

national**grid**

**Exercise Revive**

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## Executive Summary

Exercise Revive (Revive) was a Network Emergency Co-ordinator (NEC) Exercise, required under GS(M)R to test the emergency arrangements in place to manage a Network Gas Supply Emergency (NGSE).

Revive tested both the Downstream and Upstream responses to a Gas Deficit Emergency (GDE). Downstream processes were tested between the NEC the Network Emergency Management Team (NEMT), the four Gas Distribution Networks (GDN's) through their Distribution Control Centres (DCC), Distribution Network operational teams and the Shipper community. A key objective set by the HSE of the test was to replicate the process used in exercise Reform which occurred in May 2010 and tested the GDN Safety case changes.

Upstream tests focused on communications with Storage and LNG Terminal operators. The GAS reporting process and communications with DECC and Terminal Group leaders were simulated having been previously tested in exercise Avogadro. Communications were also tested between the Gas National Control Centre (GNCC) and the Electricity National Control Centre (ENCC).

Revive examined in detail the actions of the NEMT in forming an appropriate restoration strategy. New procedures and information transfers developed with the GDN's proved to be useful in informing and implementing the restoration plan. DCC's were efficient in providing information back to the NEMT.

Revive demonstrated improvements in emergency procedures from previous exercises. It also identified areas where existing procedures needed some modification and where communications could be improved.

- Compared to Exercise Quartz improvements have been made in Distribution Networks obtaining correct contact details for large consumers and increasing the quantity of load that can be shed;
- Exercise Quartz identified the restoration processes as an area for improvement. New procedures and information requirements introduced to assist restoration over multiple days proved to be effective;
- Upstream communications were successfully tested with participation from Storage and LNG Terminal Operators;
- To ensure full testing of procedures some elements were tested in parallel and time jumps were included in the scenario. These may of been more effective if specific central coordination of the transitions had occurred for each element;
- Changes to the E3 procedures were aligned and changes related to restoration and communications were successfully tested;

Revive was an effective test of emergency arrangements and the authors would like to thank all participants. Numbered footnotes in this document refer to the recommendations table in section 8.2

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## 1.0 Introduction

Revive tested the emergency arrangements in place to manage a Network Gas Supply Emergency (NGSE) and fulfilled the NEC's obligations under GS(M)R to periodically carry out a full industry exercise.

### 1.1 Exercise Scope

1.1.1 Revive was held on the 10th and 11th of November 2010. It focused on testing the emergency processes in place to effectively manage a NGSE. Day one of the exercise modelled a major supply loss leading to a GDE requiring stage three actions and subsequently limited network isolation and allocation. In common with previous exercises the demand reduction measures were simulated to achieve a supply demand balance before progression onto the next element of the exercise.

1.1.2 Restoration was examined in detail on day two of the exercise with a focus on strategy development by the NEMT and communications with the GDN's. The progress of restoration was modelled over a number of exercise days to ensure strategy development and NEMT actions could be cascaded effectively. Recently developed forms for information exchange specifically tailored to the restoration process were tested at each iteration of the restoration plan.

1.1.3 The specific procedures and processes were tested over the two days of the exercise, with the four DCC's, Shippers and end users responding to downstream actions. Terminals and Terminal Group Leaders (TGL) and use of the DECC Upstream Crisis Management process was out of scope for exercise Revive, having been thoroughly tested during DECC's tier one exercise Avogadro on the 29<sup>th</sup> June 2010. Storage sites LNG Importation Terminals and Interconnectors participated in Revive liaising with the respective NEMT teams. Interactions between the NEMT and National Grids Electricity Control Centre (ENCC) was also tested during Revive. The modelling of the Strategic Response Team, Joint Response Teams and the full DECC NEP remained out of the scope of the exercise.

1.1.4 End users and Shippers were contacted as part of the demand reduction measures enacted by Transporters.

### 1.2 Exercise Structure and Context

1.2.1 Exercise Revive built upon the experience of exercise Quartz. It enabled the NEMT greater scope to develop and implement strategic decisions in response to changes to the exercise scenario. The structure of the exercise was dictated by the two main elements being tested. The first of these was the effectiveness of Firm Load shedding

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procedures as they will be implemented in October 2011 by the GDN's as a consequence of reform of the interruption arrangements. The second was the introduction of new procedures to improve the restoration process. These new procedures were developed through a Transporter workshop held in August and iteration through the exercise planning process.

- 1.2.2 Regular planning meetings were used to develop the Master Events List (MEL) for the exercise with DN Exercise Controllers having active input. The exercise used a combination of parallel running and time jumps in order to cover the processes being tested and allow the NEMT to develop their recommended strategy. This ensured that each aspect of the exercise fulfilled the potential of giving players the experience of an NGSE.
- 1.2.3 Revive tested the consistency of NGSE procedures by simulating a rapid escalation to stage three actions and progressing to allocation and Isolation. Restoration strategy was developed towards the end of day one and progressed through iteration on day two.
- 1.2.4 For both days the NEMT and specifically the NEC, Incident Controller Network Manager Liaison and ESP operator roles, developed strategies to manage the GDE. At predefined points the focus of the NEMT actions was realigned with the process testing being actioned by the wider NEMT team and downstream players. Exercise injects were used extensively to stimulate NEMT debate and to forward the progression of the scenario to the point where restoration strategy was developed.
- 1.2.5 In addition to the above, specific tasks and injects were completed by the NEMT relating to the commercial and wider effects of the emergency. These included the extent of use of emergency specification gas; the appropriate management of risk assessments and a simulated JRT following a request from the GDN's.
- 1.2.6 Individuals were tasked to observe key industry participants actions during the exercise and report their recommendations. Feedback has also been received from industry participants and informs the production of this report.

### 2.0 Results and Observations

2.0.1 Emergency exercises are run to comply with the Gas Safety Management Regulations 1996 and Safety Case requirements. Exercises test the effectiveness of existing processes and procedures and identify where improvements are required. This section of the report assesses the success of existing procedures, discusses any communication issues encountered and identifies any problems experienced with the support tools and systems critical to managing a gas supply emergency.

### 2.1 Procedures

2.1.1 The formation of the NEMT worked well with roles being clearly defined. A number of newly trained individuals successfully took part in the exercise both as Officers In Charge (OIC) and within the defined teams. Changes to NEMT roles and duties following recommendations from exercise Quartz also proved to be constructive.

2.1.2 Issues encountered in Quartz with changes to GDN exercise contact details were resolved in exercise Revive. For Revive GDN exercise controllers were engaged in developing the MEL and in driving the definition of which numbers should be public in an NGSE. The additional planning was also effective in identifying some potential issues with respect to which data sets to utilise in the exercise. Going forward, it is recommended that a full MEL be shared with exercise controllers.<sup>1</sup> It is also recommended that attendance at key planning meetings is mandatory for all exercise controllers so that information imparted can be appropriately cascaded to GDN's.<sup>2</sup>

2.1.3 A data issue that was not identified by the exercise controllers in the planning stage was the effect of improved performance in Firm Load Shedding. In the course of the exercise the returns from the GDN's outperformed expectations. This had the consequential effect that the planning figures had to be changed during the course of the exercise to ensure exercise progress was maintained. It is recommended that a full run through at the planning stage with the relevant exercise data with input from the GDN's is conducted with GDN exercise controllers.<sup>3</sup>

2.1.4 Communications and procedures in general between the DN Liaison Officer and the four DCC's were well executed. The new procedures introduced to improve the level of detail exchanged as the Incident Controller begins preparing for restoration proved to be effective in supplying the required information to inform the restoration strategy. Feedback from the GDN's identified that the Situation Report and Additional Gas Report could replace other forms that are used to update GNCC.<sup>4</sup> This action will be forwarded through the E3 Alignment Group as well as a standard review of existing forms.

