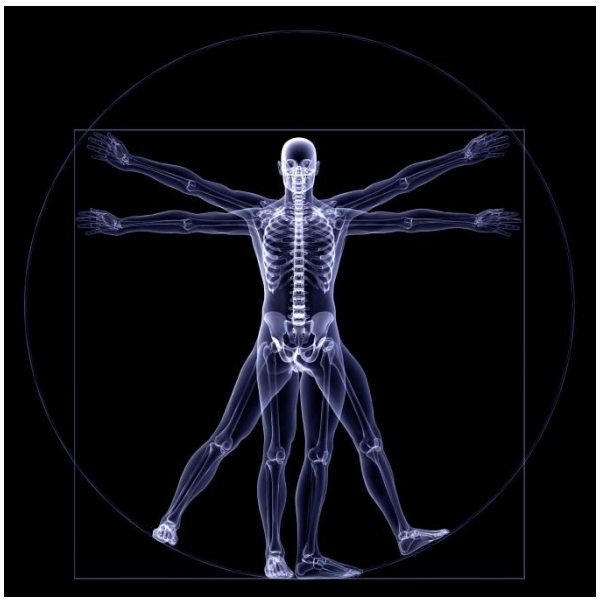
NEC

Exercise X-Ray Report

Network Emergency Coordinator (NEC)



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1. Executive summary

The Network Emergency Co-ordinator (NEC) is an independent role, established under the Gas Safety (Management) Regulations (GS(M)R), whose duty is to co-ordinate the actions across affected points of the gas network to prevent or minimise the consequences of a gas supply emergency; this is defined as an emergency endangering persons arising from a loss of pressure in a network or part thereof. The role of the NEC is currently undertaken by National Grid and is independent from any commercial interests of the gas industry.

Industry participants such as gas transporters and shippers have a legal duty to cooperate with the NEC, who has the powers to direct the duty holders. The arrangements and procedures put in place to facilitate these powers are tested yearly and this report will discuss the outcomes of these with a focus on the 2016 NEC Industry Exercise "Exercise X-Ray".

To provide assurance to the NEC that the entire industry is able to adhere to the procedures in Exercise X-Ray there were over 300 industry participants and observers from the Health and Safety Executive (HSE) were in attendance at National Grid Gas' offices in Warwick during the NEC Emergency Exercise.

Exercise X-Ray successfully demonstrated that the industry was able to respond to a Gas Deficit NGSE in accordance with the emergency arrangements. Actions areas for improvement have been developed from the feedback received and the individual reports developed by the DNs. Each of these areas has a project dedicated to it and will be tracked and reported on to the NEC throughout the coming year. The priority areas for development are the Transmission and Distribution Networks interaction, the visualisation of data and the training programme as these will have the biggest impact in improving the emergency processes.

Projects to improve these areas are already underway with visits to visualisations experts and new training plan already developed. 4 Critical Transportation Constraint Exercises are already planned for 2017 and will give an early indication to what level of progress has already been made with action areas.

Overall the suite of exercises gave assurance to National Grid and the NEC and provided valuable learning and experience to National Grid and the wider industry; this will be continued into 2017 with the inclusion of the improvements set out in this report.

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2. Introduction

To prevent a supply emergency occurring or to minimise the safety risks associated where one develops, the Network Emergency Co-ordinator (NEC) has arrangements established pursuant to the Gas Safety (Management) Regulations 1996 for coordinating the actions of duty holders, including transporters, operating on the affected part of the network. In accordance with the NEC's safety case obligations these processes are tested on a periodic basis to ensure that arrangements are robust and duty holders are cognisant of their responsibilities.

The 2016 NEC emergency exercise, "Exercise X-Ray", was split into four separate exercises to allow more focus on key areas of the emergency process:

- NEC Industry Exercise - Gas Deficit Emergency (GDE) exercise
- National Grid pre-emergency commercial strategy exercise
- Individual Distribution Network Critical Transportation Constraint (CTC) exercise
- Individual Distribution Network Firm Load Shedding (FLS) exercises

We will further consider in detail the events of both the National Grid pre-emergency strategy day and the NEC Industry exercise. It is important we include the National Grid pre-emergency strategy day as with the ever increasing complexity of the manifestation of a National Gas Supply Emergency this plays a far more significant role and will allow for a rich picture of actions taken during the exercises. This will provide assurance that the industry is prepared to handle a national gas supply emergency and an opportunity to highlight areas that could be improved. A brief overview of the other exercises is also given.

2.1. Participants

It is estimated that there are over 300 industry participants taking part in Exercise X-Ray from across a range of areas which include:

- National Grid
    - Network Emergency Management Team (NEMT)
    - Representation from Gas National Control Centre (GNCC)
    - Representation from Electricity National Control Centre (ENCC)
    - National Grid Crisis Management Team (CMT)
    - National Grid representatives from legal and communications.
- Distribution Network Operators (DNs)
    - National Grid Gas Distribution Ltd (NGGDL)
    - Northern Gas Networks (NGN)
    - Scotia Gas Networks (SGN)
    - Wales & West Utilities (WWU)
- Department for Business, Energy & Industrial Strategy (BEIS)
- Shippers
- Terminal Operators including LNG Importation Terminal Operators
- Interconnector Operators
- Storage Facility Operators
- Supplementary Transporters
- NTS Directly Connected Loads
- Oil & Gas Authority (OGA)

Observers from the Health and Safety Executive were in attendance at National Grid Gas' offices in Warwick during the NEC Industry Exercise.

2.2. Objectives

As stated in the industry brief the principal objective of the NEC Emergency Exercise was:

- To test the emergency arrangements, to stage 3, set out in the Procedure for Network Gas Supply Emergency and the response of all parties to a developing Network Gas Supply Emergency.

This principal objective was exercised primarily in the main NEC Industry Exercise but also in the Critical Transportation Constraint and Firm Load Shedding exercises. This principal objective was divided into a number of primary objectives:

1. Confirm that industry emergency arrangements remain aligned to the Procedure for Network Gas Supply Emergency
2. Test of the National Grid and Oil and Gas Authority upstream Oil and Gas Crisis management procedure, web portal and emergency response communications
3. Test of the NEMT emergency strategy development, industry communication and emergency processes through NEC emergency stages 1-3
4. Test of the Distribution Networks Netman1 process
5. Test National Grid's external emergency communications system
6. Test National Grid's emergency management instruction proformas are clear and concise and embedded within the industry's emergency procedures
7. Test that previous NEC exercise recommendations have been included within the emergency strategy development and emergency procedures

Further to these main objectives the exercises are used as an assurance exercise for members of the Network Emergency Management Team (NEMT) to confirm their competence in performing the roles.

