

CRITICAL CONTINGENCY PERFORMANCE REPORT

System Imbalance 23 May 2017

Prepared in accordance with the Gas Governance
(Critical Contingency Management) Regulations 2008

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1. Introduction

In accordance with regulation 65 of the Gas Governance (Critical Contingency Management) Regulations 2008 and 2013 Amendments (the regulations), the Critical Contingency Operator (CCO) must prepare and publish a performance report within 30 business days, or as otherwise agreed between the CCO and the Industry Body (GIC), after making a determination to terminate a Critical Contingency under regulation 60.

This report has been produced in relation to the Critical Contingency that was declared at 10:50 on 23 May 2017 and was subsequently terminated at 18:15 on the same day. The Incident Report related to this event required by regulation 64 was published on 30 May 2017.

The purpose of this performance report is to:

- assess the effectiveness of the Critical Contingency Management Plan (CCMP), the Communications Plan and the Information Guide
- assess the extent to which the regulations and these associated documents achieved the purpose of the regulations.
- identify any amendments to the regulations and associated documents that the CCO considers would better achieve the purpose of the regulations.

The report has been prepared in consultation with the affected Transmission System Owner (TSO) and any other parties considered necessary. The TSO has provided all the information and assistance requested by the CCO for preparing this report.

The TSO must prepare a proposed revised CCMP consistent with any identified amendments recommended in this report in accordance with regulations 26-30.

The CCO must amend and publish a revised Communications Plan and/or Information Guide consistent with any identified amendments recommended in this report in accordance with regulations 35 and 37 respectively.

2. Executive Summary

At 10:50 on 23 May 2017, the CCO declared a Critical Contingency due to the breach of the Kapuni Gas Treatment Plant (KGTP) pressure threshold.

The Critical Contingency was caused by an imbalance between supply and demand. The factors that contributed to this imbalance were:

- the cumulative effect of negative pipeline imbalance over the days preceding the Critical Contingency that was not recouped by the TSO through the purchase of balancing gas, resulted in linepack levels in the Maui pipeline being below optimal.
- a planned outage of the Pohokura Production Station of approximately four hours' duration on the morning of the Critical Contingency.
- demand from the Frankley Road to Kapuni pipeline at the time of the planned Pohokura outage creating a relatively high rate of pressure decay impacting on the KGTP pressure threshold.

No curtailment directions under the regulations were required to be given by the CCO.

The Critical Contingency was terminated at 18:15 and the duration of the Critical Contingency was 7 hours and 25 minutes.

This performance report concludes with the CCO's assessment under r65 which is summarised below.

The key documents under regulation 65 (1) (a) were assessed, in the context of this event, as:

Critical Contingency Management Plan	Effective
CCO Communications Plan	Effective
CCO Information Guide	Effective

The extent to which the regulations and key documents were found to have achieved the purpose of the regulations under regulation 65 (1) (b) was assessed, in the context of this event, as:

Regulations	Purpose achieved
Critical Contingency Management Plan	Purpose achieved
CCO Communications Plan	Purpose achieved
CCO Information Guide	Purpose achieved

Specific amendments identified under regulation 65 (1)(c) were:

Regulations	None
Critical Contingency Management Plan	None
CCO Communications Plan	None
CCO Information Guide	None

CCO's Summary Conclusion:

The purpose of the regulations is to achieve the effective management of critical gas outages. Although a Critical Contingency was declared, the CCO did not need to issue load curtailment instructions or explore options for increased upstream production to stabilise the transmission system. (The regulations require that a Critical Contingency must be declared if a pressure threshold is breached.)

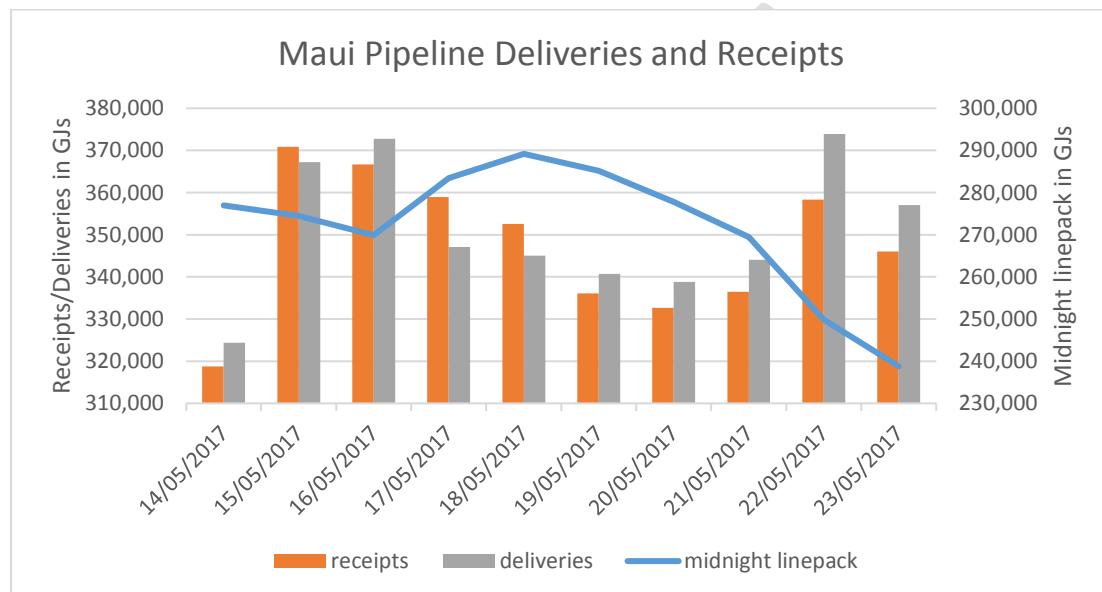
The factors present on 23 May were not extraordinary and should have been capable of being managed by the TSO and transmission system users (shippers and interconnected parties) without resulting in the need to declare a Critical Contingency.

The TSO has carried out its own internal review of this event which has been provided to the CCO and is available in Appendix 2 of this report. The TSO's review identifies several recommendations which, if fully implemented, should significantly reduce the likelihood of a reoccurrence.

3. Analysis of System Operation Activity Preceding 23 May

This section provides information on the system operation of the transmission pipelines leading up to the Critical Contingency to provide context. This is useful for the circumstances of this event to understand how the actions of industry participants in the days leading up to the 23 May contributed to a low linepack situation which reduced the resilience of the system on the day of the Critical Contingency.

3.1 Maui Pipeline Receipts v Deliveries



Explanatory Notes:

This graph includes all physical receipts and deliveries into and out of the Maui pipeline including the receipt of balancing gas purchased by the TSO.

Between 14 May and 23 May, the TSO's total calculated (or target) linepack as published on OATIS ranged between 301 and 305 TJs but actual linepack was below 290 TJs throughout. Between 19 May and 23 May, the Maui pipeline deliveries consistently exceeded receipts, despite the balancing action taken, resulting in linepack declining further.

3.2 Maui Pipeline Operating Code Actions

The TSO balances the Maui pipeline under a system known as Market Based Balancing (MBB). MBB aims to improve the incentives on shippers to balance their pipeline position daily – i.e. to match their injections of gas each day to their withdrawals/deliveries of gas.

MBB automatically “cashes out” imbalances that exceed a daily tolerance at each welded point on the Maui pipeline. The effect of automatic cash-outs is that the TSO “sells” gas to shippers that take more gas than they inject on a day, and “buys” gas from shippers that leave gas in the pipeline at the end of a day.

Between the 14 May and 23 May, the amount of imbalance on the system resulting from the actions of pipeline users progressively reduced the amount of gas in the system. The running imbalances of welded parties exceeded their allowable limits, resulting in the following cash-outs under the Maui Pipeline Operating Code (MPOC).