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- 2.1.5 Commencement of Revive began with contact between the DN Liaison Officer and their equivalents in the GDN's. With hindsight the GDN exercise controllers requested that future exercises begin with a call between the GNCC and DCC's.<sup>5</sup>
- 2.1.6 Procedures to liaise with LNG importation terminals and Storage operators worked well with the OIC Supply team managing contact and information flows with the operators. The OIC Supply team also provided guidance in the strategy NEMT as to the likely use of storage and the options with respect to storage monitors and the calculation of requirements in subsequent days of an emergency. This analysis and advice will be documented and added to the GNCC E3 procedures.
- 2.1.7 Revive also tested emergency communication procedures between the NEMT and the ENCC. These were effective when reducing load on the primary system and understanding if there could be an impact on the Gas Network. The protocol used did not cover the restoration process, and it would be prudent to explore if during restoration there would be similar consequential impacts that could impinge the effectiveness of the NEC restoration strategy.<sup>6</sup>

## 2.2 Communication

- 2.2.1 Communication between the teams and parties in Revive was effective. There were no significant delays in communications from the NEMT to other parties with all teams working well in the exercise. Telephone communications with sites were supplemented with the relevant faxed notification to Shippers and sites. The target for contacting NTS VLDMC customers by telephone of 30 minutes was met in the exercise.
- 2.2.2 As discussed in 2.1.3 there was a minor delay when the Firm load shedding returns were greater than expected. More importantly the readjustment of values did cause ambiguity in returning data to the NEMT, so strategy and process testing failed to be properly re-aligned in accordance with the MEL. Also one GDN had particular issues in filling in the appropriate forms with end of day information and queried the detail of the forms with DN liaison personnel rather than their exercise coordinator. In future exercises it is important that exercise co-ordinators do not "play" in the exercise but remain their organisations point of contact for advice. Exercise co-ordinators should maintain the role of progressing the exercise for each organisation and where play has gone off track, resolve issues or escalate as appropriate.<sup>7</sup> Similarly where the exercise contains sufficient complexity there should be a central exercise co-ordinator that maintains contact with other parties exercise co-ordinators and retains a track of participant play.<sup>8</sup>
- 2.2.3 Improvements to the Officer In Charge training programme to improve role familiarity and NEMT feedback had a positive impact on exercise Revive. Observation of new players to the officer roles demonstrated

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awareness of their role and responsibilities, and importantly the feedback required to the Incident Controller.

- 2.2.4 This improved level of feedback and discussion led to rich and deep strategy development, particularly in developing the restoration strategy. One area for focus going forward is to ensure that the log keeping role in the NEMT is developed further from capturing the key decisions to capturing the context and detail of strategic discussions that lead to decisions.<sup>9</sup> Also it is important to ensure that the final decisions and sanction meetings made at any point in time are built into exercise play.<sup>10</sup>
- 2.2.5 The provision by Shippers of effective contact details is a key performance indicator in any downstream demand reduction exercise. The results from Revive show significant improvement since Quartz. This is analysed in detail in section 3.3 and Table 3. Distribution Networks have identified that they have compiled their own data sets of correct details having first utilised the information provided by Shippers. This is identified in more detail for National Grid Gas Distribution in their submission in Appendix 3. It is recommended that Shippers and Transporters identify and remedy any obstacles that may prevent implementation of an effective feedback loop for contact details.<sup>11</sup>
- 2.2.6 In exercise Revive the Shipper Liaison Team contacted NTS consumers to canvas opinion and information on the emergency procedures and their profiles for demand reduction and restoration. For day two of Revive the profiles provided proved effective in informing the restoration strategy of the NEC.

### 2.3 Supporting systems

- 2.3.1 System performance was robust in exercise Revive. SC2004 was not utilised as the exercise tested the processes to curtail loads that will be adopted from October 2011. Instead each GDN used its own system to manage the firm load shedding process. The Emergency Strategy Program (ESP) decision support tool was used during the first part of strategy development to identify the initial quantities available to the NEMT to manage the NGSE. This performed well enabling the NEMT to explore different options to achieve an end of day balance.
- 2.3.2 For the testing of the restoration process new forms were developed with the GDN's via a workshop to ensure sufficient information was delivered to the NEMT. These forms proved effective enabling the NEMT to devise and adapt plans to restore supplies. It was noted that the forms whilst providing a good overview and forecast of GDN requirements could be enhanced with a clear decision support tool that could organise the data and enable options to restore the NGSE to be examined over a number of days.<sup>12</sup> This could then be used to track

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progress of the restoration strategy and allow identification of the optimum time to issue notification of the end of the NGSE.

## 3.0 Load Shedding Analysis

- 3.0.1 Successful demand reduction is a vital element in successfully managing a NGSE. Exercise Revive was an effective test of demand reduction on both the primary and secondary systems. In this section of the report particular attention has been paid to analysing performance with appropriate comparisons being made with both exercise Prelude and exercise Quartz to identify any trends.
- 3.0.2 It is important to note that Demand reduction in exercise Revive was executed on the basis of the Interruption Reform rules that come into effect in October 2011. The effect of these changes to the categorisation of sites is that the quantity available to DN as interruptible sites is reduced and the quantity available as Firm loads is increased.
- 3.0.3 It is also noted that DN's conducted exercise Reform in May 2010 to support their respective safety case changes prior to the implementation of Interruption Reform. In planning exercise Revive the HSE requested that the process used for exercise Reform was repeated in exercise Revive.

## 3.1 NTS and GDN VLDMC Load Shedding

- 3.1.1 The exercise structure developed for Revive was to escalate to stage three Firm load shedding. For the NTS loads this meant that all sites were contacted and requested to cease flows via telephone followed by a fax notification. The breakdown for the NTS sites contacted is represented in table 1.
- 3.1.2 As discussed in 3.0.2 for the GDN's there were no VLDMC Inruptibles to contact as the exercise was actioned on the basis of the Interruption reform. The table 2 represents the data for VLDMC's from the GDNs

### NTS VLDMC Load Shedding

NTS VLDMCs	
Time to contact All Sites 65 Mins	
Number of VLDMCs	54
Contact within 15mins	17
Contact 15 to 30 minutes	17
Contact 30 - 45 minutes	12
Contact 45- 60 minutes	4
Contact 60 minutes and over	1

Table 1

**GDN VLDMC Load Shedding**

<b>LDZ VLDMC</b>	
Time to contact All sites 9 mins	
Number of VLDMC's	10
Isolate within 1hr	10
Isolate within 1-2hr	
Isolate within 2-3hr	
Isolate within 3-4hr	

Table 2

3.1.3 For the sites contacted on both the NTS and GDN networks the VLDMC sites all reported that they would be able to isolate within one hour. For the NTS 3 sites were not contactable or were not able to establish contact with an individual within the organisation that could provide authority to cease flowing gas. These sites were eventually contacted but not within acceptable timescales. It is recommended that guidance is issued by the NTS to large customers to ensure responsibilities and obligations to comply with an NEC instruction are understood by site operators and their Shippers.<sup>13</sup>

**3.2 Firm Load Shedding > 25,000 tpa Consumers**

3.2.1 In exercise Revive GDN's were asked to contact a minimum of 200 sites in each of their networks LDZ's to enable comparison with previous exercises. A number of the networks also took the opportunity to contact a greater number of sites.

3.2.2 For the purposes of the report the results of Firm Load Shedding are examined under the following headings.

- Overall performance
- Large DN Site Performance.

**3.3 Overall performance**

3.3.1 The Firm Load Shedding results for Revive, compared to all recent exercises, are shown in the table below. For completeness this includes the results from 2010's Exercise Reform - the test conducted to support changes to the DN safety case. Where sites could be contacted and could stop using gas, calls were classed as "successful". Where sites were contacted but could not turn off gas, they were classed as "could not turn off gas". Where it was not possible to contact sites from the contact details, calls were classed as "contact details incorrect". All percentages are expressed in relation to the number of attempted calls.

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## Firm Load Shedding of Above 25,000 tpa by Exercise.