3. Scenario

The scenario for the Pre-Emergency Day and the NEC Emergency Exercise were both based on the 20th of January 2016, the highest demand day seen in the past 3 years. Basing the scenario on a historic day allowed for more realistic network modelling across the Distribution Networks, NTS and Electricity Networks to be aligned.

In addition to the high supply/demand profile of the 20th January further complexity was added to the scenario with the following injects:

- Over the past few days the UK had been experiencing cold weather and the forecast is for temperature to drop further over the next few days
- NTS resilience was lower due to less gas in the pipes (linepack) causing lower pressures. This has been caused by the supply and demand flows being imbalanced the previous day.

- Current forecasted nominated flows are again imbalanced causing a predicted further loss to pressures.

The progression of the emergency scenario was primarily caused by major losses in gas supply and increasing domestic heating demand due to the drop in temperature. The scenario in X-Ray was designed to go through Stages 1-3 of an emergency and test certain actions contained in T/PM/E/1 shown in Table 1. A detailed step through in the scenarios and the points at which action is taken is included in Appendix I –.

Table 1 - Emergency Actions

Gas Deficit Emergency		
Emergency Stage	Action	Tested in Exercise X-Ray
Stage 1 (Potential)	• Gas conforming to Schedule 3 Part II of GS(M)R	No
	• NTS Linepack utilisation	Yes
	• Distribution Network Utilisation ○ Distribution Network Storage ○ Emergency Interruption	Yes (Data gathering only)
	• Public Appeals	No
Stage 2	• National Grid Gas plc's participation in the OCM will be suspended	Yes
	• Maximise Supplies	Yes
	• Firm Load Shedding	Yes
	• Public Appeals	No
Stage 3	• Public Appeals	Exercised by BEIS
	• Allocation & Isolation	Yes
Stage 4	• Restoration	No

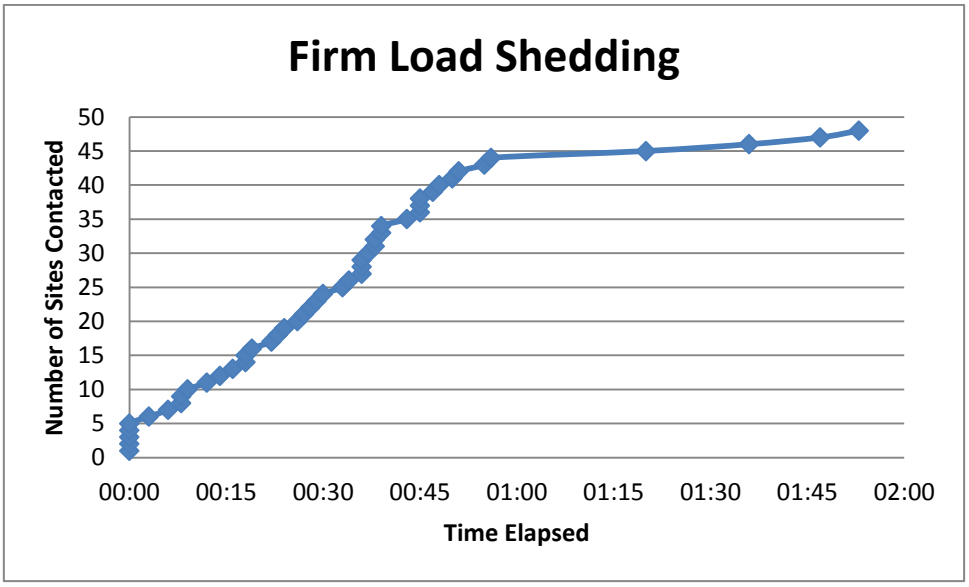
4. Firm Load Shedding

4.1. NTS Firm Load Shedding Results

A key activity in Stage 2 in an NGSE emergency is firm load shedding (FLS). The NEC Emergency Exercise X-Ray tested the performance of loads directly connected to the NTS when directed to cease taking gas. All NTS directly connected sites were contacted during the exercise. In total, 48 sites were involved and all of these sites were contactable and confirmed they would be able to cease gas consumption within the required lead time.

The task of contacting NTS directly connected sites is managed by the Shipper Team within the NEMT. A total of 5 people undertook this task and all sites were contacted, issued directions over the phone, issued a GS(M)R fax notification and all details noted in the curtailment log. Figure 1 shows the time taken from starting the firm loading exercise to making successful contact with each of the sites.

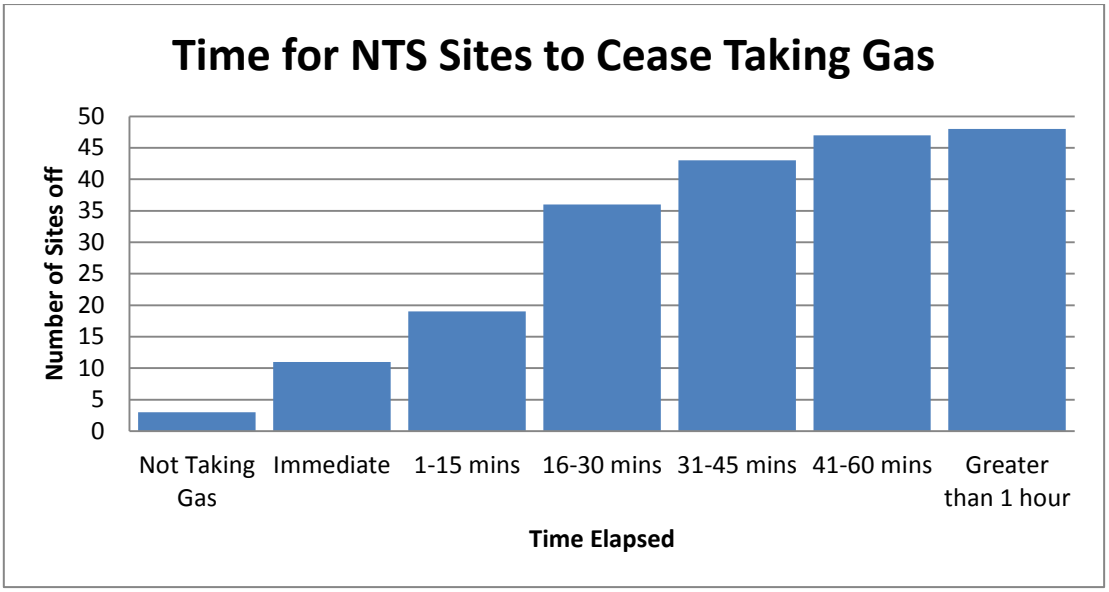
Figure 1 - Time to Contact all Directly Connected Sites.



