

NEC

Exercise Yield Report

Network Emergency Coordinator (NEC)

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1. Executive summary

The Network Emergency Co-ordinator (NEC) is an independent industry 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 Gas and is independent from any commercial interests of any organisation within 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 defined duty holders. The arrangements and procedures put in place to facilitate these powers are tested annually and this report covers the 2017 NEC Exercise “Exercise Yield”.

Over 300 industry representatives participated in the 2017 exercise and observers from the Health and Safety Executive (HSE) were in attendance at National Grid Gas’ offices in Warwick. This provides a high level assurance to the NEC that the entire industry is able to adhere to the emergency arrangements and procedures.

From the direct observations by the NEC, engagement by the industry during the exercise and subsequent reports submitted; the NEC is satisfied that the industry has successfully demonstrated that it is able to effectively respond to a Gas Deficit National Gas Supply Emergency (NGSE) in accordance with the current emergency arrangements and protect the general public and the gas network.

The exercise provides an opportunity for all parties to reflect on their processes and interactions and from this action areas for 2018 have been developed. National Grid and the gas Distribution Networks have shared these action areas with the NEC and these will be tracked and reported on throughout the coming year. The key identified priority areas for development are; timely and effective communications during an emergency and ensuring the process for managing category A customers is appropriate.

Exercise Yield is assessed by the NEC as having provided appropriate levels of assurance of the industry’s ability to respond to a Gas Deficit NGSE and also as having provided valuable learning and experience to the wider gas industry.

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2. Introduction

To prevent a gas 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 appropriate, robust and duty holders are cognisant of their responsibilities.

The 2017 NEC emergency exercise, "Exercise Yield", was split into three separate stages to allow more focus on specific key areas of the emergency process. This report covers:

- National Grid Pre-Emergency Commercial Strategy exercise
- NEC Industry Exercise - Gas Deficit Emergency (GDE) exercise
- Individual Distribution Network Firm Load Shedding (FLS) exercises.

It is important that National Grid undertake the Pre-Emergency Strategy exercise and that the NEC is able to observe where appropriate; with the ever increasing complexity of the operation of the gas network and the manifestation of different triggers for a National Gas Supply Emergency this plays a far more significant role in maximising the prevention of an emergency arising. In addition this allows for a richer picture of actions taken prior to and during an emergency situation. This will provide assurance that the industry is prepared to handle a NGSE and an opportunity to highlight areas that could be improved.

These are not the only exercises the gas industry undergoes, for example, smaller more localised Critical Transportation Constraint (CTC) exercises are tested between National Grid and the individual Distribution Networks throughout the year.

2.1. Participants

National Grid estimates there were over 300 industry participants taking part in Exercise Yield from across a range of areas including:

- 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.
- Gas Distribution Network Operators (DNs)
 - Cadent Gas (CAD)
 - 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)
- Electricity Distribution Network Operators

The involvement of the Electricity Distribution Networks in Exercise Yield was through a separate but parallel exercise that BEIS ran to test the load reduction protocols that are laid out in Electricity Supply Emergency Code.

Inspectors from the Health and Safety Executive were in attendance at National Grid Gas' offices in Warwick throughout exercise yield.

2.2. Objectives

The industry brief issued prior to the exercise set out the objectives of the NEC Emergency Exercise:

1. Ensure effective and timely communication between gas transporters and with Regulatory and Government Departments.
2. Test the upstream management procedure, web portal and emergency response communications.
3. Explore the link between localised transmission and national supply emergencies.
4. Test the escalation and interaction between crisis management teams.
5. Embed recommendations from previous industry emergency exercises principally Exercise X-Ray.
6. Build on understanding of electricity industry interaction during a major gas event through expanded electricity sector engagement.
7. Develop greater assurance around the local impact of national emergencies particularly including how the Gas Distribution Networks communicates information on sites impacted and welfare arrangements to HMG.
8. Production of post exercise reporting and assurance processes.

3. Scenario

The background scenario used for both the Pre-Emergency Commercial Strategy Day and the NEC Industry Exercise was based on a high demand day. Basing this on a fictitious, but realistic, day allowed the demand to be increased higher than we have seen in the recent past, 415 mcm/d. This allowed the pace of the exercise to be faster than in previous years, this having previously been an issue for the distribution networks.