MPOC Cash-outs between 14 May and 23 May

Date	Frankley Road	Huntly PS	Pokuru	Rotowaro	Tikorangi 3 R	Grand Total
14/05/2017	6,483			6,194		12,677
15/05/2017	7,206				1,100	8,329
16/05/2017	4,505	-	24	-		4,529
17/05/2017	7,026		3,230	4,161		14,417
18/05/2017		- 411	1,460	2,724	537	4,310
19/05/2017		- 721	3,501			2,780
20/05/2017		475	2,382	2,415	-	5,272
21/05/2017	499	-	1,596	5,588		7,683
22/05/2017	3,216	-	2,976	6,965	-	13,157
23/05/2017	8,102	-	5,683	12,825		26,611
Grand Total	37,037	- 657	20,852	40,872	1,637	99,765

Explanatory Notes:

- Quantities shown are in GJs.
- Cash-outs of less than 100GJs have been removed and interconnection points with cash-outs of 100GJs or less have been removed to simplify the data set.
- A negative cash-out represents the TSO buying gas from a welded party i.e. the interconnected party had parked gas in the pipeline and has had this positive imbalance position reduced by the pipeline buying that gas from them.
- A positive cash-out represents the TSO selling gas to an interconnected party i.e. the interconnected party had taken gas from the pipeline and has had this negative imbalance position reduced.

TSO Balancing Actions between 14 and 23 May

In its role as balancing agent, the TSO buys or sells gas to offset the cash-outs to balance physical linepack and system pressure. During this period, the TSO took the following balancing actions:

Delivery Date	BG Call (GJs)
14/05/2017	3,000
15/05/2017	9,000
16/05/2017	13,000
17/05/2017	15,000
18/05/2017	3,000
19/05/2017	5,000
20/05/2017	6,000
21/05/2017	6,000
22/05/2017	15,000
23/05/2017	Nil
Total	75,000

Explanatory Notes:

- Fuel gas purchases have been excluded
- Only balancing gas purchases were made in the period, there were no balancing gas 'puts'.

The cash-outs from the 14 May onwards were all in the same direction. The TSO cashed out the negative imbalances. The quantities cashed out by the TSO in this period exceeded the total balancing gas purchases by 24,765 GJs (99,765 minus 75,000 GJs) which reduced the amount of gas in the system.

Cash-outs occur the day after imbalances are created so the cash-outs and any consequential balancing actions always lag movements in linepack created by pipeline users' imbalance movements. The large cash-outs of 13,157 GJs and 26,611 GJs executed on 22 and 23 May reflect imbalances created on the days prior.

Between 14:25 and 17:35 on 22 May the TSO sent 'Flow to Scheduled Quantity' notices to the welded parties for Tikorangi #3 (receipt), Turangi Mixing Station, Rotowaro and Frankley Road welded points under a standard operating procedure stating:

The current flow at your Welded Points; Tikorangi #3, Turangi Mixing Station, Rotowaro and Frankley Road (Delivery), has significantly departed from your Scheduled Quantity and this is resulting in a detrimental effect on Pipeline Linepack.

Please return the transfer of Gas from the Maui Pipeline to the level of your Scheduled Quantity.

3.3 Information regarding planned Pohokura outage

The TSO provided the following comments on what they knew of the planned Pohokura outage prior to the 23 May:

- *The TSO received a phone call from SENZL (as Welded Party at Ngatimaru Road (Receipt)) saying that they were "planning an outage 07:00 – 11:00 on Tuesday 23rd May, but were still working on details and would send through an OPN closer to the time if required".*
- *On Monday 22nd May, Todd Energy advised that "Pohokura is conducting a 4-hour shutdown from tomorrow 23/05/2017 from 7AM to 11AM. Attached is an OPN for Tikorangi #3, it is expected that at no time during tomorrow a breach in peaking limits will occur however it is prudent to inform wider parties of the work to be undertaken. In aggregate the impact on ROI across the day to the Maui Pipeline is zero."*
- *There is no obligation under the MPOC to notify of such an event or provide a flow profile unless the party is requesting relief from potential peaking charges (which was not the case on 23 May). Accordingly, other than making on-duty operational personnel aware of the prospective outage no further actions were taken in response to the ~4-hour Pohokura outage. The absence of a request for peaking relief could be seen as implying that the parties can balance their position through the day and TSO intervention to balance normally would not be required.*

3.4 Maui Pipeline Imbalance as at midnight on 22 May

During 22 May participants built up a negative imbalance on the pipeline such that at midnight the total running operational imbalance across all points was -44,000 GJs. This was broken down as follows:

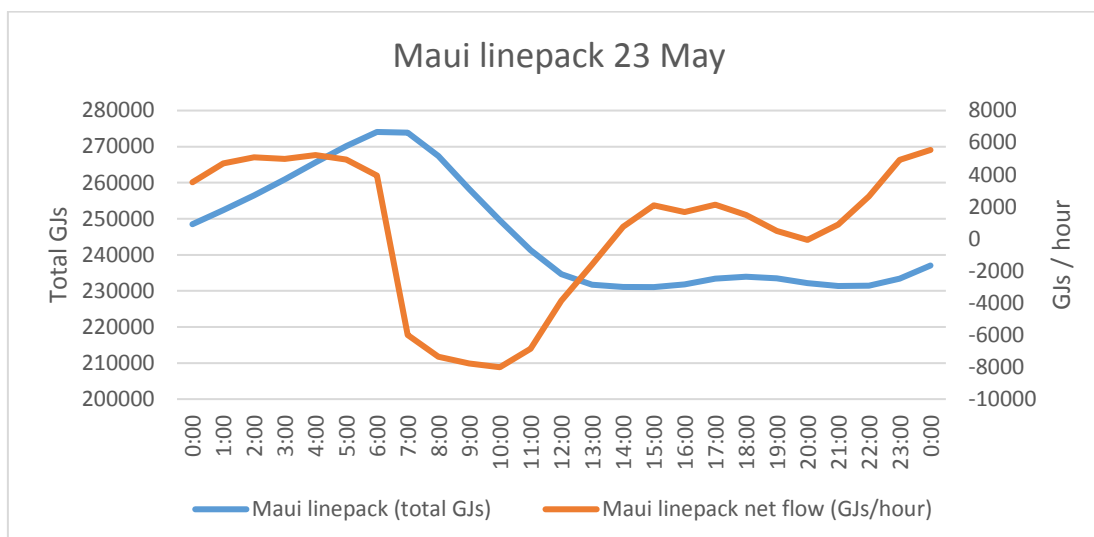
Welded Point	ROI
Huntly Power Station	-3,242
Kowhai Mixing Station	-1,056
Turangi Mixing Station	-1,325
Mokau Compressor Station	-1,443
Bertrand Road (Waitara Valley)	-449
Faull Road	-41
Ngatimaru Rd (Delivery)	-336
Ngatimaru Rd (Receipt)	110
Oaonui	416
Tikorangi #3 (Receipt)	-585
Tikorangi #2	-102
Tikorangi	-1,501
Frankley Road	-9,602
Huntly Town	-488
Ngaruawahia	-58
Oakura	-151
Okato	-77
Opunake	-300
Otorohanga	-97
Pirongia	-454
Pokuru	-7,183
Rotowaro	-14,325
Te Kuiti North	-379
Te Kuiti South	-1,289
TOTAL	-43,957

By the end of 22May the linepack at midnight was 249 TJs compared to a published total calculated (or target) linepack of 304 TJs.