Most of the sites were able to be contacted within the first hour and all sites within 2 hours. This is considered an acceptable time frame for the sites to each be individually contacted.

Once contact has been established it is key to understand how sites are able to react to a notice to reduce flows to zero. In X-Ray 100% of the sites contacted said that they could cease taking gas. The times scales for these actions can be seen in Figure 2. The timescales were showed a positive and acceptable result with all bar 1 site being able to reduce flows within the hour. Again this is felt to be a satisfactory result.

Figure 2- Time for NTS sites to cease taking gas.



4.2. Distribution Network Firm Load Shedding

All Distribution Network Operators have Safety Case obligations to maintain the contact details for the top 200 sites (in terms of offtake size, largest first) so that they can be contacted in an emergency to cease gas consumption and reduce LDZ demand. In order to assess the Distribution Network Operators ability to contact the top 200 sites, each of the four Distribution Network Operators was requested to undertake an emergency contact validation exercise prior to the NEC exercise to fully engage with their top 200 supply point consumers per Local Distribution Zone (LDZ). This exercise validated the emergency contact numbers whilst ensuring sites understood their legal obligations to comply with instructions to cease gas consumption during an emergency. In addition the DNs were requested to engage with the supplementary transporters to test communication and compliance objectives.

Successful emergency management requires prompt contact with large gas consumers and it should be expected that these consumers have at least a basic understanding of their obligations should a real emergency occur. Feedback from previous exercises suggested that limited time was provided to DNs during the NEC exercise to undertake their communications test. Separating out this exercise from the main NEC exercise allowed DNs more time to undertake this activity, providing for richer conversations with gas consumers and better information gathering.

The following analysis focuses on the performance regarding the three key measures of contact success of:

- Number of sites where contact was made and site would stop using gas
- Number of sites where contact was made and site would not stop using gas
- Number of sites who could not be contacted

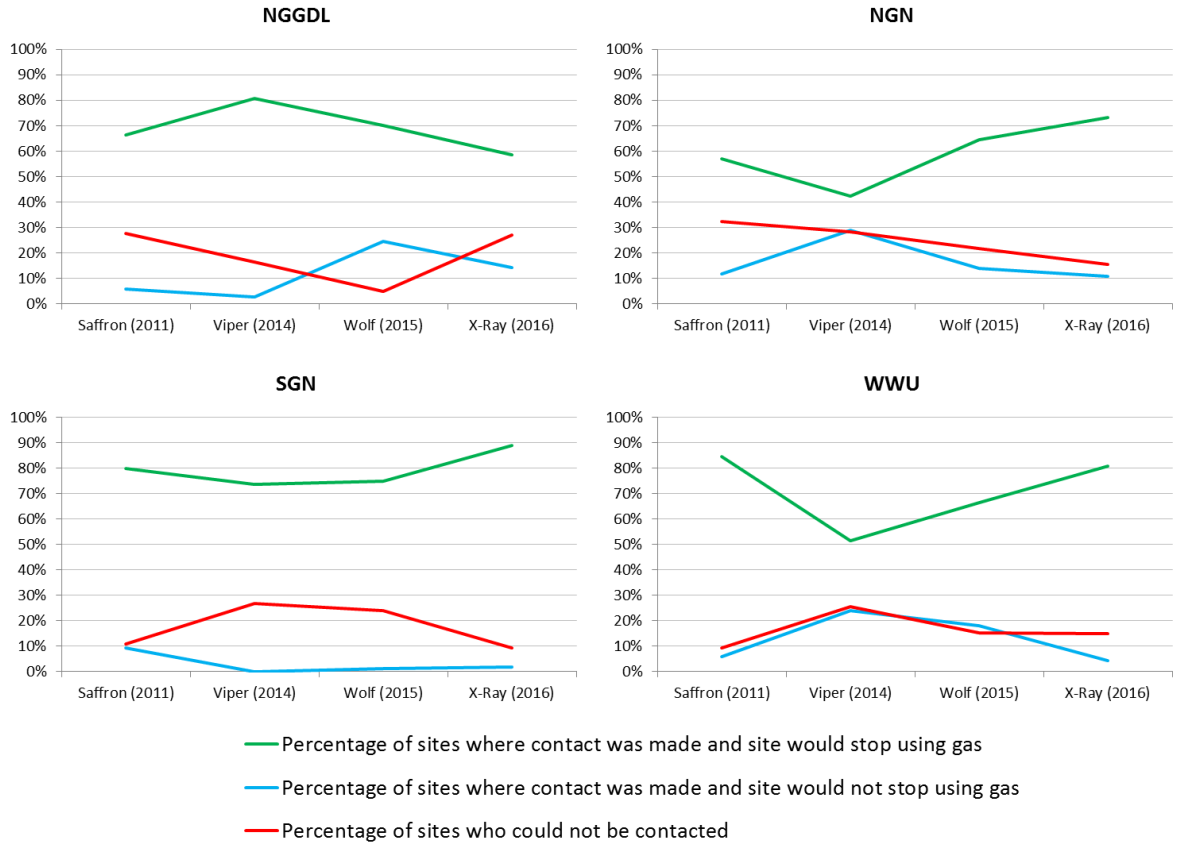
Table 2 shows the aggregated Data across all of the DNs. It shows, compared to last year's exercise, as an industry the quality of the phone calls has increased with an increase in the number of successful calls. However the number of sites that were not able to be contacted has increased.

Table 2 - Aggregated DN Firm Load Shedding Data

	No of sites attempted to be contacted	No of sites where contact was made and site would stop using gas		No of sites where contact was made and site would not stop using gas		No of sites who could not be contacted	
X-Ray 2016	**2662**	**1935**	**73%**	**232**	**9%**	**495**	**19%**
Wolf 2015	2725	1895	70%	450	17%	380	14%
Viper 2014	2493	1637	66%	282	11%	574	23%
Ulysses 2013	1673	920	55%	250	15%	503	30%
Titan 2012	1229	904	74%	134	11%	191	16%
Saffron 2011	2587	1872	72%	193	7%	522	20%

If we break down the above data into the individual Distribution Networks, Figure 3, it can be seen than in general there has been an increase in performance. National Grid Gas Distribution Ltd has, however, had a considerable increase in the number of site that could not be contacted, after a very good performance last year. This will have to be investigated and then discussed at the E3 alignment group to see if there is any shared learning to be taken from this. For all the DNs it is important that a desired state of 100% of sites contacted and will stop using gas is still sought after and work is planned in to achieve this.