Contact Type	Moscow 2005		Neptune 2006		Opus 2007		Prelude 2008		Quartz 2009		Reform 2010		Revive 2010	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Successful (could turn off)	582	36.17%	1112	42.74%	1651	47.00%	1558	52.23%	1809	51.29%	1983	73.61%	2252	76.34%
Could not turn off	515	32.01%	612	23.52%	657	19.00%	444	14.88%	589	16.70%	263	9.76%	185	6.27%
Total sites where contact was made	1097	68.18%	1724	66.26%	2308	65.36%	2002	67.11%	2398	67.99%	2246	83.37%	2437	82.61%
Contact details incorrect	512	31.82%	878	33.74%	1223	34.64%	981	32.89%	1129	32.01%	448	16.63%	513	17.39%
Total attempted contacts	1609		2602		3531		2983		3527		2694		2950	

Table 3

3.3.2 The results in Table 3 and Fig 1 demonstrate a step change in performance in exercise Revive with 82.61 % of contacts attempted being successful and (ie site contacted) and 76.34% of contacts attempted being Successful ie (they would turn off). Although fewer calls were made overall in Revive then in Prelude or Quartz the success rate for each measure in absolute terms is improved.

3.3.3 As discussed earlier the improvements observed in exercise Revive can be attributed to the increased confidence in the new process adopted by DN's to prepare for Interruption Reform. Additionally the improvements in the "Could turn off" measure may reflect improved understanding by Sites of the process, and the increased level of testing in the past year.

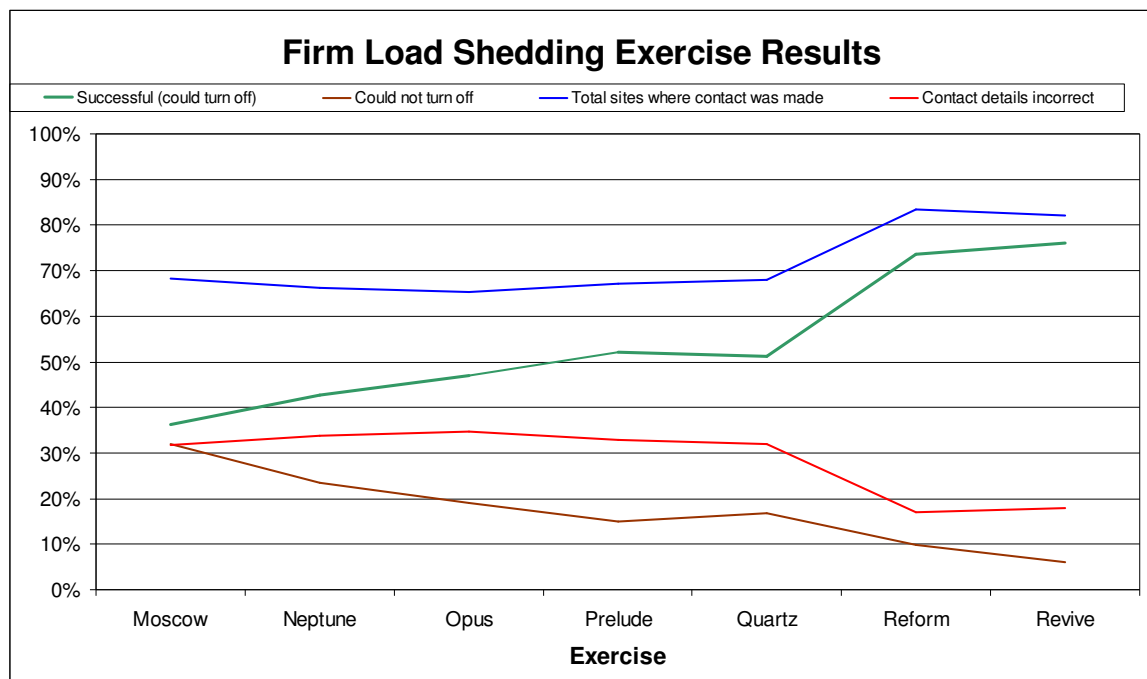


Fig 1

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3.3.4 Table 4 below shows the Firm Load Shedding results for each of the LDZ's for exercise Revive. For comparison Table 5 reproduces the results for exercise Prelude, Quartz and Revive. To illustrate the effect of Interruption reform the total quantity of SOQ for all attempted contacts by GDN's in Quartz was 350,489,213 kwh. This increased to 611,694,039 kwh in exercise Revive. One of the effects of the reform of interruption is that the NEC can have increased confidence that sites will respond with a full load reduction and that flows will decrease. Previously at stage one sites that had both Firm and Interruptible contracts could continue to flow into the firm proportion of their contracted load if they were emergency interrupted.

**Exercise Revive Firm Load Shedding By Local Distribution Zone (LDZ)**

LDZ	Calls	Unsuccessful Contacts	Can Turn off	Cannot Turn Off	% Unsuccessful Contacts	% Can Turn Off	% Cannot Turn Off	% of Site SOQ Isolated
East Anglia	250	35	212	3	14.00%	84.80%	1.20%	93.52%
East Midlands	250	19	216	15	7.60%	86.40%	6.00%	96.51%
North London	250	28	221	1	11.20%	88.40%	0.40%	97.33%
North West	250	23	216	11	9.20%	86.40%	4.40%	96.39%
West Midlands	250	52	191	7	20.80%	76.40%	2.80%	90.46%
North (NO)	250	76	132	42	30.40%	52.80%	16.80%	63.05%
Yorkshire (NE)	250	67	137	46	26.80%	54.80%	18.40%	64.67%
Scotland	200	13	174	13	6.50%	87.00%	6.50%	95.33%
South East	200	19	153	28	9.50%	76.50%	14.00%	91.89%
South	200	17	164	19	8.50%	82.00%	9.50%	88.56%
South West	200	51	149	0	25.50%	74.50%	0.00%	88.46%
Wales North	200	57	143	0	28.50%	71.50%	0.00%	89.17%
Wales South	200	56	144	0	28.00%	72.00%	0.00%	89.17%
<b>Overall</b>	<b>2950</b>	<b>513</b>	<b>2252</b>	<b>185</b>	<b>17.39%</b>	<b>76.34%</b>	<b>6.27%</b>	<b>88.79%</b>

*Table 4*

**Comparison of Firm Load Shedding Results by Exercise**

LDZ	% Unsuccessful Contacts			% Can Turn Off			% of Site SOQ Isolated		
	Prelude	Quartz	Revive	Prelude	Quartz	Revive	Prelude	Quartz	Revive
East Anglia	35.60%	42.80%	14.00%	46.40%	36.80%	84.80%	56.48%	46.18%	93.52%
East Midlands	35.20%	34.80%	7.60%	64.00%	48.80%	86.40%	73.44%	61.20%	96.51%
North London	45.20%	37.60%	11.20%	54.40%	46.00%	88.40%	56.72%	58.38%	97.33%
North West	20.80%	18.00%	9.20%	57.20%	45.60%	86.40%	65.32%	60.97%	96.39%
West Midlands	27.20%	43.60%	20.80%	55.60%	52.40%	76.40%	63.22%	63.97%	90.46%
North	19.00%	38.00%	30.40%	70.50%	54.50%	52.80%	86.01%	78.76%	63.05%
Yorkshire	31.00%	28.50%	26.80%	51.50%	41.50%	54.80%	63.32%	50.58%	64.67%
Scotland	24.78%	29.60%	6.50%	50.87%	62.80%	87.00%	58.73%	70.26%	95.33%
South East	45.60%	38.05%	9.50%	41.20%	61.06%	76.50%	52.76%	69.90%	91.89%
South	43.87%	39.20%	8.50%	38.73%	42.40%	82.00%	59.53%	55.39%	88.56%
South West	25.00%	26.45%	25.50%	52.50%	62.22%	74.50%	61.07%	70.84%	88.46%
Wales North	39.00%	29.09%	28.50%	45.50%	48.48%	71.50%	70.41%	70.26%	89.17%
Wales South	30.50%	21.88%	28.00%	53.00%	55.98%	72.00%	71.66%	69.91%	89.17%
<b>TOTAL</b>	<b>32.89%</b>	<b>32.01%</b>	<b>17.39%</b>	<b>52.23%</b>	<b>51.29%</b>	<b>76.34%</b>	<b>65.10%</b>	<b>63.45%</b>	<b>88.79%</b>

*Table 5*

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3.3.5 The graph fig 2, compares the SOQ successfully firm load shed between exercise Prelude, Quartz and Revive. Performance overall in percentage terms Increased from 63.45% in Quartz to 89.79% in Revive. In absolute terms there was an increase in the SOQ that could turn off from 222,376,334 kwh in Quartz to 543,098,693 kwh in Revive.