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

- End of day balancing activities had been an issue over the winter period with a predicted drop in the volume of gas in the pipes being nearly 30 mcm lower than desired
- Background of intermittent transmission asset problems with key assets out on maintenance
- Concern for any enduring Storage and LNG flows and availability due to a prolonged cold winter period
- Most gas fire power stations running
- High average price for gas at 70 p/therm.

3.1. Pre-Emergency Day

The Pre Emergency Commercial Strategy day, was focused on the use of commercial tools available that would attempt to mitigate any potential supply emergency.

For the first time during the Pre-Emergency Commercial Strategy exercise, DNs were invited to observe events alongside the HSE at National Grid's offices. This proved to be extremely beneficial giving both parties a deeper appreciation for the actions taken in the lead up to a potential gas supply emergency. This will be continued into future Exercises.

To begin the main NEC exercise, a constraint scenario was presented due to a compressor station tripping off and back up compressors being out of service for maintenance. This subsequently created a pressure restriction at a key terminal, reducing supply. This triggered the formation of an incident team, early contact with BEIS and National Grid to take buy actions on the commodity market increasing the cost of gas in the UK market in an attempt to encourage shippers to increase supply into the UK.

Shortly thereafter, the European interconnectors switched from supply to net demand due to a cold snap in Europe creating a spike in the price of gas on the continent. This compounded the opening imbalance in supply. National Grid took more balancing actions, further increasing the SAP, and took localised action in the south of the country to relieve localised constraints that were manifesting from the national imbalance.

For the Pre-Emergency Day it was important to provide realism in the build up to declaring an NGSE, to ensure the NEC would have accurate picture of events.

3.2. NEC Industry Exercise

The NEC Industry Exercise focused on the National Gas Supply Emergency (NGSE) Stages 1-3. National Grid UK's Executive Director observed the first day of the exercise showing great engagement from National Grid's senior leadership in ensuring preparedness for emergency situations.

To take the exercise through the NGSE Stages, following on from the Pre-Emergency Commercial Strategy exercise, injects of further losses of non-storage supply and key transmission assets were created.

The Incident Controller, along with the NEMT, developed a strategy to access tools under stage 1 and 2 of the emergency procedures. Early on the first day commercial actions were unable to resolve the scenario, therefore the Incident Controller sought approval from the NEC (observed by the HSE) to move immediately to declare a Stage 1 & 2 Gas Deficit Emergency; a combined declaration of both stages was required as the additional tools in stage 1 were not sufficient to stabilise the network. This strategy was approved by the NEC and the industry was notified of the emergency declaration.

With declaration of stage 1 and 2, the OGA was contacted to initiate GAS portal arrangements and request authorisation to initiate the GAS (Gas Availability Status) Report. The available supplies that were not flowing their maximum rate in the scenario were then requested to increase their flow to reduce the gas deficit.

NEMT then invoked load shedding arrangements on Very Large and Large End Users, to further reduce the gas deficit. This was initially taken in tranches of NTS directly customers before requesting that the Distribution Networks remove their larger customers.

Many of the NTS directly connected sites are gas fired power stations. Cessation of their gas supply can have a consequential impact on the electricity network, depending on volumes, electricity demand and generation mix at the time. The impact was minimised through active dialogue and load shedding of gas fired electricity generating stations delayed, to minimise the risk to public safety caused by instability of downstream gas networks brought about by fluctuating electricity supplies. There was some detrimental impact on the electricity network and rota disconnection was invoked by National Grid Electricity allowing BEIS to run a parallel exercise with the Electricity Distribution Networks on this process.

The final day began with the system being balanced for the day due to the use of effective tools from the stage 2 actions. Looking forward to subsequent days revealed that there would be an imbalance due to diminishing gas delivery rates of the storage sites as their stocks depleted. This initiated the NEMT to look at preparing for stage 3, if the scenario did not improve. This involved some DNs pre-emptively relocating resources within their network so they would be available and best placed on declaration of Stage 3.

A further temporary loss of LNG supplies was created resulting in a significant end of day gas deficit. As such, the NEMT presented a strategy to the NEC proposing the commencement of allocation and isolation (Stage 3). This was approved and triggered the DNs to invoke their isolation plans for removing portions of their domestic consumers.