Figure 3 – Comparison of DN firm load shedding performance



5. Critical Transportation Constraint

This year there has been 1 Critical Transportation Constraint Exercise conducted between Wales and West Utilities and National Grid Transmission. A Critical Transportation Constraint is defined when the primary transporter, National Grid, will be unable to maintain adequate pressure at any NTS offtake.

The Critical Transportation Constraint exercise was designed to create a focus for Transporter to Transporter strategy development and communication in an emerging Critical Transportation Constraint. The exercise was focused on promoting open dialogue with the requirement for the Distribution Network to determine the constraint impact on their network and articulate the level of emergency actions required to minimise it. This included identifying and considering all network utilisation and constraint options to enable a joint strategy to be articulated to the NEC. A key focus was on the DN articulation of risk, for example analysis of pressure and associated volume of load and number and type of consumers affected, to ensure a robust, justifiable and defendable analysis is submitted. This underpins the strategy taken to the NEC and subsequent emergency declaration and commencement of associated emergency actions. The approach allowed for closer inspection of a range of real world network failure scenarios and the transporters ability to quantify the risk associated with diminished exit pressures.

The exercise lasted approximately 4 hours and was led by National Grid's Emergency Planning Team. The exercise was based on a historic high demand day and then initiated with a NTS failure scenario which would trigger a reduction in offtake pressures in a specific area of the NTS and an associated Local Distribution Zone (LDZ).

6. Observations and Recommendations

This section covers the observations and recommendations from National Grid Transmission and the DNs across all the exercises described above. They have been grouped into 8 action areas and were generated through the feedback collated through various means. The priority areas for development are the Transmission and Distribution Networks interaction, the visualisation of data and the training programme, as these will have the biggest impact in improving the emergency processes.

6.1. Transmission and Distribution Networks interaction

It is important to continually improve how the transmission network and the distribution networks work collaboratively together as this relationship is key to developing and implementing the most effective action plan for administering an emergency. This relationship is managed through the E3 Alignment Group that meets quarterly and continually reviews the networks role in emergencies.

The first improvement action to complete is to ensure the right flow of data is happening. This initially includes a review of all the forms that are used. There will also be a deeper look at how best to convey instructions, who is best to give the instructions to and whether the current forms are the best way.

With a large amount of resource change in the emergency teams there has been a reduction in knowledge of the processes the distribution network operators have. Therefore as part of the renewed training approach team members, that are managing the interactions between the NTS and

the distribution networks, will visit a distribution networks and sit in during an exercise. This learning will help improve the relationships between the network operators during an exercise.

A key process that should be witnessed during the visits is how the firm load shedding and isolation processes interact on the distribution networks and the time these processes will take to enact for different amounts of load.

Finally consistent messaging from the network operators to industry and government needs to be looked at and who is best to give what information. This will form part of the E3 Alignment Group agenda

6.2. Visualisation of Data

One of the key comments from the day was that it was very hard to tell quickly what the current status and progress of the incident was and what actions had been taken to assist the situation and what benefit they were expected to have. This is not helped by the fact that there is no live data available for an exercise. The issue is worsened outside the incident room for those that are not directly involved in the action planning but are in contact with the industry.

This has triggered a piece of work to look into the best ways to display data in an emergency to both the NEMT and the wider teams. External parties have already been engaged to help learn from other industries and bring best practice into our processes.

6.3. Training Programme

The feedback and DN reports highlighted areas for improvement in the training provided before the exercise. To tackle this, the training plan has been reviewed and the main focus is to look at the style of training. The training currently is mostly classroom based combined with experience during the NEC Exercise. The aim is to change this to be more practical training which will include engaging with the relevant parties which the teams interact with, internal and external. This is most important when interfacing with the distribution networks so a more detailed and robust transporter strategy can be created. These more interactive sessions should improve familiarity with the tools used in an emergency.

6.4. Facilities

During an incident or exercise the GNCC incident room is used for the briefings for the leads of each team, however the teams themselves have been struggling to find the best way to set up outside of the incident room. The plan is to review the needs of each of the teams and standardise the use of the rest of the office so in an emergency the Incident Controller will always know where the teams are based and communications across the teams will be improved.

Inside the incident room there can be many people in the room at once and can change seating position between each meeting of the NEMT. HSE shared best practise as part of the feedback on X-Ray and fixed seated positions for important roles combined with place cards should help the Incident Controller in addressing the room and assist the Technical Secretary in recording names of who has taken on actions.

The last facilities issue faced during X-Ray was an issue with telephones and which numbers to use. For this an investigation into a technical solution of having fixed numbers for each of the teams is being investigated.

6.5. Industry Communications

Communications is a key area when dealing with an emergency and there has been a lot of feedback on how these can be improved and make things clearer to the industry.

Firstly during the exercise our mass communication system that sends out instant messages and faxes had two major issues on the day. Firstly there were corrupt files attached to emails sent out with emergency declarations therefore they could not be opened. This also caused some fax machines issues with printing blank faxes. This issue was able to be corrected by our service provider during day 1 and therefore further communications were not been effected. The second issue was more complex; when generating direction notices the system creates these with a set name depending on the site that they are being sent to. However when the system went to look for these it found old messages that were stored in the cache from previous years exercise and therefore sent out notices with the wrong information on it. This has now been rectified by our service provider.

The Emergency Stage Declaration Notices have received some comments that they could be made clearer especially when declaring 2 separate types of emergency as was the case in X-Ray, Stages 1-3 for a Gas Deficit Emergency and Stage 1 for a Storage Monitor Breach Emergency. These will be looked at and tested ready for the next exercise.

There were several reliability issues with the fax machines used in an emergency and therefore there is a project underway to see if we can do away with fax being the primary form of communication in an emergency and to see if there is a more appropriate form of communication to use as the primary communication type.

Again there were issues with incorrect contact details being held for use in an emergency. This has been an issue in the past and a continual process of contact validation was put in place. However this does not seem to have resolved the issue. Therefore there is a project underway to look into how this could be done smarter and improve accuracy and performance in an emergency.

The final issue with communication was not related to the emergency process but notifying industry prior to the exercise. This is being reviewed and will be improved on ahead of the next exercise.

6.6. Exercise Set up

Some of the feedback was associated with the setup of the exercise rather than the processes used in an emergency. First of which was to ensure that if there were anything unusual happening on the NTS in real time then this needs to be made aware to the relevant teams calling customers so they are best informed and able to make a clear differential to the user.