4. Analysis of the System Operation on 23 May

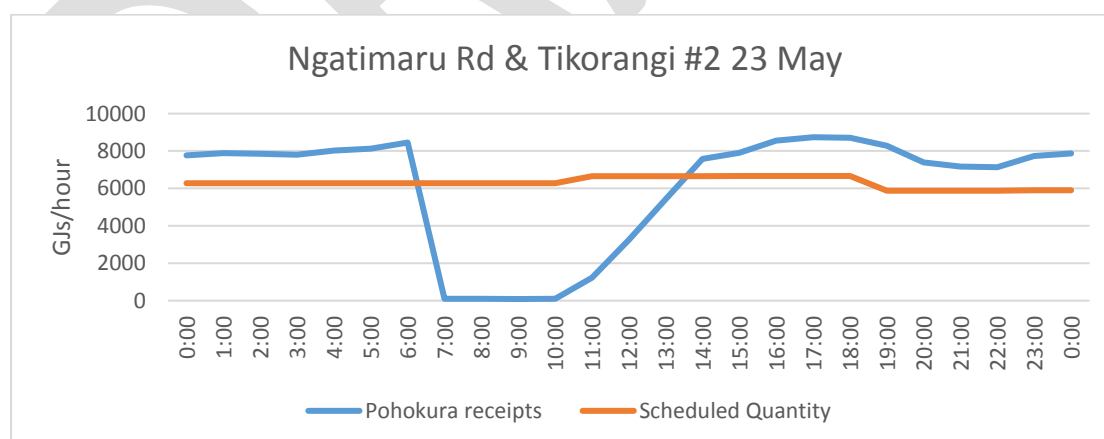
This section provides an analysis of the pipeline system from midnight on 22 May until the end of the Critical Contingency at 18:15 on 23 May.

4.1 Maui Pipeline linepack



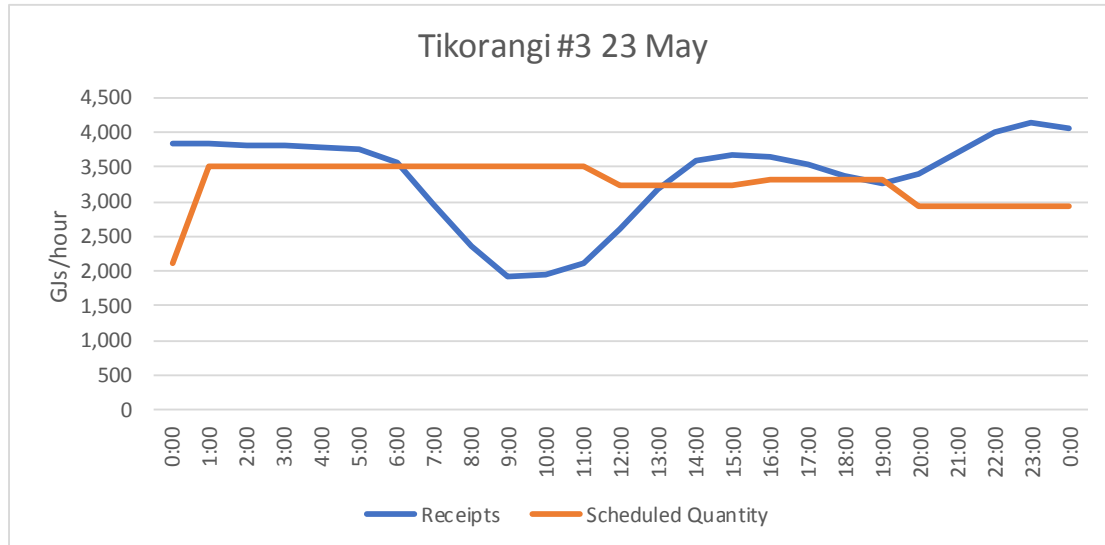
At the start of 23 May, the Maui linepack was at 249 TJ and rising at a rate of approximately 4 TJ per hour. Deliveries were relatively low and Pohokura production station was delivering more than its hourly scheduled quantity in advance of a planned outage. A large imbalance created the day prior by pipeline users was due to be automatically cashed out.

4.2 Pohokura Production Station (Receipts)



Explanatory Notes:

This graph shows the sum of receipts from Ngatimaru Rd (receipt) and Tikorangi #2, the two welded points with gas wholly sourced from the Pohokura gas field.



Explanatory Notes:

Tikorangi#3 receipt point is partially fed from the Pohokura gas field so was also affected by the Pohokura planned field outage.

These graphs show how at the start of the day Pohokura delivered gas in excess of their scheduled quantity, through the two welded points that are fed solely from the Pohokura gas fields and through Tikorangi #3, prior to the planned outage. During the outage, the Ngatimaru Rd and Tikorangi#2 receipts ceased altogether, while the Tikorangi #3 flows were reduced. By the end of the day all three welded points had delivered their scheduled gas and had positive ROIs.

Pohokura Planned Outage

SENZL, the operator of the Pohokura Production Station, provided the following narrative on the planned outage:

Pohokura had a planned-outage scheduled for the morning of May 23rd. The outage was a relatively short, routine outage, with a planned duration of 4 hours commencing at 07:00 NZST. As per normal Operating Practice, SENZL considered the potential impact of the outage: overall nominations for the day were reduced in-line with the available capacity from the field, and the field was set to flow ahead from midnight the previous night to get ahead of deemed-flow / increase the line pack in the Maui Pipeline prior to the outage. By the time the outage commenced at 07:00, Pohokura had increased the line-pack by 10,000 GJ at Ngatimaru Rd (Receipt). Todd Pohokura Ltd had concurrently increased the line-pack by around 2,700 GJ at Tikorangi 2.

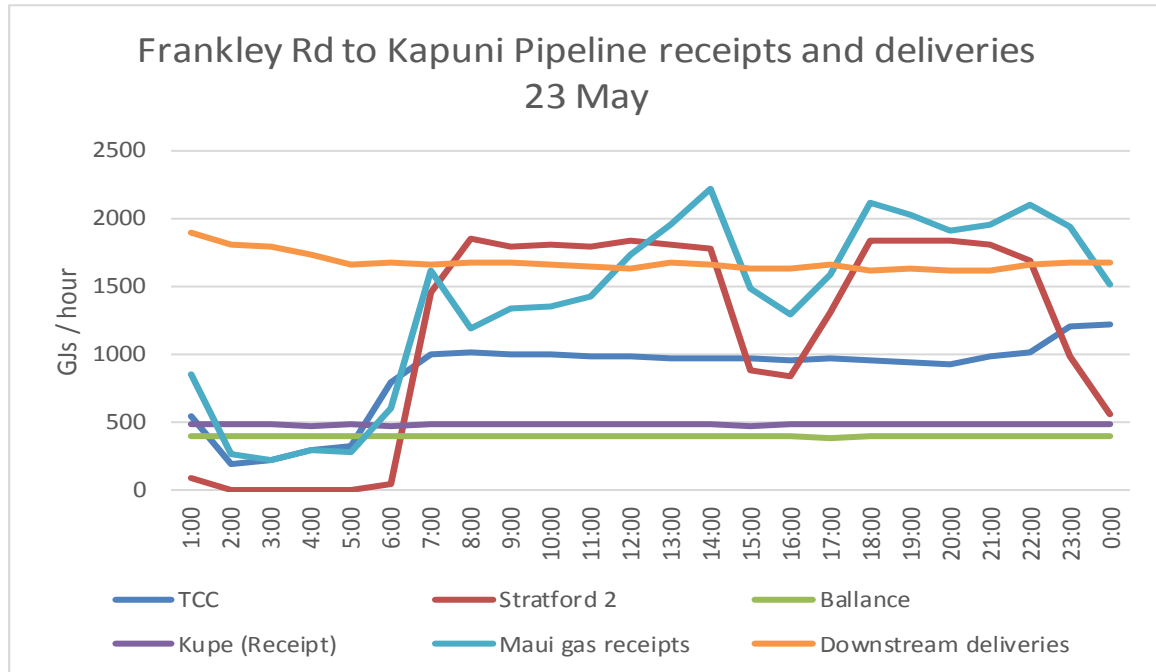
As the planned outage would not result in the need for peaking, SENZL did not request an Operational Profile to be approved by First Gas. Regardless of the need for an OPN, SENZL called the First Gas scheduling team on May 22nd, to advise them of the details of the planned outage, and the plans to flow ahead to mitigate the impact.

The planned outage was completed and flow restarted at 10:30 am, 30 minutes ahead of schedule.

When the pressure threshold at KGTP was breached at ~10:30 am, Pohokura was restarting flow. At this point, Pohokura was only around 8.5 TJ behind deemed flow

at Ngatimaru Rd (Receipt), and we estimate that Tikorangi 2 was not behind on deemed flow. The ramp-up to full rates took approximately 3 hours.