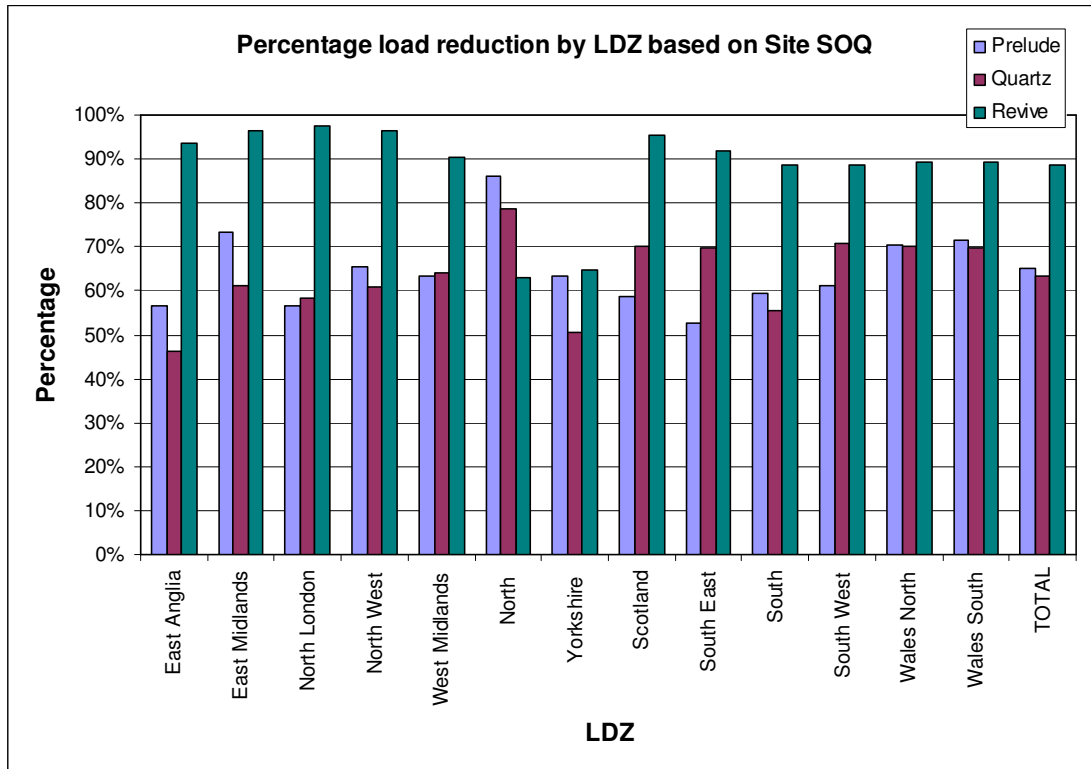


Fig 2

3.3.6 Key to establishing improvements in the ability to Firm Load Shed effectively is developing customer's understanding of what to do when called by a Transporter to curtail flows. This is measured in the "Can Turn Off" percentage in an NEC exercise. Fig 3 charts the 'Can turn off' percentage for each LDZ. The work progressed by all Transporters to contact customers to prepare for Interruption reform and in conducting exercise Reform on 11 May 2010 have had the effect of improving the response by customers when contacted.

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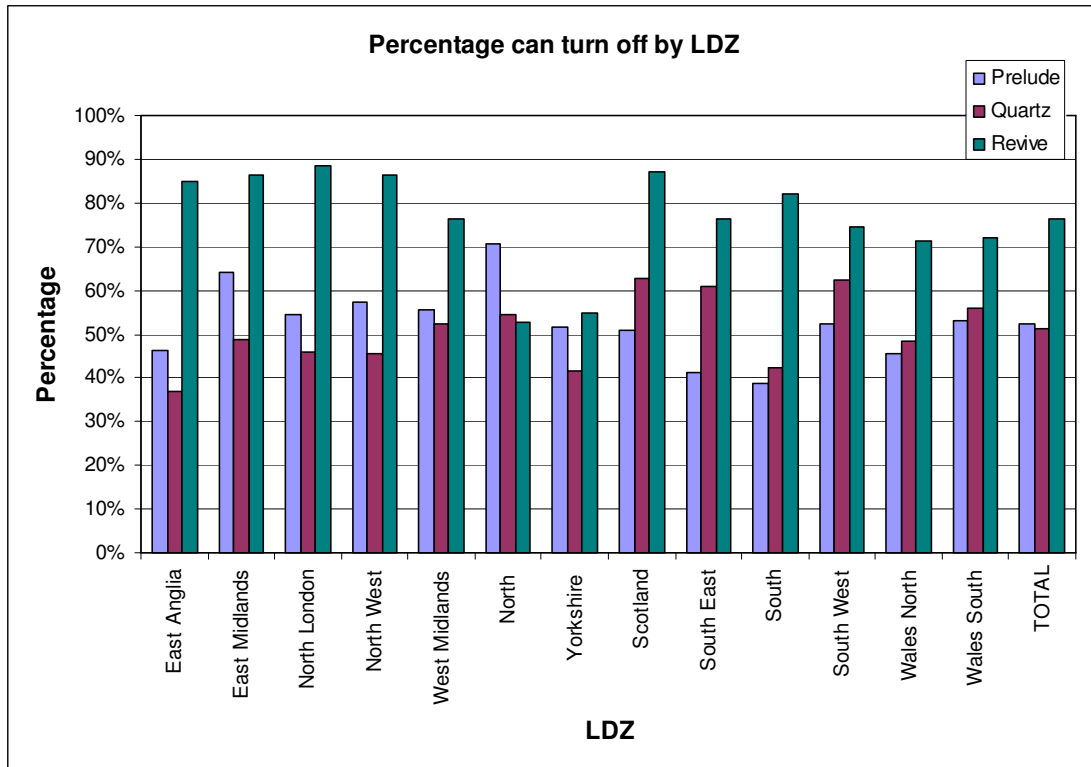
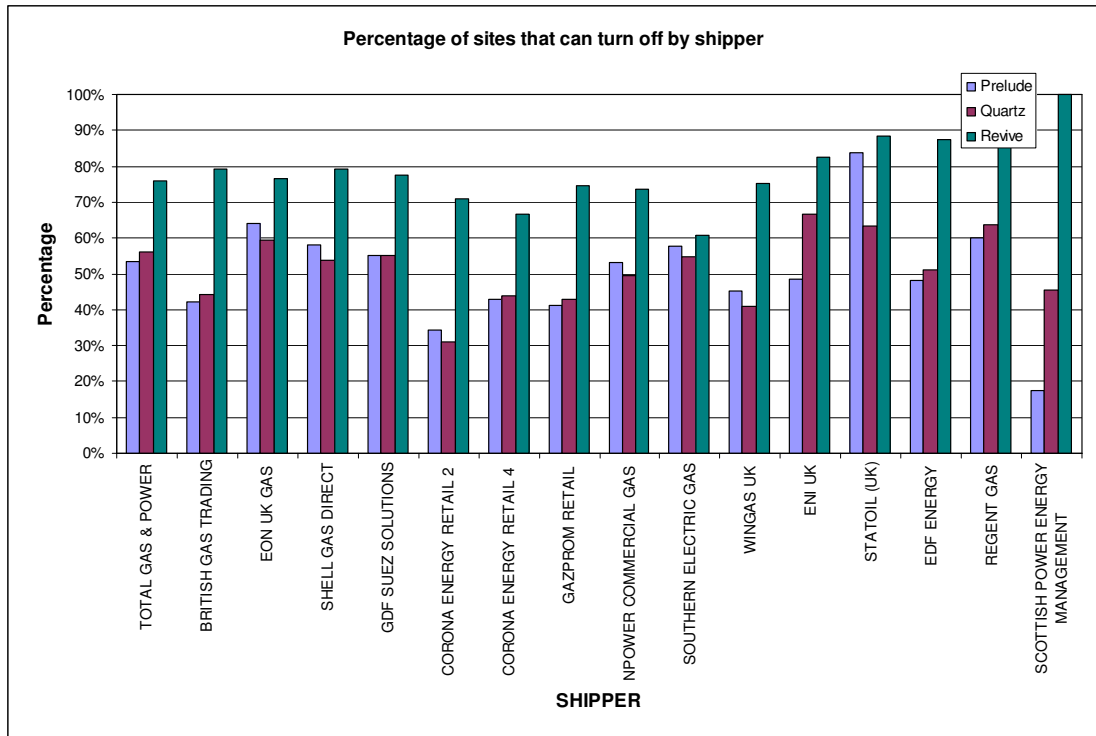