The exercise is currently used as part of the training approach, therefore we normally have “shadow” roles during the exercise. These are people who are not fully participating but are witnessing as part of their training. This however makes the incident room overcrowded and can

take away from the NEMT meetings. Therefore as part of the new training plan, discussed above, these roles will be kept to a minimum so to get the best value from the exercise.

The scenario this year was based on a historic day however this did not push the NTS to a big enough extreme and slowed down the progression though the stages of an emergency. Especially the decision to get to go into firm load shedding on the distribution networks, which was highlighted in their reports. Therefore the scenario for the next NEC Exercise will look at a higher demand day than X-Ray and depending on this winter's conditions it may have to be a fictitious scenario.

Communications issued at the start and end of the exercise. This needed to be made clearer and should include an indication of the requirements from industry for each day.

Only 1 CTC exercise was carried out this year and it has been recommended by the DNs that these are a useful exercise and all DNs should take part next year.

6.7. Tool Development

During the exercise there were many new participants and this has generated many new ideas for tools that could be used to simplify processes and ensure simpler and more consistent decision making. Initiatives have been progressed and project papers are being put together to see if these would be of value and hopefully put together to improve the systems used in an emergency and possibly more generally. These systems should produce consistent situation reports that can be used to inform different parties as well as produce all the notices and forms from one place with one consistent set of data and messages.

A further item of feedback indicated, that with the implementation of our new Gas Control Suite (GCS) a few of the decision support tools had bugs that came out during the exercise. These will be investigated, corrected and implemented as soon as possible.

6.8. E1 Update

After the latest update to the NEC safety the E1 needs updating to reflect the changes that have been put in place. These are thought to me mainly non material changes however will require a full review.

7. Next Steps

Internally the next steps will be to action the improvements to the areas discussed in section 6. Table 3 lays out the start date for each of the projects that tackle theses and a brief comment on the projects.

Table 3 - Action Area Next Steps

Action Area	Start Date	Comments
Transmission and Distribution Networks interaction	Jan 17	Will discuss an action plan at the next E3 meeting and individual National Grid and Distribution Network Liaison meetings.
Visualisation	Dec 16	Project looking into how other industries visualise incident data has started.
Training Programme	Dec 16	A new enhanced training plan has been created and runs up until the next Exercise.
Facilities	June 17	These actions are internal to National Grid and will be corrected before the next exercise
Industry Comms	Dec 16	A project to look into how best we keep on top of emergency contact details has started
Exercise Set up	July 17	These actions will be developed and deployed during the creation of the next NEC exercise
Tool Development	Dec 17	Improvements to ensure all the tools work alongside the new GCS have already begun.
E1 Update	March 17	Update to E1

Industry engagement will be required to complete the above projects as well continual testing to ensure that progress is being made. Table 4 lays out the timeframes for what is already planned for next year. Although not complete some activities that still have to be planned for 2017 include:

- Table top exercises
- Test of OGA Web Portal
- Further E3 Alignment Group meetings

Table 4 - Exercise Plan

Date	Activity	Players	Description
January	E3 Alignment Group Meeting	National Grid / DNs (BEIS Optional)	Next E3 alignment group meeting between National Grid and the distributions Networks where the action plans for covering the recommendations for the joint interaction will be discussed.
January / February	NG/DN Work Shops	National Grid / DNs	Individual workshops with each DN to cover a range of topics.
February	Out of hours mobilisation	NEMT	Exercise to test effectiveness of mobilisation of NEMT during out of office hours
March / April	CTC Exercises	NEMT DNs	Four CTC Exercises, one with each of the DNs, over the two months.
June- July	NETMAN1 Exercises	National Grid / DNs	Exercises to test NETMAN 1 processes between NEMT and Distribution Networks
September -October	NEC Pre-Emergency Exercise	National Grid / DNs	This exercise was found very useful this year to provide a richness to the scenario that is played out during the NEC Exercise.
September -October	NEC Exercise	Industry	The next industry wide NEC Exercise

8. Conclusions

Undertaking emergency exercises is central to assuring the NEC that the gas industry remains committed to continuous improvement of its safety critical emergency processes. The annual NEC Exercise is a requirement under the NEC Safety Case and GS(M)R and remains a critical annual focal point for all UK gas industry participants to test their own emergency processes.

The objectives to test National Grid and the industries coherence to emergency procedures were successfully completed with some actions areas improvement that have been developed from feedback received. The priority areas for development from the DNs and National Grid are the training programme, the Transmission and Distribution Networks interaction and the visualisation of data, as these will have the biggest impact in improving the emergency processes.

Overall the suite of exercises gave assurance to National Grid and the NEC and provided valuable learning and experience to National Grid and the wider industry; this will be continued into 2017 with the inclusion of the improvements set out in this report.

9. Appendix I –Timeline of Events

9.1. Pre-Emergency Day Events

This section details the series of events and actions that were run through during the Pre-Emergency Day exercised by National Grid to provide an enriched back story for the NEC Emergency Exercise. This is a test of normal operational activities and produces a richer back story to the NEC exercise.

Initially the NTS Linepack started lower than desired and SAP Buy price was settled at 52p/therm. Figure 4 gives the outlook for the pre emergency gas day. It shows that there is a flat supply profile for the day (the green line) and the demand being higher than supply for a majority of the day (the red line). Due to this there is a further loss in linepack predicted for the day. This is indicated by the hourly change in linepack graph (the blue bars). The maximum and minimum linepack points are shown on the graph along with the predicted closing linepack.