4.3 Frankley Road to Kapuni Pipeline Receipt & Deliveries



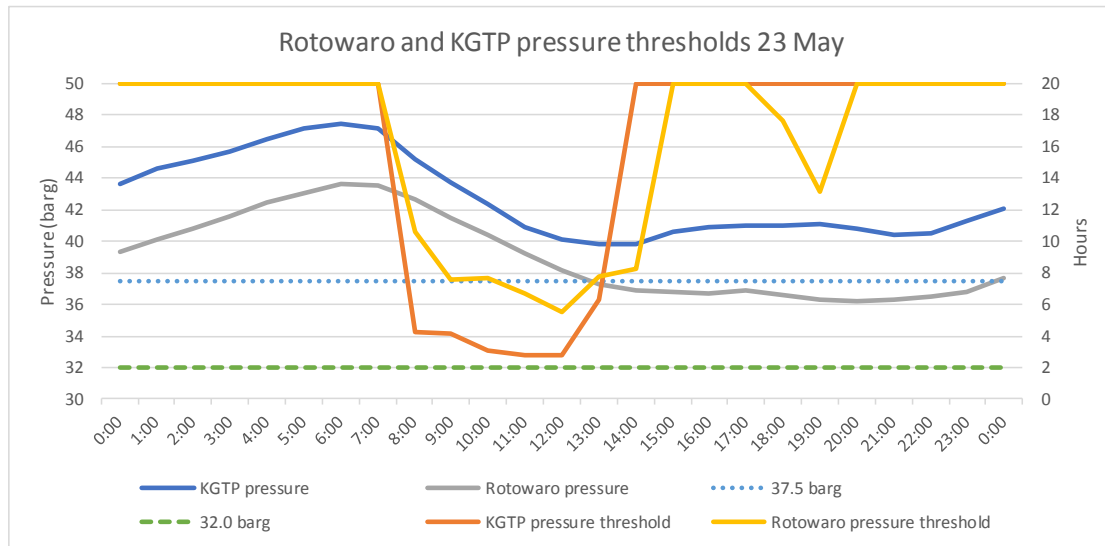
Explanatory Notes:

Ahuroa storage did not operate on 23 May

The Frankley Road to Kapuni pipeline is connected directly to the Maui pipeline without any pressure or flow control between the two systems so it is directly affected by the prevailing pressures and linepack in the Maui pipeline.

The KGTP pressure threshold is affected by demand from the Frankley Road to Kapuni Pipeline. As can be seen from this graph, both TCC and Stratford 2 (the Stratford Peaker plant) increased flow rates between 05:00 and 07:00, at about the same time as Pohokura commenced their planned outage. This type of “step-increase” in flow by gas fired electricity generation is normal practice although it can result in a short-term transient drop of the adjacent pressure threshold until the system recovers from the sudden increase in demand.

4.4 Impact on Critical Contingency Thresholds



Explanatory Notes:

Relevant Critical Contingency thresholds: KGTP 3 hours to reach pressure of 37.5barg; Rotowaro 3 hours to 32.0 barg

The combined effect of the low Maui pipeline linepack, continued negative imbalance by pipeline users and the planned Pohokura planned outage led to a rapid decline of both the Rotowaro and KGTP pressure thresholds from approximately 07:00.

Whilst both pipeline thresholds were at-risk, the rate of the decline of the Rotowaro threshold was slightly less than that of the KGTP threshold due to the nature of the demand on the system at that time. The step increase in demand by gas fired electricity generation supplied from the Frankley Road to Kapuni combined with the low linepack and negative system imbalance resulted in a breach of the KGTP threshold.

The pressure thresholds are set by the TSO and specified in the CCMP. The KGTP threshold is currently set at 3 hours to 37.5barg. Schedule 1 of the regulations allow for this threshold to be set between 3 to 6 hours to a pressure of 35 (+/- 2.5) barg.

The TSO provided the following comment on the suitability of the KGTP threshold setting:

- Both time to Pmin and Pmin were reviewed at the last CCMP update. Time to Pmin is already at minimum (3 hours), which is still appropriate since the threshold is measured at the plant inlet. The Pmin value is at the max allowed and reflects plant and compressor equipment limits. An engineering study and equipment rerating may allow these limits to be lowered, but how likely that is, is not known.

4.5 Maui Pipeline Operating Code actions

At 10:00 the total running operational imbalance on the system (excluding the amounts that would be automatically cashed out later that day) was - 19TJs and was distributed as follows:

Large Welded Point ROI											
Frankley Road	Huntly Power Station	Kowhai Mixing Station	Mokau Compressor Station	Ngatimaru Rd (Receipt)	Oaonui	Pokuru	Rotowaro	Tikorangi	Tikorangi #3 (Receipt)	Turangi Mixing Station	
5,314	- 1,991	- 1,048	- 1,443	- 6,002	4,260	- 4,860	- 2,340	- 1,500	- 3,845	- 1,561	

Explanatory Notes:

- Small welded points and those with a ROI of less than 1TJ have been removed to simplify the data set.
- Figures have been adjusted for amounts that were to be automatically cashed out later on 23 May.

At 10:17 the TSO published a low linepack notice and at 10:30 sent a 'Flow to Scheduled Quantity' notice to the welded party for Ngatimaru Rd (Receipt).

By 14:00 the total ROI on the system had grown to -37 TJ distributed as follows:

Large Welded Point ROI											
Faull Road	Frankley Road	Mokau Compressor Station	Ngatimaru Rd (Delivery)	Ngatimaru Rd (Receipt)	Oaonui	Pokuru	Rotowaro	Tikorangi	Tikorangi #3 (Receipt)	Turangi Mixing Station	
- 2,849	4,454	- 1,445	2,530	- 15,869	1,740	- 5,960	- 4,944	- 1,500	- 5,514	- 1,417	

Explanatory Notes:

- Small welded points and those with a ROI of less than 1TJ have been removed to simplify the data set.
- Figures have been adjusted for amounts that were to be automatically cashed out later on 23 May.

At 14:10 the TSO performed cash-outs on four welded points. They were all "pipeline sell" cash-outs to reduce negative running imbalance positions in excess of the imbalance limits, as they stood at midnight on 22 May. The amounts were as follows:

Tikorangi	1
Frankley Road	8,102
Pokuru	5,683
Rotowaro	<u>12,825</u>
	<u>26,611</u> GJs

The TSO provided the following comment on their efforts to buy balancing gas for delivery on 23 May:

- *On 22 May First Gas had purchased 15TJ of balancing gas (for delivery on the 22nd) to replace a similar amount of aggregate negative cash-outs. In accordance with the provisions of the MPOC and Maui Pipeline Balancing Gas Standing Operating Procedure, First Gas sought to purchase balancing gas from the emsTradepoint market (the only "approved trading platform" under the MPOC) as soon as it opened on the morning of 23 May. First Gas bid for gas directly on the market before asking our market broker to obtain offers on our behalf, but no gas was offered on the market or available through the broker for delivery on 23 May throughout the course of the day.*

At 16:00, the TSO purchased 3 TJs of balancing gas for delivery on 24 May and at 17:20 a further 3 TJs for 24 May.

	Published target for 23 May	Prior to outage	Determination of CC	Lowest point	Termination of CC
Time	00:00	06:00	11:00	15:00	18:00
Total Maui Linepack	303 TJ	274 TJ	241 TJ	231 TJ	234 TJ
Maui Linepack Net Flow		+3.9 TJ/hr	-6.8 TJ/hr	+2.1 TJ/hr	+1.5 TJ/hr

5. Review of the Event Response and Management

A detailed log of the actions taken by the CCO and TSO immediately before and during the Critical Contingency is provided in the Incident Report which is shown in Appendix 1.

This section assesses the effectiveness of the event response and management against the requirements of the regulations, the CCMP, the Communications Plan and the Information Guide.