Fig 3

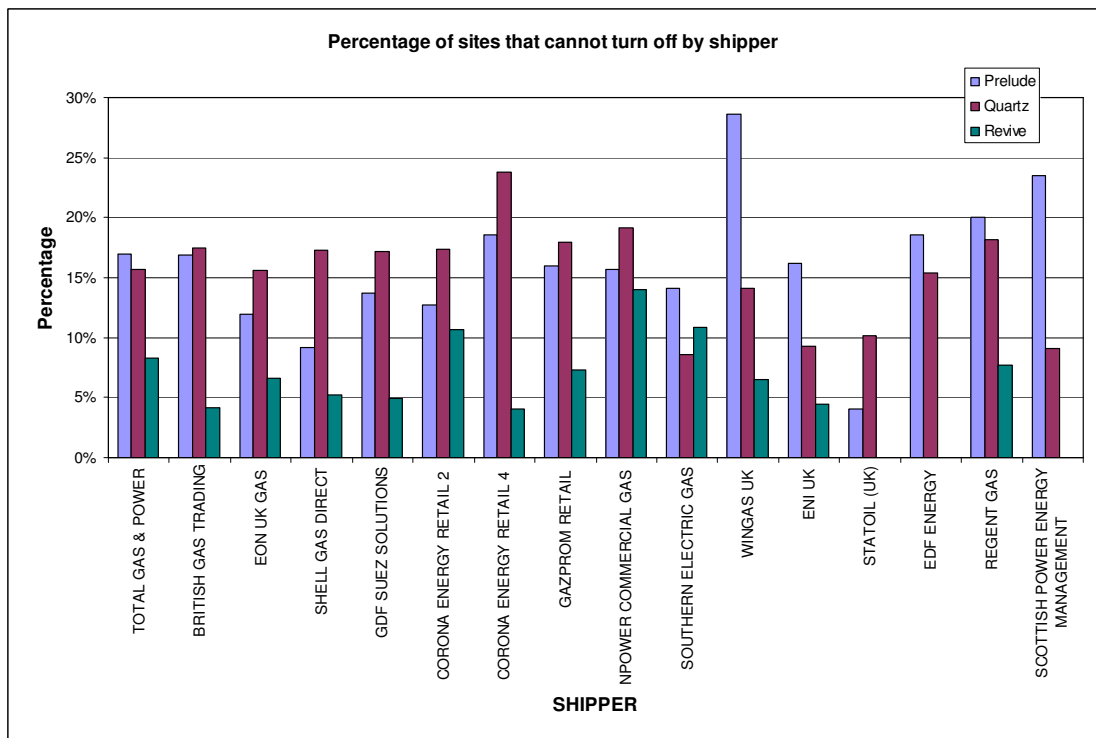
3.3.7 Shippers are responsible for providing emergency contacts via Xoserve to Transporters. It was noted in Exercise Quartz that contact information would be improved if specific consumer contact details were passed back for update to Shippers. The improvement in the contact detail performance is welcome but as discussed in 2.2.5. GDN's report that they have worked to ensure contacts are correct, but as yet there is not an effective feedback loop established with Shippers. Differences in Shipper and Network contacts are identified in Appendix 3. Any changes that would ensure that these improvements can be reflected back to shippers and further down the DN's demand curve are encouraged. Fig 4 below shows the successful contacts made by GDN's on a shipper by shipper basis.

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*Fig 4*

3.3.8 The following chart fig 5 measures the percentage of sites contacted that could not turn off. As such it is a useful indication of whether the person contacted has the knowledge and authority to comply with the transporters request. This shows a significant improvement on previous exercises and increases confidence that when asked to do so sites will act to curtail their flows in an emergency.



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### 3.4 Large GDN Loads.

3.4.1 Large GDN Loads are defined by each Distribution Network as the sites that it has a high confidence can be load shed quickly and represent a significant element of the network's demand. Revive measured the capability to load shed these sites.

3.4.2 The tables below Table 6 and Table 7 enable comparison of performance between Revive and Quartz for the Large GDN Loads.

**Exercise Revive Large Gas Distribution Network Loads**

LDZ	No of Large GDN Loads	No of Large GDN Loads shed by phone	% SOQ of Large GDN Loads Shed by Phone	No of Large GDN Loads visited in exercise	% SOQ of Large GDN Loads shed by visit in exercise	Predicted No of Large GDN Loads shed in 4 hours	% SOQ of GDN Large Loads reduced in 4 hours	Predicted time to deliver maximum load shed of Large GDN Loads
East Anglia	21	21	100.00%	0	0.00%	21	100.00%	210
East Midlands	45	45	100.00%	0	0.00%	45	100.00%	210
North London	18	18	100.00%	0	0.00%	18	100.00%	210
North West	48	48	100.00%	0	0.00%	48	100.00%	210
West Midlands	27	27	100.00%	0	0.00%	27	100.00%	210
North	27	18	64.15%	9	35.85%	27	100.00%	150
Yorkshire	31	18	69.65%	13	30.35%	29	92.41%	390
Scotland	38	38	93.64%	4	6.36%	38	100.00%	120
South East	13	13	95.43%	1	4.57%	13	100.00%	90
South	10	10	100.00%	0	0.00%	10	100.00%	60
South West	24	24	100.00%	0	0.00%	24	100.00%	75
Wales North	8	8	100.00%	0	0.00%	8	100.00%	75
Wales South	25	25	100.00%	0	0.00%	25	100.00%	75
<b>TOTAL</b>	<b>335</b>	<b>313</b>	<b>93.90%</b>	<b>27</b>	<b>6.10%</b>	<b>333</b>	<b>99.42%</b>	

*Table 6*

3.4.3 The most notable feature of Revive relative to Quartz is the shortened timescales across most LDZ's for load shedding. The exception to this is the data for North and Yorkshire LDZ's which includes the time to curtail sites that are visited. It is recommended that going forwards the time to make telephone contact and the time to visit are recorded separately.<sup>14</sup> It is also worth noting the increase in the number of sites from 157 in Prelude and 163 in Quartz to 335 in Revive. This is largely due to previously Interruptible sites that from October 2011 will be classified as large DN loads for the purposes of emergency load shedding.