Figure 4 – Outlook for Pre-Emergency Gas Day

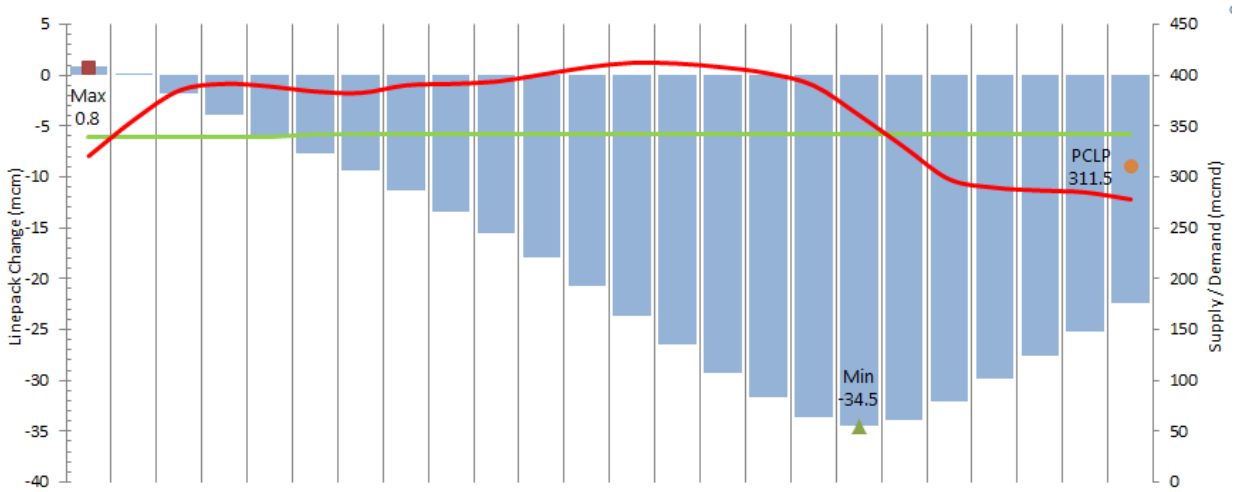
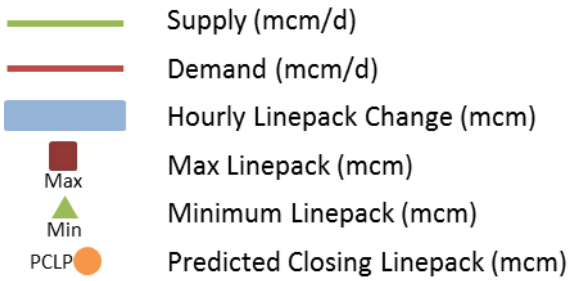


Figure 5 - Key for linepack graphs.



The first event of the day was a reduction in European supplies due to issues on the continent, increasing the predicted loss to linepack. To counter this National Grid Started to trade early seeking to raise the price to 60 p/therm, this is higher than the previous day and it was hoped this would send a clear message to the market to balance. In addition to this National Grid sent a message to the industry that, due to limited system flexibility available and with a difficult outlook for the day, the rules laid out in Section J of the UNC TPD were going to be strictly enforced to ensure maximum warning to all detrimental changes in demand.

There was a positive reaction to these actions which encouraged the market to trade and the closing linepack was predicted to increase. However shortly after this there was a significant supply loss on the network that was predicted to last 4 days. This once again meant there was a predicted reduction in line pack.

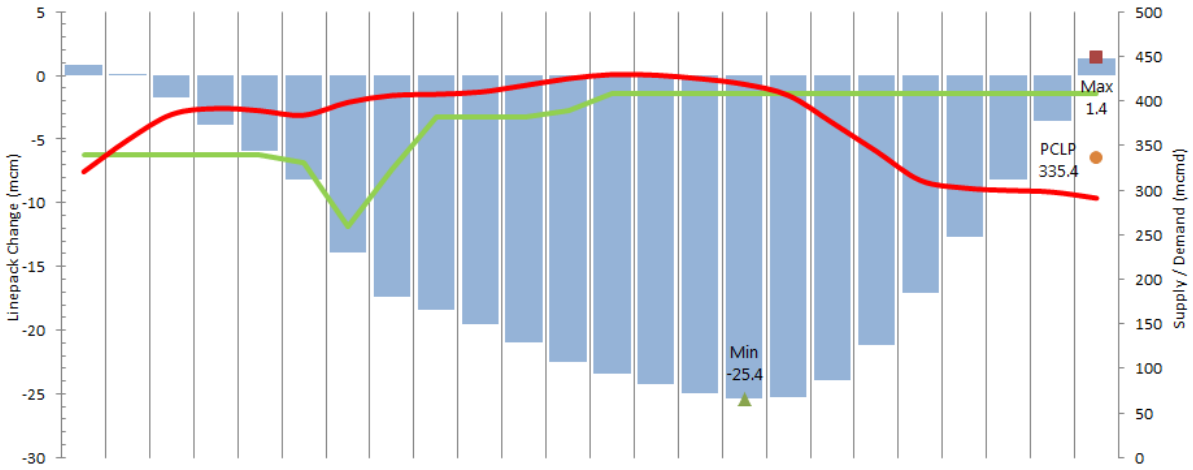
Worsening the effect of the loss in supply, demand from the Distribution Networks increased due to colder than predicted weather. This situation lead National Grid to issue a Gas Deficit Warning (GDW).

The GDW, combined with continued trading by National Grid up to £1/therm, increased supply brought on to the NTS, however still predicting an unsustainable loss in linepack. The time to fail of the NTS was predicted as 6 am the following day. Potential scale back in off-peak exit capacity was identified, which consisted largely of gas powered power stations. The scale back options were taken and the ENCC were made aware of upcoming reduction in supply. This information was consistent with guidance on compliance and only consisted of the zone the actions were to be taken and the volume reduction in gas demand. Analysis showed that the Electricity network should be able to operate with the reduced generation from gas fired power stations.

Further trading by National Grid moved the price to £1.10/therm which encouraged nearly all known remaining supply on. The NTS was now in a position where it would be sustainable for the day with 0limited supplies left to come on and no further offers available on the balancing market.

The closing position for the pre emergency day can be found in Figure 6 showing that the linepack was able to be brought back to its, already low starting position however there are no more supplies available to support the NTS. With a low closing position the outlook for the following day was acceptable if the demand was stable and supply remained.

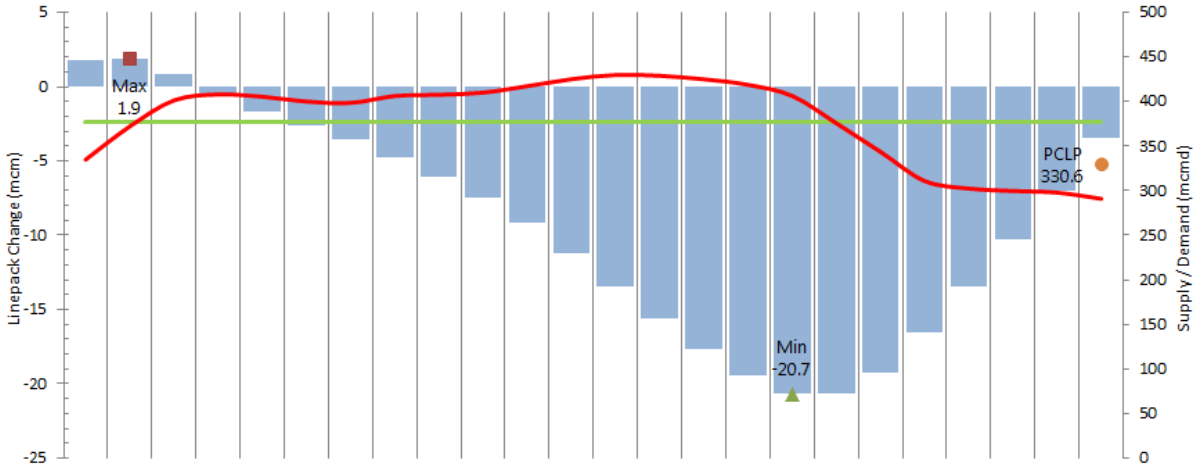
Figure 6 - Closing position for Pre-Emergency Gas Day