5.1 Prior to Determination of a Critical Contingency

The CCO was not aware of the planned Pohokura outage which is not an uncommon situation as there is no requirement in the regulations or CCMP on the producer or the TSO to notify the CCO.

The regulations require the TSO to alert the CCO “of any event within the transmission system that has the potential to create a critical contingency”. The CCMP and the Communications Plan require that the CCO be notified of unplanned production outages by the TSO.

The CCO became aware of the production outage through his own routine monitoring of the supply and demand on the transmission system on the morning of 23rd and contacted the TSO at 08.30 to determine if it was a planned or unplanned outage.

The TSO confirmed that it was a planned outage between 07:00 and 11:00 and that it was not anticipated to have an adverse impact on the transmission system provided they return to operation as planned.

The CCO receives hourly files of transmission system data from the TSO which is used in the CCO System Load Model to assess a variety of pipeline system conditions including the status of pressure thresholds, linepack levels and system survival times. The files are delivered to the CCO approximately 35 minutes after the hour that the data relates to. By 09:40, using the data relating to 09:00 it was evident to the CCO that conditions on the Maui pipeline and the Frankley Road to Kapuni pipeline were deteriorating relatively quickly due to the imbalance between supply and demand.

The CCO discussed the pipeline conditions with the TSO and requested to visit the TSO Gas Control Room to monitor the system.

At the time the pipeline conditions were deteriorating, TSO personnel were also responding to a separate emergency situation.

While the CCO was mobilising to the TSO Gas Control Room, the TSO issued a low linepack notice for the Maui pipeline at 10.17.

The CCO arrived at the TSO Gas Control Room at 10:33 and observed on the SCADA system that a breach of the pressure threshold at KGTP had occurred. SCADA was indicating 2.8 hours to 37.5barg (pressure threshold is 3hours to 37.5barg). The Rotowaro pressure threshold was indicating 6.8 hours to 32barg (pressure threshold is 3 hours to 32barg).

OBSERVATION

The CCO was not notified of the potential Critical Contingency and was not notified of the actual breach of the KGTP pressure threshold as required by the regulations, the CCMP and the Communications Plan.

There were extenuating circumstances to these omissions. Firstly, TSO personnel were responding to a separate emergency and secondly, the CCO had already mobilised because of its own monitoring and assessment.

Once the breach of the KGTP pressure threshold was fully evident to the TSO Duty Officer, the processes and procedures set out in the CCMP and Communications Plan were implemented and worked well.

The pipeline conditions were assessed by the CCO and the TSO could confirm that the pressure threshold breach was not due to short-term transient conditions on the pipeline that were not a true reflection of the rate of pressure decay.

5.2 Critical Contingency Declaration & Notification

At 10:50, the CCO determined that Critical Contingency conditions had occurred under regulation 48(1)(a) and verbally advised the TSO Duty Officer that a Critical Contingency declaration notice would be issued as soon as possible.

The Critical Contingency declaration notice was issued by the CCO to the TSO and subsequently the TSO issued the notice to Retailers and Large Consumers. Both notices were issued within the required time-frames set out in the regulations, CCMP and Communications Plan.

The liaison and communications between the CCO and TSO was effective and worked well and was enhanced by having the CCO present in the TSO Control Room and being able to access real-time SCADA data.

OBSERVATION

The regulations provide for the CCO to be provided with remote, real-time, and read-only access to the TSO's SCADA system. Due to issues with the current SCADA system the TSO has not been able to provide this access for the CCO. As an interim solution, the TSO has granted permission for the CCO to mobilise to the Gas Control Room. It is anticipated that the CCO will obtain access as part of the next SCADA system upgrade by the TSO.

5.3 Consideration of Curtailment

After issuing the Critical Contingency declaration notice, the CCO assessed the requirement for load curtailment to stabilise the transmission system.

Pohokura had recommenced flowing at very low rates at around 10:35. However, this had not been sufficient to arrest the decline of both the Rotowaro and KGTP pressure thresholds.

The CCO liaised with the Pohokura Operator SENZL at 11:24 who advised that Pohokura was returning to full rates as planned and that they intend to fulfil their nominated quantities for the day.

By 11:35, SCADA indicated that the decline of the pressure threshold at KGTP had been arrested. The CCO considered that curtailment was not required and continued to monitor the situation. Provided Pohokura continued to maintain their return to full rates, curtailment would not be required.

The CCO also liaised with the TSO on requirement for the CCO to explore options for increased upstream production. However, given that load curtailment was not required the CCO considered that this would not be necessary and continued to monitor the situation in case there were any issues with Pohokura re-start.

5.4 System Recovery and Termination of Critical Contingency

During the Critical Contingency, the CCO issued two Status Update Notices to keep Stakeholders informed as to the status of the Critical Contingency as set out in the Information Guide.

In the first Status Update Notice issued at 13:10, the CCO advised no further CCO action was planned at that stage. However, the need for increased production and/or demand curtailment could not be discounted until the supply of gas into the system is sufficient to meet or exceed the reasonably expected demand. The CCO continued to closely monitor the situation in liaison with the TSO.

In the second Status Update Notice issued at 15:20, the CCO advised that although supply of gas into the system was exceeding demand and pipeline linepacks were slowly increasing, it was anticipated that system demand would increase over the evening peak period. The CCO could not terminate the Critical Contingency until the supply of gas into the system was sufficient to meet or exceed the reasonably expected demand. The CCO continued to monitor the system to see if the balance of receipt/delivery flows continued to support stabilisation of linepack.

By about 18:00 the CCO had seen sufficient evidence of stabilisation of the system supply and concluded in liaison with the TSO that further increased demand was not likely. Subsequently, a Critical Contingency termination notice was issued and published at 18:20.

There was one minor issue when the CCO issued Status Update #2 CC-0039 by email to Stakeholders listed in the Information Guide with "Termination Notice" in the subject line of the email. This error was quickly spotted and corrected. The content of the actual Notice was correct.

6. Conclusions Arising from This Event

The Critical Contingency was caused by an imbalance between supply and demand. The factors that contributed to this imbalance were:

- the cumulative effect of negative pipeline imbalance over the days preceding the Critical Contingency that was not recouped by the TSO through the purchase of balancing gas, resulted in linepack levels in the Maui pipeline being below optimal.
- a planned outage of the Pohokura Production Station of approximately four hours' duration on the morning of the Critical Contingency.
- demand from the Frankley Road to Kapuni pipeline at the time of the planned Pohokura outage creating a relatively high rate of pressure decay impacting on the KGTP pressure threshold.

CCO's Conclusions:

- The purpose of the regulations is to achieve the effective management of critical gas outages. Although a Critical Contingency was declared, the CCO did not need to issue load curtailment instructions or explore options for increased upstream production to stabilise the transmission system. However, the regulations require that a Critical Contingency must be declared if a pressure threshold is breached.
- The factors present on 23 May were not extraordinary and should have been capable of being managed by the TSO and transmission system users (shippers and interconnected parties) without resulting in the need to declare a Critical Contingency.
- The pressure threshold breach occurred only 15 minutes after action being taken by the TSO under the operating code in relation to the low level of linepack on the Maui pipeline. The general principle should be that the triggers for action to be taken under the operating codes should be reached prior to a Critical Contingency trigger being breached, to allow the operating code to deal with the situation before a regulatory response is required.
- The situation of low levels of linepack at times of relatively high demand is not an uncommon occurrence. There have been many occasions in recent times when both the Rotowaro and KGTP pressure thresholds have been vulnerable to rapid rates of decay because of "imbalance between supply and demand" situations. This issue stems in part from the difference in approach; the pipeline operating code philosophy uses linepack measured in gigajoules whereas the Critical Contingency thresholds use a defined time in hours to a minimum pressure.
- Given the difference in approach there needs to be sufficient alignment between the pressure thresholds in the CCMP and the linepack thresholds in the pipeline operating codes to avoid a pressure threshold being breached during "business as usual" events such as planned production station outages and step-change increases in demand.
- The risk to pressure thresholds is significantly reduced if:

- the pipeline system is operated at sufficiently high linepack levels to ensure the system has sufficient resilience to cope with imbalance between supply and demand situations, and
- the pipeline is operated in a manner that is fully cognisant of the potential impact of step- changes to supply and demand on the pressure thresholds.
- It is essential that the pipeline operating code regime can adequately police/incentivise/underpin the requirement for shippers to balance receipts and deliveries.