In parallel to the DN's actions the NEMT looked to invoke public appeals to assist with reducing the gas demand. A request was made to BEIS to send out a public appeal.

Finally, as a result of the actions taken across stages 1-3 and by LNG supplies returning to the NTS, the gas system closed out physically balanced on day two.

3.3. Summary

A summary of the actions tested in Exercise Yield is shown in Table 1. A high level step through of the scenario and the points at which actions were taken is included in Appendix I –.

Table 1 - Emergency Actions

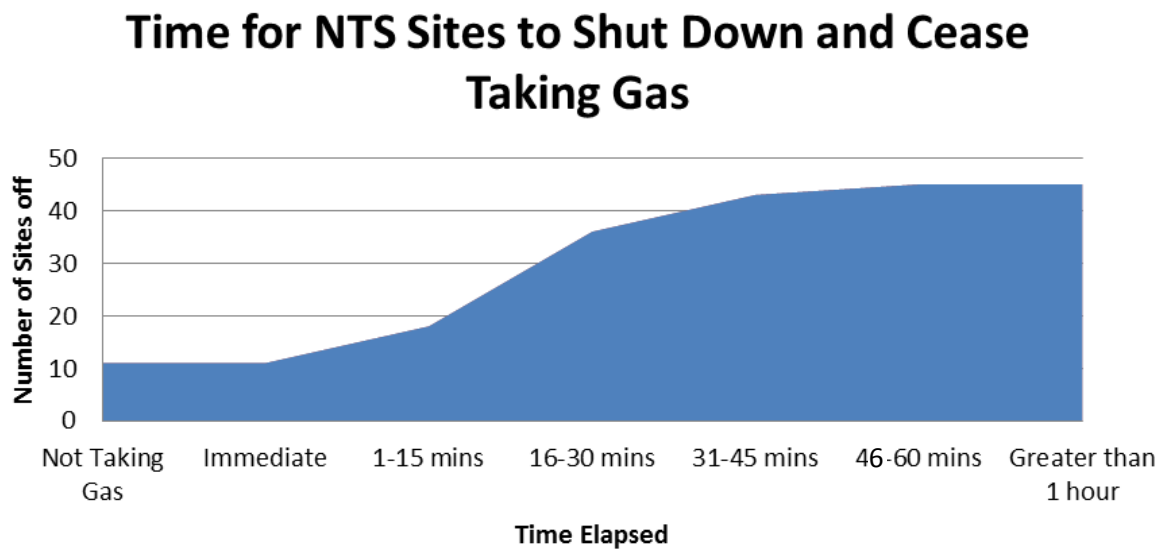
Gas Deficit Emergency		
Emergency Stage	Action	Tested in Exercise Yield
Stage 1 (Potential)	<ul style="list-style-type: none"> • Gas conforming to Schedule 3 Part II of GS(M)R 	No
	<ul style="list-style-type: none"> • NTS Linepack utilisation 	Yes
	<ul style="list-style-type: none"> • Distribution Network Utilisation <ul style="list-style-type: none"> ○ Distribution Network Storage ○ Emergency Interruption 	Yes (Data gathering only)
	<ul style="list-style-type: none"> • Public Appeals 	No
Stage 2	<ul style="list-style-type: none"> • National Grid Gas plc's participation in the OCM will be suspended 	Yes
	<ul style="list-style-type: none"> • Maximise Supplies 	Yes
	<ul style="list-style-type: none"> • Load Shedding 	Yes
	<ul style="list-style-type: none"> • Public Appeals 	No
Stage 3	<ul style="list-style-type: none"> • Public Appeals 	Yes
	<ul style="list-style-type: none"> • Allocation & Isolation 	Yes
Stage 4	<ul style="list-style-type: none"> • Restoration 	No

4. Load Shedding

A key activity in Stage 2 of an NGSE is load shedding. Exercise Yield tested the ability of National Grid to contact and achieve a reduction in gas supplied to loads directly connected to the NTS as well as the DN's ability to do the same for their largest 200 sites in each of the distribution networks, albeit the load shedding exercise for the DNs was not undertaken on the day of the NEC Industry Exercise, to allow for the resources required for the exercise to be managed effectively and ensure minimal impact to business as usual activities.

