12,457 customers supplies were temporarily transferred off Malton Grid before the n° 1 incoming 132kV circuit was made dead from Osbaldwick Grid, the n° 1 132kV Transformer isolator at



	<p>Scarborough Grid was closed ('dead') and the whole circuit re-energised from Osbaldwick Grid;</p> <ul style="list-style-type: none"> • All supplies were restored by 08:33; and • The network was restored to normal running apart from the on-going outage on the n° 2 circuit (the request for an early return to service having been cancelled when the n° 1 132kV infeed was restored to Scarborough Grid).
Additional pre-visit information provided	Based on the SoF the AE drew up a list of initial questions. These were discussed during the audit visit. This initial list of questions, together with NPG's responses, is contained in paragraph 67 of the report.
Location of audit visit	NPG's Penshaw Control Centre
Date of audit visit	12 September 2014
Visiting Auditor	Geoff Stott (ep)
NPG's Representatives	Roy Barnes, Neil Dunn-Birch, Matthew Preston and Ian Punshon
Information provided during and subsequent to the audit visit	<p>Comprehensive documentation / information including:</p> <ul style="list-style-type: none"> • A discussion of the protection arrangements on NPG's Osbaldwick Grid to Scarborough Grid feed Malton Grid feed Knapton Generation 132kV circuits; • The settings applied to the above protection schemes; • A discussion of the tripping of the n° 1 66kV Scarborough Primary feed Yedingham Primary circuit-breaker at Malton Grid and the subsequent confirmation that the protection operated correctly; • Sight of NPG's switching programme for the incident which shows the loss of supplies from NPG's Scarborough Grid at 07:10 on 11 April 2013, the auto-isolation at Malton Grid and the auto-reclose to restore Malton Grid and Knapton Generation within 3 minutes; • Sight of NPG's switching programme for the tripping of the n° 1 66kV Scarborough Primary feed Yedingham Primary circuit-breaker at Malton Grid - showing the trip when the 132kV circuit-breaker at Osbaldwick Grid re-closed and its subsequent re-closing via tele-control at 07:22; • Sight of NPG's switching programmes showing the restoration of the supplies from Scarborough Grid that were lost as a result of the incident, including the SI that affected the already-restored supplies and which was needed to close the 'dead' operation only 132kV Grid Transformer isolator at Scarborough Grid; • Copies of the relevant 132kV, 66kV, 33kV and 11kV SLDs; • Sight of the printout from NPG's SCADA system that shows the alarms generated by the event; • Sight of NPG's incident report that shows: <ul style="list-style-type: none"> ◦ the number of customers affected by the incident to be 44,271; and ◦ the customer minutes lost due to the incident to be 2,268,072;



- The AE confirms that these figures agree with those quoted in NPG's SoF;
- Using NPG's total connected customers at 30 September 2013 of 1,586,437 the number of customers affected equates to a CI of 2.79 $[44,271 \times 100 / 1,586,437]$;
- Similarly, the customer minutes lost for this event equate to a CML of 1.43 $[2,268,072 / 1,586,437]$;
- NPG's photographs of the area of the 33kV compound at the point of damage, together with "Google Maps" views showing Scarborough Grid Substation's surrounding compound fence;
- No need to visit Scarborough Grid Substation to clarify anything;
- Discussed post-fault learning points, including anything to affect the NPG's future policy on shrouding bushings / cat 3 isolators – NPG's learning points include:
 - The consideration of shrouding around exposed high-voltage bushings and busbars (and other high-voltage components) where there is an increased risk that bridging by wildlife will result in the interruption of supplies to a significant number of customers for a significant duration. This would need to be considered on a case-by-case basis; and
 - Future investment in the replacement of category 3 (dead operation) disconnection devices with modern types should be considered where the use of dead operation disconnection devices could potentially result in the interruption of supplies to a significant number of customers for an extended duration. This would need to be considered on a case-by-case basis;
- Confirmed P2/6 compliant (85.57 MVA firm);
- NPG provided answers to the initial questions plus additional information both during and subsequent to the audit visit; and
- Okay regarding compliance with Appendix 4 of Paragraph 8.58 of CRC 8.



Table A-2: Impact on CI and CML

	CI		CML	
	Claimed	Audited	Claimed	Audited
132kV	0	0	0	0
EHV	2.79	2.79	1.43	1.43
HV	0	0	0	0
LV	0	0	0	0
Total	2.79	2.79	1.43	1.43
NPG Threshold (total)	1.6		1.3	
Part 1 Exceptionality Test	Pass		Pass	
Part 1 Precondition of eligibility (meets App 3 to paragraph 8.57 of CRC 8)	Pass			

AE's note: the figures in NPG's SoF used the then current customer numbers as at 30 September 2012 – this report uses the relevant figure as at 30 September 2013

General note: NPG's measurement systems are subject to QoS audits for accuracy of reporting and it is not within the AE's ToR to repeat that work as part of the examination of exceptional event claims, although any consequential adjustments to reporting accuracy will be reflected in Ofgem's final adjudication of reported performance for the regulatory reporting year 2013/14.



Appendix B - NPG's photographs

Photograph 1 – The dead sea-bird at the foot of the 33kV side of the number 1 132/33kV Grid Transformer





Photograph 2 – The dead sea-bird in relation to the number 1 132/33kV Grid Transformer





Photograph 3 – The exposed 33kV connections of the number 1 132/33kV Grid Transformer at the time of the incident





Photograph 4 – A recent view of the number 1 132/33kV Grid Transformer at NPG's Scarborough Grid Substation showing the additional shrouding of the 33kV bushings and overhead conductors



Photograph 5 - A close-up of the fence surrounding NPG's 132/33kV Scarborough Grid Substation showing the electrified wire extension above the 2.4 metre-high 'unclimbable' palisade palings





Photograph 6 - A general view of NPG's 132/33kV Scarborough Grid Substation