The TSO has carried out its own internal review of this event which has been provided to the CCO and is available in Appendix 2 of this report. The TSO's review identifies several recommendations which, if fully implemented, should significantly reduce the likelihood of a reoccurrence.

7. Assessment and Identified Amendments

The purpose of the regulations is to achieve the effective management of critical gas outages and other security of supply contingencies without compromising long-term security of supply.

This section assesses the effectiveness of the regulations, the CCMP, the Communications Plan and the Information Guide in the context of this event and identifies any amendments to these that would better achieve the purpose of the regulations.

In accordance with regulation 65 (1) (b), and in the context of this event, the CCO considers the regulations, CCMP, Communications Plan and Information Guide all achieved the purpose of the regulations.

In accordance with regulation 65 (1) (a), and in the context of this event, the CCO considers that the CCMP, the CCO Information Guide and CCO Communications Plan were all substantially effective with the following observations:

Regulations

No amendments to the regulations have been identified because of this event.

CCMP

No amendments to the CCMP have been identified because of this event

CCO Communications Plan

Except for an omission by the TSO in notifying the CCO of the potential Critical Contingency due to extenuating circumstances, all communications and issuing of notices from the CCO to the TSO were carried out in accordance with the requirements and time-frames specified in the Communications Plan.

No amendments to the Communications Plan have been identified because of this event.

CCO Information Guide

Except for a minor error where the title of a CCO email stated Termination Notice instead of Status Update Notice which was quickly corrected, all communications and issuing of notices from the CCO to Stakeholders were carried out in accordance with the requirements and time-frames specified in the Information Guide.

No amendments to the Information Guide have been identified because of this event.

DRAFT

Appendix 1 – Incident Report

Log of actions taken by CCO and TSO immediately before and during the Critical Contingency as provided in the Incident Report

The CCO and TSO notices referred to in the log of actions are shown in full in the appendices to the Incident Report which is available on the CCO website at: www.cco.org.nz/historical-cc-events

Time	Action Taken
08:25	CCO carries out routine check of system load model and observes no flow from Pohokura. CCO's most recent hourly SCADA data file indicates Maui linepack at 07:00 is 274TJ and falling at 6TJ/hr. KGTP pressure at 31 hours to threshold.
08:30	CCO calls the TSO Gas Control to query Pohokura status. TSO advises that Pohokura have a planned outage between 06:30 and 11:00. Gas Controller needed to be brief as he had other calls relating to another potential emergency.
08:35	CCO checks most recent SCADA data file which arrived at 08:32 and indicates that at 08:00 Maui linepack is 267TJ and falling at 7.5TJ/hr. KGTP inlet pressure at 4.2 hours to 37.5barg. (Threshold for a Critical Contingency is 3 hours 37.5barg).
08:43	CCO contacts TSO Gas Control to request hourly SCADA data file be switched to event mode, which provides data files every 20 minutes.
09:30	CCO calls TSO Gas Control to follow up request for SCADA data file be switched to event mode. Gas Controller notes that Control Room has been busy dealing with another emergency. Gas Controller switches SCADA data file to event mode.
09:38	CCO checks most recent SCADA data file which arrived at 09:32 and indicates that at 09:00 Maui linepack is 258TJ and falling at 8TJ/hr. KGTP pressure is still at 4.2 hours to 37.5barg.
09:54	CCO checks 09:35 SCADA data event mode file which arrived at 09:52. Maui linepack at 253TJ and falling at 9.6TJ/hr. KGTP pressure still at 4.2 hours to 37.5barg.
10:00	CCO calls TSO Control Room Manager to discuss pipeline conditions. Control Room Manager unable to take call due to involvement in a system emergency but advised he would return the call shortly.
10:09	TSO Transmission Services Manager calls CCO to cancel TSO/CCO Monthly Liaison Meeting scheduled for 10:30 that morning due to a system emergency. CCO raises concern at condition of Maui linepack and pressures and requests to visit TSO Control Room to monitor the situation with the TSO. It is agreed that CCO can attend Gas Control.
10:17	TSO publishes Critical Notice 37707 on OATIS (Maui) advising of low linepack and that the System Operator may have to take further action if the situation is not resolved.
10:33	CCO arrives at TSO Control Room and observes that Critical Contingency Threshold at KGTP is in critical alarm and indicating 2.8 hours to 37.5barg.
10:35	CCO consults with TSO and requests TSO to confirm whether threshold alarm is the result of transient conditions due to sudden flow changes or an accurate rate of change due to the prevailing system conditions.

Time	Action Taken
10:35	TSO SCADA indicates that Pohokura has commenced flowing at low rates of 0.4TJ/hr. (Target flow rate to return to pre-outage conditions would be circa 8TJ/hr which would take at least two hours).
10:40	CCO notices large fluctuations in flow rates to the Methanex delivery points. A call is made to Methanex who confirm that they are re-valving to change flows between their delivery points but do not intend to change their total offtake.
10:45	TSO advises CCO that threshold breach is not as the result of transient conditions. Maui linepack still falling at 7.5TJ/hr. KGTP pressure at 2.4 hours to 37.5barg
10:50	CCO determines that there is a Critical Contingency under r48(1)(a) and advises the TSO that a Critical Contingency Declaration Notice will be issued as soon as possible.
10:55	CCO determines that the Critical Contingency is not a regional contingency.
11:10	CCO consults with TSO on content of CC Declaration Notice and TSO confirms that the notice concurs with the TSO's understanding of the situation.
11:14	CCO issues Critical Contingency Declaration Notice CC-0038 to TSO, Stakeholders and Interested Parties via email.
11:16	CCO uploads Declaration Notice and updates "Current CC Events" page on CCO website.
11:21	CCO sends SMS to CCO Stakeholders listed in Information Guide to advise that Critical Contingency Declaration Notice CC-0038 has been issued.
11:24	CCO contacts Pohokura Operator SENZL who advise that Pohokura is returning to full rates as planned and that they intend to fulfil their nominated quantities for the day.
11:24	CCO contacts Electricity System Operator to discuss situation and determine the current thermal generation status and if they would need on-going generation from the Huntly Rankine units if demand curtailment is required.
11:28	TSO publishes Critical Notice 37711 on OATIS (Maui). Critical Contingency Declaration Notice CC-0038.
11:31	TSO publishes Critical Notice 37712 on OATIS (Vector). Critical Contingency Declaration Notice CC-0038.
11:37	TSO issues Security of Supply Update #1 to CCO.
11:35	TSO SCADA indicates Maui linepack at 236TJ and losing 4.6TJ/hr. KGTP pressure is 2.4 hours to 37.5barg. Rotowaro pressure threshold now at 5.2 hours to 32barg. (Threshold is 3 hours to 32barg).
11:55	TSO SCADA indicates Maui linepack at 235TJ and losing 3.6TJ/hr. KGTP pressure threshold 2.8 hours to 37.5barg (improving). Rotowaro pressure threshold at 5.6 hours to 32barg (improving). Pohokura flowing at 3.7TJ/hr (target 8TJ/hr).
12:00	CCO determines that pressure threshold declines have ceased and curtailment under the CCM Regulations is not required although the system is not fully stabilised.
12:35	TSO SCADA indicates Maui linepack at 233TJ and losing 2.5TJ/hr. KGTP pressure threshold 4 hours to 37.5barg (improving). Rotowaro pressure threshold at 6.6 hours to 32barg (improving). Pohokura flowing at 4.4TJ/hr.