In Exercise Yield NTS directly connected sites were contacted and their gas supply reduced (by simulation) in real time, with different tranches of customers taken at different times within the exercise. Figure 1 shows the time it took, from first contact, for each of the customers to cease taking gas.

Figure 1 - Total NTS Demand Reduction

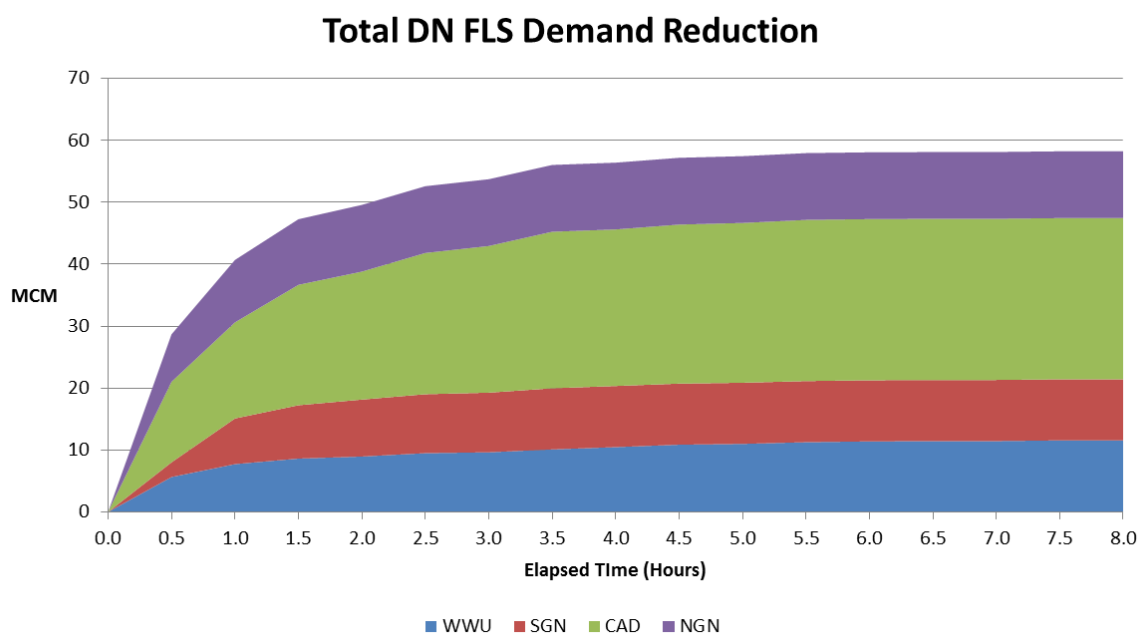


National Grid was able to contact 92% of directly connected NTS sites and 100% of these confirmed they would be able to cease taking gas on the day in under an hour. This would have resulted in removing nearly all the available 91 mcm/d within an hour, if required, rather than tranches over time as was required by the scenario in Exercise Yield. This is an excellent response from the contacted sites and is reflective of previous years recorded response times.

A full review of contact details and engagement with customers is to be conducted by National Grid to remind directly connected customers of their obligations and ensure that there is no delay in making contact with them in the future.

The load shedding exercises for the Distribution Networks took place outside the two days for of the NEC exercise. Figure 2 shows the volume of the reduction of demand against the simulated time be reduced on the Distribution Networks based on the responses given from the customers contacted. Comparing the volume of gas demand that can be reduced in a timely manner to that of the NTS's 91 mcm/d in an hour, it shows the importance of the load shedding process on the NTS - as more demand can be removed from the NTS than is achieved through the top 2600 customers across all of the DNs combined.

Figure 2 - Total FLS DN Demand Reduction



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

- 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, that all measures have demonstrated improvement.