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### Exercise Quartz Large Gas Distribution Network Loads

LDZ	No of Large GDN Loads	No of Large GDN Loads shed by phone	% SOQ of Large GDN Loads Shed by Phone	No of Large GDN Loads visited in exercise	% SOQ of Large GDN Loads shed by visit in exercise	Predicted No of Large GDN Loads shed in 4 hours	% SOQ of GDN Large Loads reduced in 4 hours	Predicted time to deliver maximum load shed of Large GDN Loads
East Anglia	7	3	34.67%	4	65.33%	7	65.33%	240
East Midlands	20	16	88.25%	4	11.75%	20	100.00%	300
North London	10	9	91.53%	1	8.47%	10	100.00%	240
North West	17	8	54.20%	5	26.75%	13	80.95%	360
West Midlands	30	22	80.55%	4	12.54%	26	93.08%	360
North	20	20	100.00%	0	0.00%	20	100.00%	55
Yorkshire	9	5	54.60%	4	45.40%	9	100.00%	75
Scotland	12	12	100.00%	0	0.00%	12	100.00%	120
South East	5	5	100.00%	0	0.00%	5	100.00%	120
South	5	5	100.00%	0	0.00%	5	100.00%	120
South West	9	9	100.00%	0	0.00%	9	100.00%	240
Wales North	6	6	100.00%	0	0.00%	6	100.00%	240
Wales South	13	13	100.00%	0	0.00%	13	100.00%	240
<b>TOTAL</b>	<b>163</b>	<b>133</b>	<b>85.67%</b>	<b>22</b>	<b>11.69%</b>	<b>155</b>	<b>95.62%</b>	

*Table 7*

3.4.4 It was noted in exercise Quartz that due to the reform of interruption the “demand reduction achieved through large DN loads is going to increase as DN interruptible sites transfer to firm status. It is important that this transition is managed and tested through the 2010 exercise programme and beyond to ensure the good response rate of Large DN loads is maintained.” The improvements in the measures for both Large DN loads and Firm load shedding are evidence of the improvements that GDN’s have made in connecting with their customers to ensure that demand can be curtailed safely in the event of an NGSE.

### 4.0 Other Exercise Injects

- 4.0.1 The structure of exercise Revive enabled elements of free play for the NEC and NEMT in developing, approving and implementing strategy. Exercise injects were used to facilitate a variety of options and actions available to the NEMT and exercise participants at different points in the emergency. A number of salient exercise injects are highlighted in the following paragraphs.
- 4.0.2 During the exercise injects were used to simulate requests for Emergency Specification gas from a number of sources. The use of different terminals and different projected flows enabled the NEMT to explore the physical impact of allowing or restricting flows within GSMR Schedule 3 Part II limits. This proved useful in exploring the process used for risk assessment and the potential implications for downstream networks.
- 4.0.3 At the request of the GDN's the SRT Liaison Officer modelled a Joint Response Team teleconference to explore the options related to the Purge and Relight process used when restoring isolated GDN consumers. Although the NEMT and NEC have no vires in this area, the GDN representatives found it a useful part of the exercise enabling them to understand the requirements that would be needed by the relevant authorities. The details of the material presented to the SRT Liaison Officer will be forwarded to the HSE.

### 5.0 Restoration strategy

- 5.0.1 The development of a structured restoration strategy was a key element of exercise Revive. The Incident Controller was tasked to propose a restoration strategy from stage four back to normal operation. The new processes introduced for GDN's to forecast forward their requirements over a number of days was utilised and informed the strategy. Further realism was added by issuing injects that could influence the strategy. In addition to inputs from the Network Manager Liaison and OIC Supply the commercial implications were also explored with advice and assistance from National Grid Commercial representative. An orderly strategy was developed by the Incident Controller to stabilise the network and manage the transition back to normal operation.
- 5.0.2 The Incident Controller considered the expected demand, supply and storage positions for each day and identified key milestones that would have to be achieved. The options available were reassessed when injects were introduced. Part of the process involved consideration of the criteria that would be used to identify stability on the primary

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network and from that the notice required to resume National Grid participation on the OCM.

- 5.0.3 This became particularly relevant when considering a supply surplus and the effect this would have on the network as demand recovered. It was noted that resuming normal operation by the revocation of load shedding notices may have the consequence of increasing within day fluctuations in demand and supply. Guidance as to the legal and commercial implications of executing the restoration process should also be included in the E3 documentation.<sup>15</sup>
- 5.0.4 As the restoration process developed and the NEMT reacted to subsequent injects, it was clear that the strategy decisions made when reducing demand had an effect on the options available to the NEMT. This tested the log keeping process and as discussed in 2.2.4 the context of options and decision making needs capturing as well as the decisions themselves, as this helps inform later strategy development and assists the handover process.
- 5.0.5 GDN's identified their restoration strategy and as discussed provided information via new forms. These forms worked well and as in 2.1.4 changes will be pursued by the alignment group. It has been suggested that using real time data would provide a more realistic scenario and enable detailed network analysis of the prevailing and predicted conditions leading to restoration. It is recommended that this approach be work shopped by the relevant exercise co-ordinators to ensure that if adopted for the next NEC exercise it has sufficient depth.<sup>16</sup>

## 6.0 Supplementary transporters

- 6.0.1 The processes to inform and engage with supplementary transporters worked well. NEC declarations at each of the relevant stages of the NGSE. GDN's provided the supplementary transporters with contact details and cascaded subsequent actions from their DCC's to ensure a co-ordinated approach to the emergency.

## 7.0 Bord Gais Eireann

- 7.0.1 The BGE process was successfully tested for reducing and restoring load through the Moffat interconnector. Transfer of information was successful over both days of the exercise though BGE reported that Stage notifications had not been received although these had been identified as being successfully sent. It is noted that the information from BGE would require iteration and finessing in the event of an actual emergency as their shipper nominations reduced.

## 8 Findings and Recommendations

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8.0.1 Exercise Revive successfully tested processes and NEMT strategy development against a scenario of a progressive Gas Deficit Emergency. Revive had a particular emphasis on the restoration process and the actions and options available to Transporters. It was a wide ranging and challenging exercise that sought to simulate a real emergency for the NEMT. It has highlighted areas for improvement and these are detailed in the table under section 8.2 . The findings below detail and summarise some of the key issues.

### 8.1 Findings

8.1.1 Exercise Revive proved to be a very effective test of the emergency procedures and the actions of the NEMT. The engagement from all parties prior to and during the exercise was constructive. The workshop to develop new forms for restoration between transporters was effective, and provided an excellent basis to explore restoration issues during the exercise.

8.1.2 In addition to proving the effectiveness of improvements to restoration, Revive also demonstrated a step change in performance for Firm Load Shedding. To prepare for the changes to the interruption regime GDN's conducted exercise Reform in May 2010. In preparation GDN's contacted their customers to explain the changes to the regime, captured contact details where they are different from shippers, and revised their processes. The improvement in firm load shedding performance in Revive builds on the best practice established in the Reform exercise.

8.1.3 The improvement to the firm load shedding results in 3.3.4 and the transparency of the firm load shedding process, provides a level of confidence that firm load shedding would be effective in reducing demand in an NGSE. As noted in 2.2.5 and 3.3.7 there is still no effective feedback loop from Transporters to Shippers of changes to contact details. One option that should be considered would be an obligation on Shippers to check the currency of their contact information if notified that this was different.

8.1.4 Revive was a complex exercise involving parallel running and time jumps in order to successfully test in depth the NGSE processes. Clarity as to the role of exercise controllers in the exercise may have made on the day process testing and communication between Transporters more effective. Additionally changes to the NEMT logkeeper role identified in 2.2.4 should be enacted to ensure a greater input from the logkeeper in managing the NEMT meetings and recording the context of decision making.

8.1.5 Revive also utilised scenario specific data during the exercise. As noted in 2.1.3 and 5.0.5 this can cause issues with interpretation and downstream systems. Going forward consideration should be given to

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the advantages of using “on the day” data balanced with having sufficient depth of process testing and NEMT strategy development.

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### 8.2 Recommendations.