9.2. NEC Exercise X-Ray Day 1 Events

NEC Exercise followed on from the scenario developed during Pre-Emergency day. The NTS opened with a lower than desirable linepack, limited known supplies left to come onto the system and forecasted further loss to the NTS Linepack however this was seen as manageable. The outlook is represented in Figure 7.

Figure 7 – Outlook for NEC Exercise Day 1



The first event of the day was a significant supply loss. National Grid's commercial tools were looked into as options; however they had been exhausted the previous day. With no further supplies to bring on this placed the NTS into a state where the Incident Controller was required to seek approval from the NEC to declare an emergency. In this scenario there was no GS(M)R Schedule 3 Part II gas available and the NTS was already running with a low linepack from the previous day, therefore none of the actions available in a Stage 1 emergency would address the demand/supply imbalance (the actions available can be found in Table 1 in section **Error! Reference source not found.**). This eant that Stage 1 and 2 Emergencies were called simultaneously.

The first tool to be utilised in stage 2 was the firm load shedding process. For the exercise all the communications and full capability of firm load shedding on the NTS every directly connected customer was contacted and asked to cease taking gas as soon as possible. The results of which can be seen in Section 4.1.

For the scenario, only some sites were firm load shed at this point. Some of these sites were power stations which triggers appropriate conversations between the gas and electricity control room. These conversations are around understanding impact to the electricity network of taking action on the gas network without disclosing proposed actions or strategy. The NEC is primarily interested in the safety of the NTS and should only consider the electricity network if it is going to have a detrimental effect to the gas network or instructed to via an "Order In Council" enforced through BEIS. At this point in the scenario the electricity network was still able to operate.

Further information was requested of the industry at this point. The NETMAN1 forms were requested from the DNs and the terminals were asked to complete the Gas Availability Situation report which is situated on the Oil and Gas Authorities web portal.

These actions brought the network to a point where again a significant quantity of NTS linepack had been utilised by the end of day however the deficit was manageable.

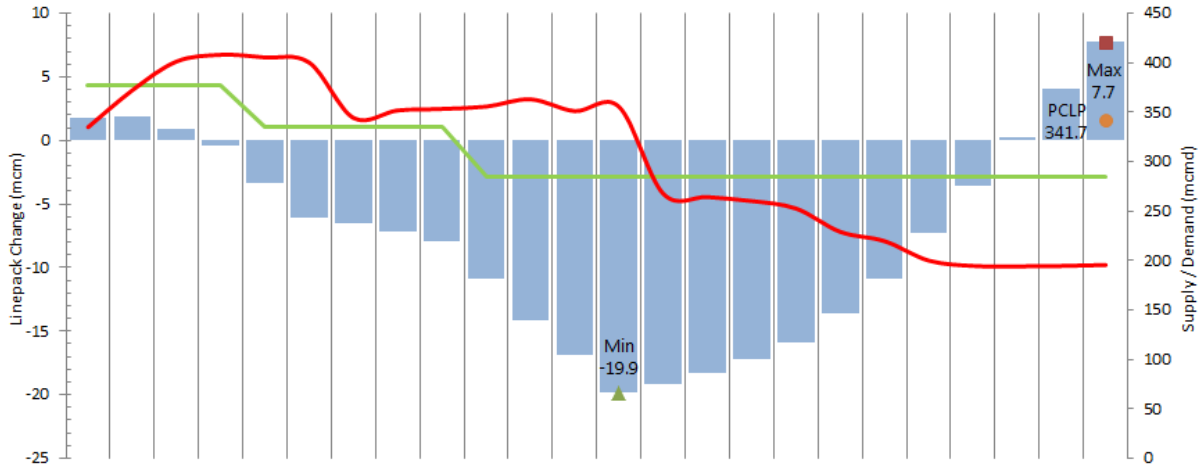
This was short lived however and a further supply loss was then experienced on the system. This reduction in supply required further emergency actions on the NTS. The remaining demand on the gas network was analysed and showed that NTS Firm Load shedding would not be sufficient on its own to maintain adequate pressures and therefore DN Firm Load shedding would be required.

For the exercise the Distribution Networks conducted separate firm load shedding exercises in line with their safety case where at least the top 200 sites per LDZ are contacted and requested to cease taking gas, the results of which are detailed in Section 4.2. For the scenario during the NEC exercise the Distribution networks were requested to firm load shed all demand that had been categorised as having a larger than 2 mtpa demand.

On the NTS the remaining firm load shedding at this point was mostly gas fired power stations. Removing all the power stations at once would cause the electricity network significant issues and potentially causing a black start situation. NEC decided that this could have unpredictable impacts on the Gas Demand therefore a phased approach was taken ensuring that there was enough generation to get through the electricity network daily peak and then only leaving 4 stations on that would be able to facilitate a black start if required.

These events left the NTS in a position where the supply to domestic customers was able to maintained, however there were no further supplies to be brought on to be able to start reinstating customers that had come off as part of the firm loading process. The closing position can be seen in Figure 8. In this figure the green line clearly shows where the two significant losses in supply happened and followed after by the reduction in demand caused by the firm load shedding, shown by the red line.