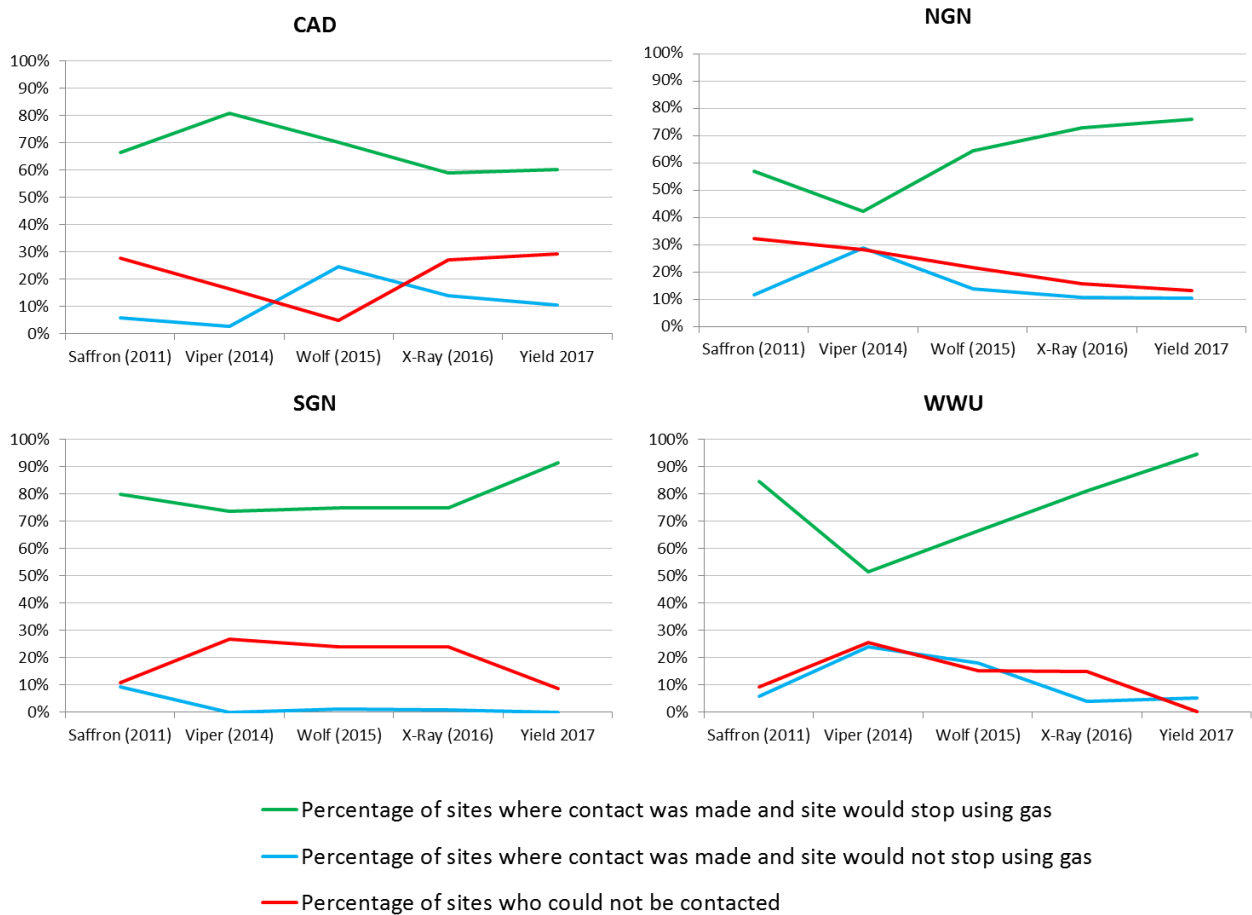
Table 2 - Aggregated DN Firm Load Shedding Data

	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	
Yield 2017	2633	2031	77%	200	8%	402	15%
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%

Disaggregating the data into the individual Distribution Networks, Figure 3, it shows that 3 out of the 4 DNs improved. Cadent has however showed little change from last year. This is an ideal opportunity for best practise sharing across the DNs through 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 they target that 100% of sites can be contacted and confirm they will stop using gas; DNs have confirmed that work is planned in 2018 to achieve this.

Figure 3 – Comparison of DN firm load shedding performance



5. Outcomes of Objectives and Observations

This section considers each of the Exercise objectives in turn and determines what assurance was obtained for each.

Objective 1: Ensure effective communication between gas transporters and with Regulatory and Government Departments.

Feedback received has highlighted that communication was much improved this year. This has been most notable between National Grid and the Distribution Networks with all networks feeding back on the clarity of requests being made by the NEMT.

This is the second year that National Grid and Government have tested the communication paths between each other. During this exercise a new simplified Situation Report template was used by National Grid, this allowed the document to be produced more quickly and ensure the deadlines provided by BEIS were met. This template is to be shared between all gas transporters to ensure that best practice is shared.