No.	Issue	Action	Owner	Target
1	Improve transparency of exercise actions for all active exercise controllers	Full MEL including strategy actions to be shared with exercise controllers to provide a full overview of the exercise	EPT	Future exercise planning
2	Improving understanding of exercise objectives and ensure appropriate organisational cascade.	Mandatory attendance of exercise controllers at exercise planning meetings.	DN Ex Control	Future exercise planning
3	Ensure clarity during the exercise over data required and information exchange requirements.	Full end to end run through of the MEL as a final part of the exercise planning process.	EPT	Future exercise planning
4	Improving feedback to the NEMT through effective information exchange between transmission and distribution transporters.	Improvements to NEMT forms to be progressed through the E3 alignment group.	EPT	Sept 2011
5	Exercise commencement to begin via control room contact to replicate actual process.	Incorporate this as an action into future exercise planning.	EPT	Future exercise planning
6	Communication between Network Manager / NEMT and ENCC in restoration.	Develop an appropriate communications protocol for use by Gas and Electricity control rooms when restoring the primary gas network.	EPT	August 2011
7	Role of GDN exercise co-ordinators needs to be expressly defined in the tests planning stage.	Exercise co-ordinators should maintain the role of progressing the exercise and not undertake a functional role. They should be fully conversant with the tests, forms and actions required.	GDN	Future exercise planning
8	For complicated exercises a Central exercise co-ordinator role is required.	Should be identified in the MEL. Maintain a formal track through counterparts of exercise progress and be the point of escalation for any issues.	EPT	Future exercise planning
9	Logkeeping role currently maintains the formal tracking of decisions. This should be extended to incorporate the formal administration of the NEMT meetings and the capture of the context of decision making.	Full review of the NEMT logkeeper role to understand how it can be enhanced to support the Incident controller and NEMT in the course of an emergency.	EPT	August 2011

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10	No formal IC / NEC challenge and review scheduled in the exercise.	Scheduling of space within exercises to have a number of formal IC / NEC challenge and review sessions.	EPT	Future exercise planning
11	No formal feedback loop to shippers from GDN's to improve contact details.	GDN's to Propose a way forward to work with the Shipper community to understand and remove any blockers to completing the update process. As level 2 responders GDN's should advise shippers of the 2007 advice from the Cabinet Office "Data Protection and Sharing – Guidance for Emergency Planners and Responders"	GDN	Ongoing
12	Assimilation of restoration data from the GDN's into the NEMT strategy.	Develop a support tool to enable the NEMT to quickly understand the forecast position of GDN's during restoration and assimilate this with Transmission data.	EPT	October 2011
13	Restatement of obligations for NTS sites to comply with NEC directions including the provision of appropriate contact details.	Communication with NTS Sites.	EPT	May 2011
14	Improvements in the recording of FLS and other emergency actions.	Clear guidance to be provided to DN's to accurately record where visits are undertaken. Template for exercise capture to be provided with additional guidance and clarity over formats.	E3 Alignment group	August 2011
15	Capture of the legal and commercial implications of restoration.	Guidance to the legal and commercial implications of restoration to be included in GNCC E3.	EPT	August 2011
16	Consider the appropriate use of real time GDN data and GDN network analysis in exercise planning.	Workshop with GDN exercise controllers to determine the extent to which Real time data can be used in modelling an NGSE.	Exercise co-ordinators	As part of NEC exercise planning programme

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### Appendix 1 - Gas Distribution Network Firm Load Shedding data

#### Exercise Revive Firm Load Shedding By Local Distribution Zone (LDZ)

LDZ	Calls	Unsuccessful Contacts	Can Turn off	Cannot Turn Off	% Unsuccessful Contacts	% Can Turn Off	% Cannot Turn Off	SOQ Can Turn Off	Total Site SOQ	% of Site SOQ Isolated
East Anglia	250	35	212	3	14.00%	84.80%	1.20%	43748373	46779233	93.52%
East Midlands	250	19	216	15	7.60%	86.40%	6.00%	74856351	77567026	96.51%
North London	250	28	221	1	11.20%	88.40%	0.40%	49269600	50618871	97.33%
North West	250	23	216	11	9.20%	86.40%	4.40%	77620813	80530145	96.39%
West Midlands	250	52	191	7	20.80%	76.40%	2.80%	45531475	50334840	90.46%
<b>National Grid Distribution</b>	<b>1250</b>	<b>157</b>	<b>1056</b>	<b>37</b>	<b>13%</b>	<b>84%</b>	<b>3%</b>	<b>291026612</b>	<b>305830115</b>	<b>95%</b>
North (NO)	250	76	132	42	30.40%	52.80%	16.80%	31278560	49608588	63.05%
Yorkshire (NE)	250	67	137	46	26.80%	54.80%	18.40%	31458077	48645195	64.67%
<b>Northern Gas Networks</b>	<b>500</b>	<b>143</b>	<b>269</b>	<b>88</b>	<b>29%</b>	<b>54%</b>	<b>18%</b>	<b>62736637</b>	<b>98253783</b>	<b>64%</b>
Scotland	200	13	174	13	6.50%	87.00%	6.50%	58257744	61110478	95.33%
South East	200	19	153	28	9.50%	76.50%	14.00%	28768866	31307014	91.89%
South	200	17	164	19	8.50%	82.00%	9.50%	23392463	26415634	88.56%
<b>Scotia Gas Networks</b>	<b>600</b>	<b>49</b>	<b>491</b>	<b>60</b>	<b>8%</b>	<b>82%</b>	<b>10%</b>	<b>110419073</b>	<b>118833126</b>	<b>93%</b>
South West	200	51	149	0	25.50%	74.50%	0.00%	30570791	34559130	88.46%
Wales North	200	57	143	0	28.50%	71.50%	0.00%	12411613	13918476	89.17%
Wales South	200	56	144	0	28.00%	72.00%	0.00%	35933967	40299409	89.17%
<b>Wales and West Utilities</b>	<b>600</b>	<b>164</b>	<b>436</b>	<b>0</b>	<b>27%</b>	<b>73%</b>	<b>0%</b>	<b>78916371</b>	<b>88777015</b>	<b>89%</b>
<b>Overall</b>	<b>2950</b>	<b>513</b>	<b>2252</b>	<b>185</b>	<b>17%</b>	<b>76%</b>	<b>6%</b>	<b>543,098,693</b>	<b>611,694,039</b>	<b>89%</b>

#### Exercise Quartz Firm Load Shedding By Local Distribution Zone (LDZ)

LDZ	Calls	Unsuccessful Contacts	Can Turn off	Cannot Turn Off	% Unsuccessful Contacts	% Can Turn Off	% Cannot Turn Off	SOQ Can Turn Off	Total Site SOQ	% of Site SOQ Isolated
East Anglia	250	107	92	51	43%	37%	20%	11040403	23906187	46%
East Midlands	250	87	122	41	35%	49%	16%	27308973	44625619	61%
North London	250	94	115	41	38%	46%	16%	15000495	25695787	58%
North West	250	45	114	91	18%	46%	36%	25259095	41432069	61%
West Midlands	250	109	131	10	44%	52%	4%	23828908	37252186	64%
<b>National Grid Distribution</b>	<b>1250</b>	<b>442</b>	<b>574</b>	<b>234</b>	<b>35%</b>	<b>46%</b>	<b>19%</b>	<b>102437874</b>	<b>172911848</b>	<b>59%</b>
North (NO)	200	76	109	15	38%	55%	8%	24280626	30827678	79%
Yorkshire (NE)	200	57	83	60	29%	42%	30%	10653272	21061306	51%
<b>Northern Gas Networks</b>	<b>400</b>	<b>133</b>	<b>192</b>	<b>75</b>	<b>33%</b>	<b>48%</b>	<b>19%</b>	<b>34933898</b>	<b>51888984</b>	<b>67%</b>
Scotland	250	74	157	19	30%	63%	8%	16144693	22977705	70%
South East	226	86	138	2	38%	61%	1%	12369313	17694886	70%
South	250	98	106	46	39%	42%	18%	12330880	22262857	55%
<b>Scotia Gas Networks</b>	<b>726</b>	<b>258</b>	<b>401</b>	<b>67</b>	<b>36%</b>	<b>55%</b>	<b>9%</b>	<b>40844886</b>	<b>62935448</b>	<b>65%</b>
South West	397	105	247	45	26%	62%	11%	18967651	26776246	71%
Wales North	361	105	175	81	29%	48%	22%	8098920	11526368	70%
Wales South	393	86	220	87	22%	56%	22%	17093105	24450319	70%
<b>Wales and West Utilities</b>	<b>1151</b>	<b>296</b>	<b>642</b>	<b>213</b>	<b>26%</b>	<b>56%</b>	<b>19%</b>	<b>44159676</b>	<b>62752933</b>	<b>70%</b>
<b>Overall</b>	<b>3527</b>	<b>1129</b>	<b>1809</b>	<b>589</b>	<b>32%</b>	<b>51%</b>	<b>17%</b>	<b>222,376,334</b>	<b>350,489,213</b>	<b>63%</b>