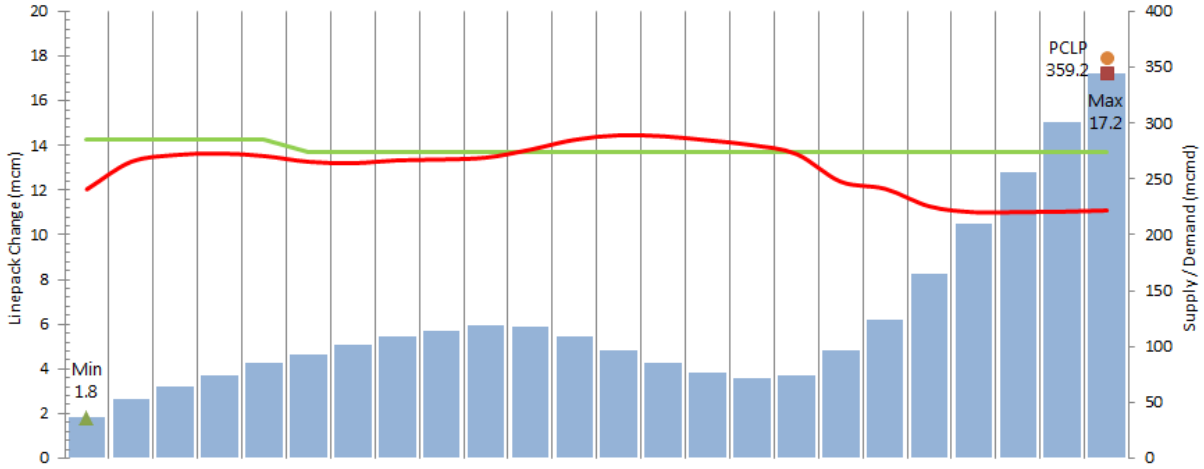
Figure 8 - Closing position for NEC Exercise Day 1



9.3. NEC Exercise X-Ray Day 2 Events

The forecast for day 2 predicted that a further minor loss in supply due to a change in the supply pattern. One supply point will have emptied its stores and another should have supply issues from the previous day resolved. This can be seen in Figure 9 in the small dip in the green line. Demand was forecast to roughly match supply until the evening where it would drop off a little giving some gas back into linepack. This imbalance would be looked at later in the day to see if any customers could be restored.

Figure 9 - Outlook for NEC Exercise Day 2



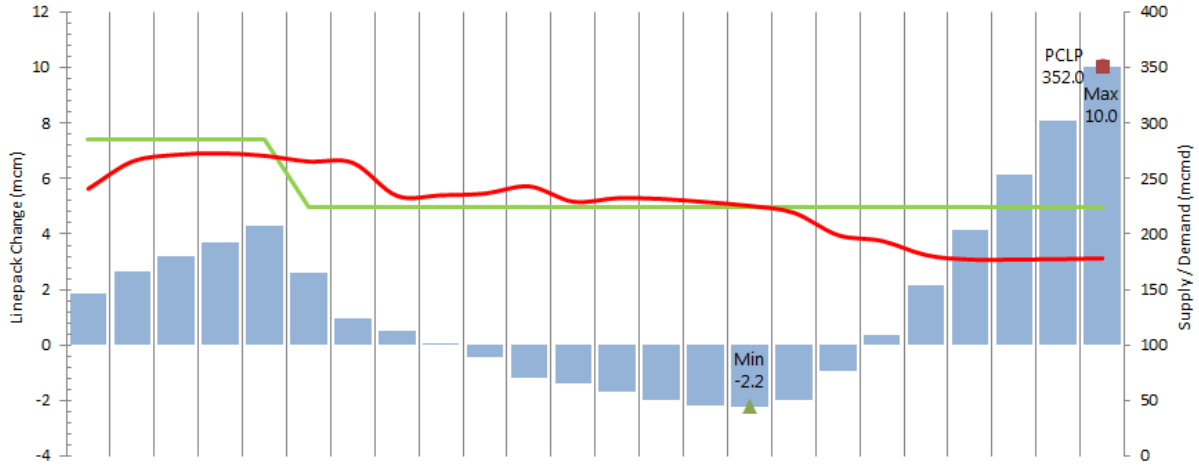
Shortly after the exercise started on Day 2 the outlook dramatically changed with the news that the supply point that was due to come back would not be doing so for the remainder of the day. The forecast for the NTS showed it would be losing further linepack and struggling to hit acceptable extremity pressures. The only action left in stage 2 was to firm load shed sites on the distribution network that were in the 2 mtpa to 25 ktpa bracket.

The large loss of supply had triggered on storage to move to maximum output. This combined with the supply/demand position experienced, and the use of storage, in the lead up to this scenario; the deliverability rate of the storage sites was forecast to drop off over the next few days. This meant that if further action was not taken today over the next few days the situation could be considerably worse. Therefore the Incident Controller sought out the NEC for approval to declare a Stage 3 emergency to start the isolation of domestic customers. The reduction in deliverability rate from the storage sites also triggered a Stage 1 Storage Monitor Breach Emergency therefore declaration of this was sent to industry.

Since this was a nation-wide shortage of gas all DNs were requested for a 10% reduction in demand. Once enacted the NTS was forecasted to be in a secure and stable state for the foreseeable future and the Exercise was drawn to a close.

Figure 10 shows the closing position for the second day of the NEC Exercise. Again the green line clearly shows when here was a loss in supply on the NTS. The red line then shows a reduction in demand shortly after where there was some further firm load shedding action completed on the distribution networks. The demand is then reduced further after the isolation actions are implemented. A test of the restoration process was not included in this exercise scenario.

Figure 10 - Closing Position for NEC Exercise Day 2



10. Appendix II - Glossary and References

CTC	Critical Transportation Constraint
DECC	Department for Energy and Climate Change
DN	Distribution Network
DNCCs	Distribution Network Control Centres
DST	Decision Support Tool
ENCC	Electricity National Control Centre
ERT	Emergency Response Team
GDE	Gas Deficit Emergency
GNCC	Gas National Control Centre
GNCC/E/3	Network Emergency Management Team's Emergency Procedure
GS(M)R	Gas Safety (Management) Regulations 1996
kWh	Kilowatthour
LDZ	Local Distribution Zone
LGSE	Local Gas Supply Emergency
LNG	Liquefied Natural Gas
MCM	Millions of Cubic Metres
MJ/m^3	Megajoules per Cubic Metre
NEC	Network Emergency Co-ordinator
NEMT	Network Emergency Management Team
NGD	National Grid Distribution
NGN	Northern Gas Networks
NGSE	Network Gas Supply Emergency
NTS	National Transmission System
OGA	Oil and Gas Authority
T/PM/E/1	Procedure for Network Gas Supply Emergency
SGN	Scotia Gas Networks
SOQ	System Offtake Quantity
UAT	User Acceptance Testing
WWU	Wales & West Utilities

National Grid's Emergency Webpages:
http://www2.nationalgrid.com/UK/Industry-information/Gas-transmission-system-operations/Network-Gas-Supply-Emergency/

National Grid's System Management Principles Statement:
http://www2.nationalgrid.com/UK/Industry-information/Business-compliance/Procurement-and-System-Management-Documents/