Objective 2: Test the upstream management procedure, web portal and emergency response communications.

The OGA web portal used by terminals and by National Grid to share information on the available supply was extensively tested during Exercise Yield. There was a delay in some terminals producing the data, therefore there is a need to review the process to see what improvements can be made with regard to the speed of flow of data from the terminals to National Grid, who use the information to make real time decisions on the network.

Objective 3: Explore the link between localised transmission and national supply emergencies.

This was covered extensively by both the gas and electricity networks. The National Gas supply emergency invoked firm load shedding and allocation and isolation actions on the distribution networks. As designed, the NGSE exercise reduced generation on the electricity network to such an extent that the electricity network was required to unvoke load management protocols across the transmission and distribution networks. This is covered further in Objective 6.

Objective 4: Test the escalation and interaction between crisis management teams.

The interaction between National Grid, Government and the Distribution Network crisis management teams was a strong part of Exercise Yield. The observed interaction here was better than in previous years however can still be improved, most notably between Distribution Networks and Government where Distribution Networks were struggling to answer queries at the pace BEIS required. A suggestion for managing the information requests from BEIS could be to mirror the specific liaison role held within the National Grid NEMT. This role manages the Situational Reports going to all other emergency response teams (e.g. BEIS ERT and National Grid's internal Gold Command) and manages queries and responses as a focal point.

Objective 5: Embed recommendations from previous industry emergency exercises including Exercise X-Ray.

Many improvements have been made from Exercise X-Ray to Exercise Yield and some of these are listed in Appendix 2. Most notable of these is the improved communications and interactions between the Distribution Networks and National Grid. This has been noted by both parties as being the best experience in an emergency exercise.

Objective 6: Build on our understanding of electricity industry interaction during a major gas event through expanded electricity sector engagement.

During the exercise National Grid Gas and National Grid Electricity had effective communication between each other to ensure that the impact on the electricity network was managed to minimise the risk to public safety caused by instability of downstream gas networks brought about by fluctuating electricity supplies. The actions taken to manage the Gas Deficit Emergency did impact the electricity network to the extent of utilising the emergency process of load disconnection following the process set out in the Electricity Supply Emergency Code.

The impact of utilising this process was tested in the exercise via BEIS through the separate involvement of the electricity distribution networks and them reacting to National Grid Electricity invoking the process. The outcome and review of this has been completed by BEIS.

Objective 7: Develop greater assurance around the local impact of national emergencies particularly including how the Gas Distribution Networks communicates information on sites impacted and welfare arrangements to HMG.

As highlighted previously, gas Distribution Networks experienced some challenges responding within the deadlines around communications with BEIS. However, assurance was provided that localised impacts of managing a NGSE is a key consideration for DNs. This includes the impact of any interaction between the gas and electricity markets.

Additionally under this objective, during the exercise an instruction was issued to cease gas supplies to gas DN Category A¹ customers. This was not an intended outcome of the exercise scenario. Investigation of this instruction highlighted that this was a breakdown of communication between National Grid's NEMT and the sub teams communicating with the Distribution Networks. The initial solution is to ensure that the NEC is contacted when this level of decision is being proposed and provides specific approval, as turning off priority Category A customers can increase the risk of a direct impact on the public.

Objective 8: Production of post exercise reporting and assurance processes.

This objective is fulfilled by the reports produced for the NEC following the exercise by the Distribution Networks and National Grid as well as the NEC direct observations and involvement and this report.

All participants have been asked to report internally on the exercise and ensure that their emergency processes and procedures are reviewed and amended where necessary.

6. Action Areas

Based on observations and associated reporting, the 5 main action areas to be worked on by industry working groups such as the E3 alignment group and the Gas Task Group are:

6.1. Engagement with Terminals and NTS directly Connected Sites

Further development of the OGA portal, and associated procedures, and a move to contacting directly connected sites by telephone call with a follow-up email.

6.2. Communications

Utilisation of the Communications Task Group as part of E3C to review and improve communications paths especially with respect to public appeals and the clarification of the accountabilities within this process.

¹ Category A - Consumers (using more than 25,000 therms per annum, 732 megawatt hours) on firm supply contracts, where a failure in the supply to their premises could put lives at risk. Examples of such consumers would be hospitals or homes for the elderly and disabled.