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### Appendix 2 – Load shedding of Large Gas Distribution Network Loads

**Exercise Revive Large Gas Distribution Network Loads**

LDZ	No of Large GDN Loads	Total SOQ of Large GDN Loads	No of Large GDN Loads shed by phone	SOQ of Large GDN Loads shed by phone	% SOQ of Large GDN Loads Shed by Phone	No of Large GDN Loads visited in exercise	SOQ of Large GDN Loads shed by visit in exercise	% SOQ of Large GDN Loads shed by visit in exercise	Predicted No of Large GDN Loads shed in 4 hours	Predicted SOQ of Large GDN Loads shed in 4 hours	% SOQ of GDN Large Loads reduced in 4 hours	Predicted time to deliver maximum load shed of Large GDN Loads
East Anglia	21	24,799,520	21	24,799,520	100.00%	0	0	0.00%	21	24,799,520	100.00%	210
East Midlands	45	47,281,355	45	47,281,355	100.00%	0	0	0.00%	45	47,281,355	100.00%	210
North London	18	29,141,015	18	29,141,015	100.00%	0	0	0.00%	18	29,141,015	100.00%	210
North West	48	52,280,012	48	52,280,012	100.00%	0	0	0.00%	48	52,280,012	100.00%	210
West Midlands	27	20,827,857	27	20,827,857	100.00%	0	0	0.00%	27	20,827,857	100.00%	210
North	27	27,225,984	18	17,464,333	64.15%	9	9,761,651	35.85%	27	27,225,984	100.00%	150
Yorkshire	31	26,263,181	18	18,291,249	69.65%	13	7,971,932	30.35%	29	24,269,521	92.41%	390
Scotland	38	40,042,757	38	37,494,757	93.64%	4	2,548,000	6.36%	38	40,042,757	100.00%	120
South East	13	11,570,606	13	11,042,143	95.43%	1	528,463	4.57%	13	11,570,606	100.00%	90
South	10	8,367,185	10	8,367,185	100.00%	0	0	0.00%	10	8,367,185	100.00%	60
South West	24	17,954,022	24	17,954,022	100.00%	0	0	0.00%	24	17,954,022	100.00%	75
Wales North	8	7,938,814	8	7,938,814	100.00%	0	0	0.00%	8	7,938,814	100.00%	75
Wales South	25	27,413,066	25	27,413,066	100.00%	0	0	0.00%	25	27,413,066	100.00%	75
<b>TOTAL</b>	<b>335</b>	<b>341,105,374</b>	<b>313</b>	<b>320,295,328</b>	<b>93.90%</b>	<b>27</b>	<b>20,810,046</b>	<b>6.10%</b>	<b>333</b>	<b>339,111,714</b>	<b>99.42%</b>	

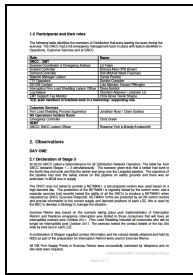
**Exercise Quartz Large Gas Distribution Network Loads**

LDZ	No of Large GDN Loads	Total SOQ of Large GDN Loads	No of Large GDN Loads shed by phone	SOQ of Large GDN Loads shed by phone	% SOQ of Large GDN Loads Shed by Phone	No of Large GDN Loads visited in exercise	SOQ of Large GDN Loads shed by visit in exercise	% SOQ of Large GDN Loads shed by visit in exercise	Predicted No of Large GDN Loads shed in 4 hours	Predicted SOQ of Large GDN Loads shed in 4 hours	% SOQ of GDN Large Loads reduced in 4 hours	Predicted time to deliver maximum load shed of Large GDN Loads
East Anglia	7	5,540,048	3	1,920,753	34.67%	4	3,619,295	65.33%	7	3,619,295	65.33%	240
East Midlands	20	17,446,424	16	15,396,050	88.25%	4	2,050,374	11.75%	20	17,446,424	100.00%	300
North London	10	6,837,851	9	6,258,716	91.53%	1	579,135	8.47%	10	6,837,851	100.00%	240
North West	17	9,377,039	8	5,082,020	54.20%	5	2,508,770	26.75%	13	7,590,790	80.95%	360
West Midlands	30	16,272,436	22	13,106,674	80.55%	4	2,040,006	12.54%	26	15,146,680	93.08%	360
North	20	16,112,680	20	16,112,680	100.00%	0	0	0.00%	20	16,112,680	100.00%	55
Yorkshire	9	4,642,911	5	2,534,922	54.60%	4	2,107,989	45.40%	9	4,642,911	100.00%	75
Scotland	12	8,598,876	12	8,598,876	100.00%	0	0	0.00%	12	8,598,876	100.00%	120
South East	5	2,699,641	5	2,699,641	100.00%	0	0	0.00%	5	2,699,641	100.00%	120
South	5	5,464,086	5	5,464,086	100.00%	0	0	0.00%	5	5,464,086	100.00%	120
South West	9	5,255,217	9	5,255,217	100.00%	0	0	0.00%	9	5,255,217	100.00%	240
Wales North	6	4,172,559	6	4,172,559	100.00%	0	0	0.00%	6	4,172,559	100.00%	240
Wales South	13	7,932,870	13	7,932,870	100.00%	0	0	0.00%	13	7,932,870	100.00%	240
<b>TOTAL</b>	<b>163</b>	<b>110,352,638</b>	<b>133</b>	<b>94,535,064</b>	<b>85.67%</b>	<b>22</b>	<b>12,905,569</b>	<b>11.69%</b>	<b>155</b>	<b>105,519,880</b>	<b>95.62%</b>	

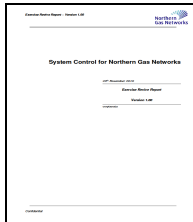
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## Appendix 3 – Distribution Network Exercise Reports

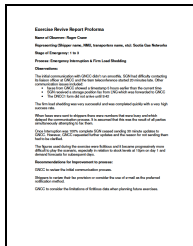
*The following reports are submitted on behalf of the Gas Distribution Networks*



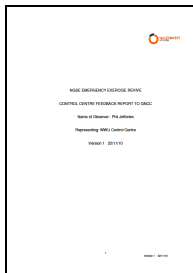
### National Grid Gas Distribution



### Northern Gas Networks



### Scotia Gas Networks



### Wales and West Utilities

## National Grid

### Appendix 4

The Revive Briefing Pack – This was issued to industry in advance of the exercise and is reproduced alongside this document .

### Appendix 5 - Glossary

ANS	Automatic Notification System
BGE	Bord Gáis Eireann
DECC	Department of Energy and Climate Change
GDN	Gas Distribution Network
DCC	Distribution Control Centres (collective term used in this document for all Distribution network control rooms)
E3	Gas Supply Emergency Procedure
ESP	Emergency Strategy Programme
EPT	Emergency Planning Team
FLS	Firm Load Shedding
GAS	Gas Availability Status reports
GNCC	Gas National Control Centre
GS(M)R	Gas Safety (Management) Regulations 1996
HSE	Health and Safety Executive
IT	Information Technology
JRT	Joint Response Team
LDZ	Local Distribution Zone
LGSE	Local Gas Supply Emergency
NEC	Network Emergency Co-ordinator
NEMT	Network Emergency Management Team
NGSE	Network Gas Supply Emergency
NTS	National Transmission System
OCM	On the Day Commodity Market
OIC	Officer in Charge
OPN	Offtake Profile Notice
SRT	Strategic Response Team
tpa	Therms per annum
TGL	Terminal Group Leaders
UKD	UK Distribution
VLDMC	Very Large Daily Metered Consumer

## National Grid

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