Time	Action Taken
12:50	CCO prepares Status Update Notice CC-0039 and consults with TSO on content who confirms that the notice concurs with the TSO's understanding of the situation.
12:55	TSO SCADA indicates Maui linepack at 231TJ and losing 1.6TJ/hr. KGTP pressure threshold 6.3 hours to 37.5barg (improving). Rotowaro pressure threshold at 6.6 hours to 32barg (improving). Pohokura flowing at 5.4TJ/hr (target 8TJ/hr).
13:10	CCO issues Status Update CC-0039 by email to Stakeholders listed in the Information Guide issued advising curtailment not required at this time and CCO is continuing to monitor the situation.
13:12	CCO uploads Status Update Notice and updates "Current CC Events" page on CCO website.
13:15	CCO sends SMS Message to Stakeholders to advise that Status Update Notice CC-0039 has been issued.
13:18	TSO publishes Critical Notice 37713 on OATIS (Maui). Critical Contingency Status Update Notice CC-0039.
13:21	TSO publishes Critical Notice 37714 on OATIS (Vector). Critical Contingency Status Update Notice CC-0039.
13:43	CCO updates Electricity System Operator that any curtailment under the CCM Regulations of any electricity generation now unlikely provided system continues to recover at current rates and stays stable.
13:55	TSO SCADA indicates Maui linepack at 231TJ and gaining 0.8TJ/hr. KGTP pressure now increasing and Rotowaro pressure stabilised. Pohokura flowing at 7.6TJ/hr.
14:24	TSO issues Security of Supply Update #2 to CCO. TSO advises that "linepack still remains very low with an ongoing risk of dropping below CC threshold until normal operational levels are reached and maintained".
14:55	TSO SCADA indicates Maui linepack at 231TJ and gaining 1.9TJ/hr. Pohokura flowing at 7.8TJ/hr.
15:00	CCO prepares Status Update Notice #2 CC-0039 and consults with TSO on content and TSO confirms that the notice concurs with the TSO's understanding of the situation.
15:15	CCO issues Status Update #2 CC-0039 by email to Stakeholders listed in the Information Guide advising increased production and/or curtailment not required but cannot be fully discounted due to the potential impact of the evening peak period.
15:20	CCO uploads Status Update Notice #2 and updates "Current CC Events" page on CCO website.
15:27	CCO sends SMS Message to Stakeholders to advise that Status Update Notice CC-0039 has been issued.
15:28	CCO re-issues Status Update #2 CC-0039 by email to Stakeholders listed in the Information Guide as a correction. Previous email at 15:15 had "Termination Notice" in the subject line which was an error.
15:36	TSO publishes Critical Notice 37723 on OATIS (Maui). Critical Contingency Status Update Notice CC-0040.
15:38	TSO publishes Critical Notice 37724 on OATIS (Vector). Critical Contingency Status Update Notice CC-0040.

Time	Action Taken
15:55	TSO SCADA indicates Maui linepack at 232TJ and gaining 3.1TJ/hr. Pohokura flowing at 8.7TJ/hr.
16:19	CCO updates Electricity System Operator that curtailment under the CCM Regulations of any electricity generation still unlikely provided system continues to recover at current rates and stays stable over the evening peak period.
16:55	TSO SCADA indicates Maui linepack at 233TJ and gaining 2.1TJ/hr. Pohokura flowing at 8.7TJ/hr.
17:55	TSO SCADA indicates Maui linepack at 234TJ and gaining 1.6TJ/hr. Pohokura flowing at 8.7TJ/hr.
18:00	CCO consults with TSO to determine if system is now considered “stable” and no material increase in demand is reasonably expected. TSO and CCO concur that CCO can be terminated at 18:15.
18:10	CCO prepares Termination Notice CC-0041 and consults with TSO on content and TSO confirms that the notice concurs with the TSO’s understanding of the situation.
18:20	CCO emails Critical Contingency Termination Notice CC-0041 to TSO and Stakeholders.
18:22	CCO uploads CC Termination Notice and updates “Current CC Events” page.
18:23	CCO sends SMS message to Stakeholders to advise that Critical Contingency Termination Notice CC-0041 has been issued.
18:30	TSO publishes Critical Notice 37726 on OATIS (Maui). Critical Contingency Termination Notice CC-0041.
18:32	TSO publishes Critical Notice 37727 on OATIS (Vector). Critical Contingency Termination Notice CC-0041.

Appendix 2 – TSO Internal Review of Critical Contingency



FIRST GAS INFORMATION PAPER

DATE: June 2017

RE: Internal Review of Critical Contingency on 23 May 2017

1. SUMMARY

A critical contingency on the gas transmission system was declared at 10.50am on Tuesday, 23 May 2017 and was terminated later the same day at 6.15pm. The event was triggered by the breach of a pressure limit at Kapuni Gas Treatment Plant (KGTP), which is prescribed in the First Gas Critical Contingency Management Plan issued pursuant to the Gas Governance (Critical Contingency Management) Regulations 2008.

As the Transmission System Owner (TSO), First Gas is responsible for managing the physical condition of the gas transmission system including the amount of gas in the system (linepack). First Gas discharges these responsibilities in a way that meets its contractual obligations under access codes (MPOC and VTC) and minimises emergencies on the transmission system (including critical contingency events).

This report explores the factors that caused the critical contingency event on 23 May, and considers the appropriateness of First Gas' response to those circumstances. This report also contains a series of recommended actions for First Gas over the near term (under existing transmission access codes) and over the longer term (under a new transmission access code) to learn from this event. The CCO will also release a performance report by 5 July 2017.

2. FINDINGS

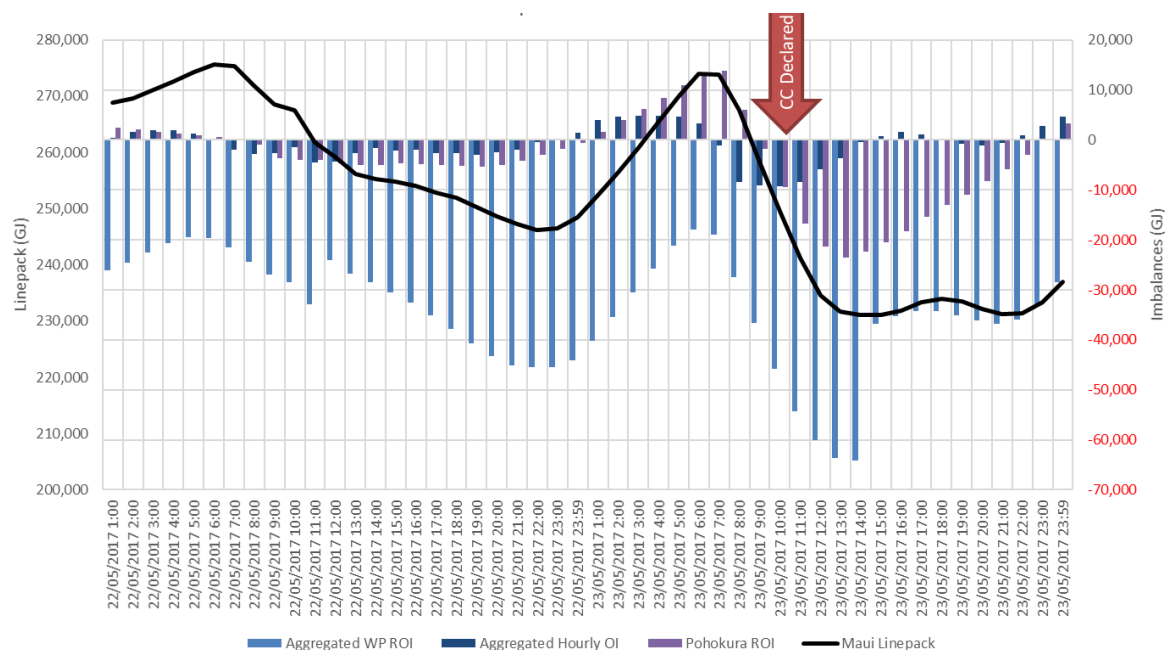
Critical contingencies should only be declared in the most serious of situations, when the ongoing supply of gas via the transmission system is under threat. This could involve either a shortage of gas supply relative to demand, or a physical failure on an important component of the gas supply chain. The circumstances leading to the event on 23 May did not meet the high threshold expected for critical contingencies. This review finds that the factors present on 23 May were capable of being managed by First Gas and transmission system users (shippers and interconnected parties) without the need for a critical contingency.