6.3. Electricity and Gas Interaction

Build on understanding of interdependencies between the two networks. One area of focus is the impact of an emergency on the electricity network and its potential to reduce available supplies available on to the NTS.

6.4. Priority customers

The NEC to be consulted before a decision is made to isolate any priority category customer to ensure there is a formal approval at this point.

Review sites and volumes under the various priority categories so that the NEC has full information available for the approval process/decision.

6.5. Restoration

Work with DNs through E3 Alignment Group to review Stage 4 – Restoration process of NGSE. Consider inclusion of this process in the 2018 NEC Exercise.

7. Next Steps

The recommended action areas should be reviewed and adopted by the E3 Alignment Group, managed by the National Grid Emergency Planning team and progress reported to the NEC in their function within the Office of the NEC. Some actions that are already underway and are detailed in Table 3.

Table 3 – Next Steps

Action Area	Next Step
Engagement with Terminals and NTS directly Connected Sites	National Grid will reach out through their periodic customer liaison interactions. Exercises for the NEMT Shipper team should be scheduled more frequently so Directly Connected customers are more comfortable with the process.
Communications	Present at the January Communications Task Group under the E3C structure, an action plan will be agreed.
Electricity and Gas Interaction	Included as part of the Black Start Task Group.
Priority Customers	An investigation into the instruction to isolate Category A customers has been concluded. Revised processes are being developed to ensure it does not happen again.
Restoration	An exercise is being scheduled in early 2018 with the Distribution Networks and iGEM to look at restoration scenarios for the exercise framework. Appropriate revised processes, procedures etc. will then be developed.

8. Conclusions

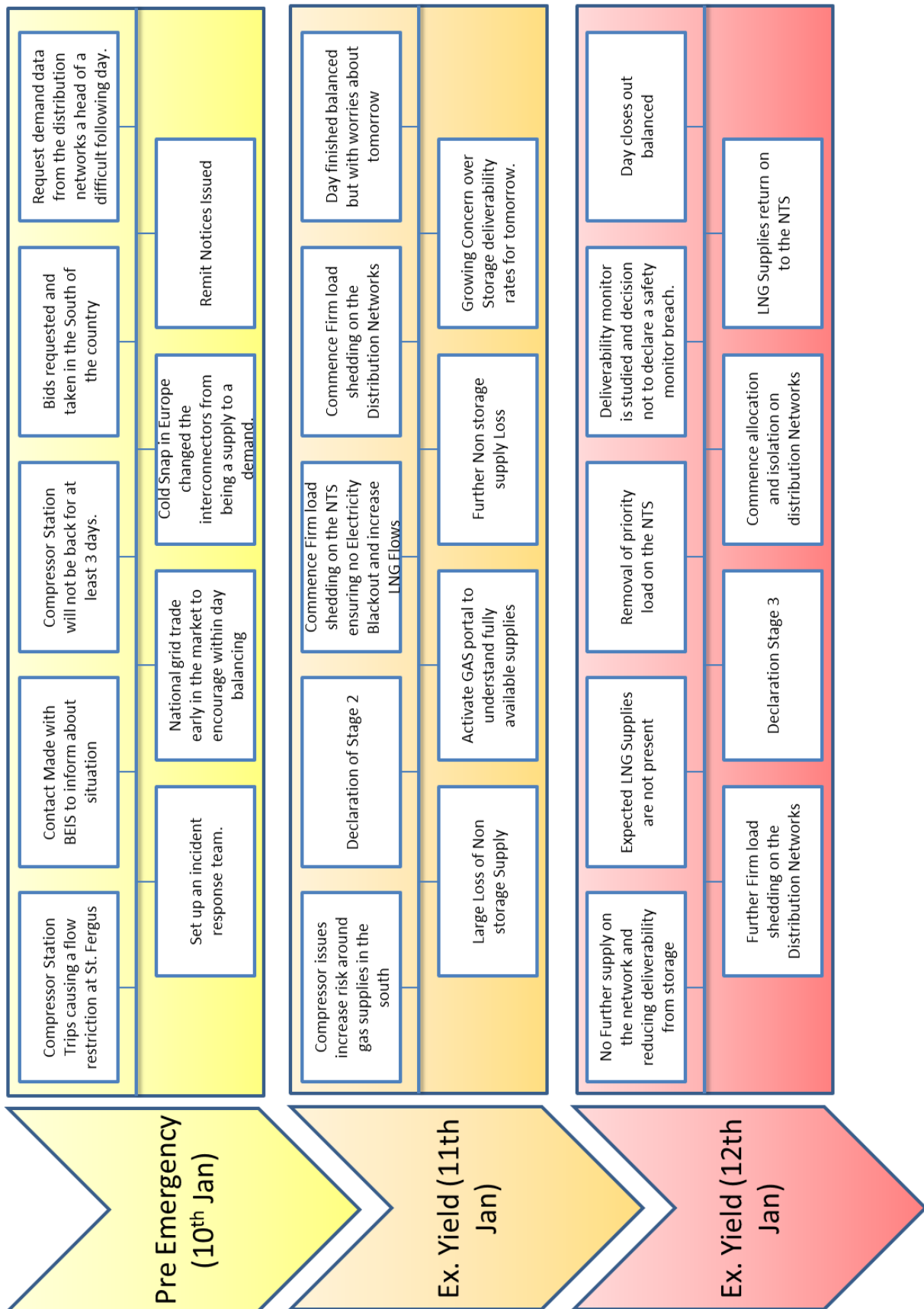
Undertaking emergency exercises is central to assuring the NEC that the gas industry can effectively manage a NGSE and that it remains committed to continuous improvement of its safety critical emergency processes. The annual NEC Exercise is a requirement under the NEC Safety Case and GS(M)R, and remains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

The objectives to test the industry's adherence to emergency procedures were successfully met with action areas for improvement developed from observations and feedback received.

The exercise gave appropriate assurance to the NEC that the industry can demonstrate that it is able to effectively respond to a Gas Deficit National Gas Supply Emergency (NGSE) in accordance with the current emergency arrangements and protect the general public and the gas network.

The exercise also provided valuable learning and experience to all parties; the improvements set out in this report will be delivered in 2018 and tested via the objectives to be set for the next NEC Industry Exercise.

9. Appendix I - Timeline of Events



10. Appendix II – Update of objectives from X-Ray

Action Area	Comments
Transmission and Distribution Networks interaction	This was extensively tested during Exercise Yield. Both National Grid and the Distribution Networks recognised that the interaction during and the exercise has been greatly improved.
Visualisation	New visualisation tools were designed and tested during the pre-emergency day and found to be too complex for managing a real time emergency. This prompted a rapid development process of new visualisation tools. This consisted of creating new simplified views in Shredder and structuring where the data is shown in the incident room in a coherent way. This was tested during Exercise Yield and received good feedback.
Training Programme	The new training programme was a big contributor for the interaction between NG and the DNs improving.
Facilities	Utilising the area outside the Incident Room was well received in Exercise Yield, as was the provision of structured seating for the Incident Room.
Industry Comms	Comms before the exercise were improved with feedback being received that 'it felt that fewer people were unaware of the exercise'.
Exercise Set up	The feedback on the exercise was extremely positive. The main points were; 'the scenario felt real and therefore was more engaging. Also, the production of a more detailed MEL really helped put structure around the day'.
Tool Development	Shredder was updated to contain more useful views and remove the broken functionality. Tableau is still being looked into as a replacement for the ESP extract.
E1 Update	E1 has been updated and is awaiting final sign off.

11. Appendix III - Glossary and References

BEIS	Department for Business Energy and Industrial Strategy
CTC	Critical Transportation Constraint
CAD	Cadent Gas
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	Kilowatt-hour
LDZ	Local Distribution Zone
LGSE	Local Gas Supply Emergency
LNG	Liquefied Natural Gas
MCM	Millions of Cubic Metres
MJ/m ³	Mega Joules per Cubic Metre
NEC	Network Emergency Co-ordinator
NEMT	Network Emergency Management Team
NGN	Northern Gas Networks
NGSE	Network Gas Supply Emergency
NTS	National Transmission System
OGA	Oil and Gas Authority
SOQ	System Offtake Quantity
T/PM/E/1	Procedure for Network Gas Supply Emergency
UAT	User Acceptance Testing
WWU	Wales & West Utilities

National Grid's Emergency Webpages:

<https://www.nationalgrid.com/uk/gas/network-gas-supply-emergencies-ngse>