The main cause of the critical contingency event was the high level of negative shipper imbalance on the Maui pipeline on the days leading up to the event and on 23 May. First Gas did not respond effectively to the amount of gas being withdrawn from the system that was not matched with gas injections, resulting in insufficient linepack and decreasing pipeline pressures. The low Maui linepack was exacerbated by a scheduled outage of the Pohokura Production Station, which reduced gas injections on the morning of 23 May in the hours immediately before and during the critical contingency.

The combination of these factors is illustrated in Figure 1. This graph shows that aggregated operational imbalance at welded points on the Maui pipeline (the blue bars) created a significant draw on linepack ahead of the critical contingency. This was exacerbated by very

high hourly operational imbalance of nearly 10 TJ per hour (the dark blue bars) in the three hours immediately before the critical contingency was declared. At the same time, imbalance resulting from the Pohokura scheduled outage (the purple bars) was drawing down linepack, with that effect continuing throughout the remainder of 23 May.

Figure 1: Imbalances and linepack on the Maui pipeline (22-23 May 2017)



Existing procedures and processes were correctly executed by First Gas staff. However, those processes do not adequately manage pipeline conditions in response to the magnitude of shipper imbalances that occurred.

3. RECOMMENDATIONS

First Gas can and should implement changes to reduce the risk of future critical contingencies arising from the circumstances present on 23 May. A full list of recommendations is provided in section 4 of this review. The highest priority near term recommendations arising from this review are for First Gas to:

- Formalise and enhance the capability of First Gas to proactively carry out pipeline balancing activities to increase Maui pipeline flexibility linepack by 40 TJ, leading to an overall calculated line pack position typically over 300 TJ. This will include ensuring sufficient escalation of balancing activities on the wholesale market and exploring the possibility of negotiating 24/7 instant access bilateral contracts that provide an avenue for First Gas to obtain gas when it cannot be secured from the wholesale spot market in the timeframes and quantities required to maintain target linepack.
- Improve internal processes for moving from “normal” operations for linepack management to processes that reflect heightened risks of low linepack and critical contingencies, including involving senior management in operational decisions.
- Define improvements to First Gas’ ability to forecast multiple future pipeline operating states to better understand whether shipper imbalances, production station outages, or

other circumstances present heightened risks of low linepack and the possibility of triggering critical contingencies. We will also explore ways to obtain more information from interconnected parties to assist with linepack management.

This review also provides recommendations for longer term solutions under the new Gas Transmission Access Code (GTAC). These recommendations focus on further improving incentives for primary balancing by encouraging shippers to resolve their own imbalances, rather than relying on First Gas as the buyer and seller of gas of last resort.

The remainder of this report proceeds as follows:

- Section 2 explores the causes of the critical contingency on 23 May;
- Section 3 summarises the possible actions available to First Gas to mitigate the risk of a critical contingency on 23 May; and
- Section 4 presents recommended changes to First Gas contracts and processes to learn from the critical contingency on 23 May and improve the way these events are managed in the future.

4. CAUSES OF THE CRITICAL CONTINGENCY

A summary of the relevant facts is contained in the Incident Report published by the Critical Contingency Operator on 30 May 2017.

While there were other factors that contributed to the timing of the event, we believe that the two main causes of the critical contingency event were:

- Shipper mismatch and imbalances on the transmission system and First Gas' responses to maintain Maui pipeline linepack; and
- The scheduled outage at the Pohokura Production Station.

Our assessment is that the transmission system could have accommodated either one of these causes individually, but together they led to the declaration of a critical contingency. This is because both factors reduced linepack in the Maui pipeline that ultimately led to the critical contingency threshold being breached.

These causes are explained in more detail under the subheadings below.

Shipper imbalance and First Gas' response

Since October 2015, First Gas has balanced the Maui pipeline under a system known as Market Based Balancing (MBB). One of the key benefits of MBB has been to improve the incentives on shippers to balance their pipeline position daily – i.e. to match their injections of gas each day to their withdrawals/deliveries of gas.

MBB increased balancing incentives by automatically “cashing out” imbalances that exceed a tolerance (known as a ROIL and currently set at 1.5TJ per day at each welded point on the Maui pipeline). Cash outs occur at midnight each day. The effect of automatic cash outs is that First Gas “sells” gas to shippers that take more gas than they inject on a day, and “buys” gas from shippers that leave gas in the pipeline at the end of a day. Overall, MBB has been

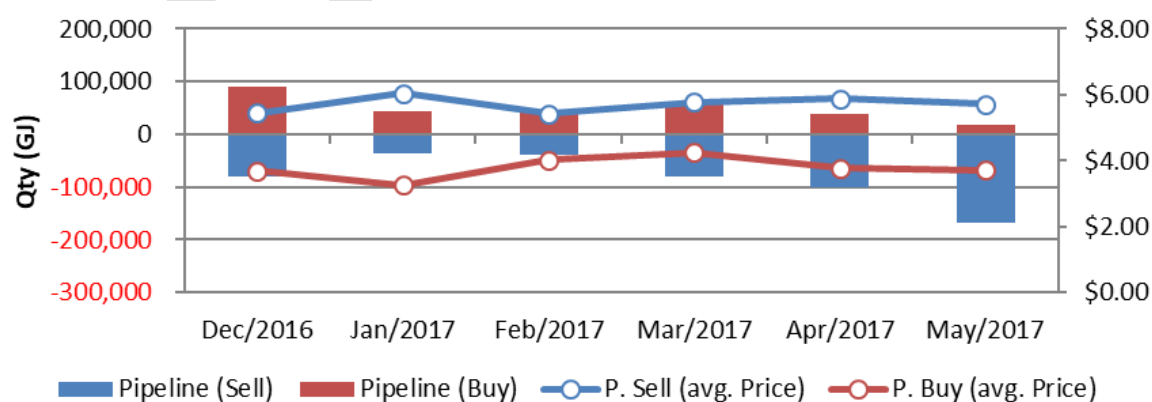
relatively effective at improving the performance of shippers in meeting their primary balancing obligation under the codes.¹

By design, MBB puts First Gas in the position of buyer and seller of gas of last resort. This is because on any day shippers have the option of balancing their own position (including by buying more gas from the wholesale spot market if they are short), or being cashed out by First Gas. The price that shippers face for a cash out relative to what they can buy gas for themselves clearly influences the effort that shippers make to balance their own positions. Depending on the price of other gas purchasing options, automatic cash outs create the ability for shippers to reduce their total costs by being cashed out.

In late 2016, First Gas received feedback from shippers and the market operator (emsTradePoint) about the cost-effectiveness of balancing actions and impacts on market performance. The essence of this feedback was that prices under MBB were not “market based” since participants would not transact at the prices reflected in First Gas trades. First Gas has endeavoured to ensure that balancing actions are broadly reflective of market conditions by taking a more active approach to engaging in the wholesale market and using a broker to help improve prices achieved for balancing actions. While this has improved the value for money of the balancing actions taken by First Gas, it has also weakened the incentive for shippers to balance their own position and has increased the likelihood that cash outs are less concerning for shippers.

The relationship between cash out price and volume is shown in the following graph (with cash volumes shown by the bars and referenced to the left-hand axis, and prices shown by the lines and referenced to the right-hand axis). From December 2016 to March 2017, positive and negative cash out volumes were relatively equal and offsetting – that is, shippers were leaving as much gas in the pipeline as they were taking out over the course of the month. That changed in April 2017, with negative cash outs of around 100 TJ and positive cash outs of only 39 TJ. By 23 May, negative cash outs had increased again to 167 TJ and positive cash outs had fallen to 19 TJ. The average price for negative cash outs (pipeline sell) in May was \$5.71/GJ.

Figure 2: Summary of Maui pipeline cash out quantities and prices (Dec 2016 to 23 May 2017)

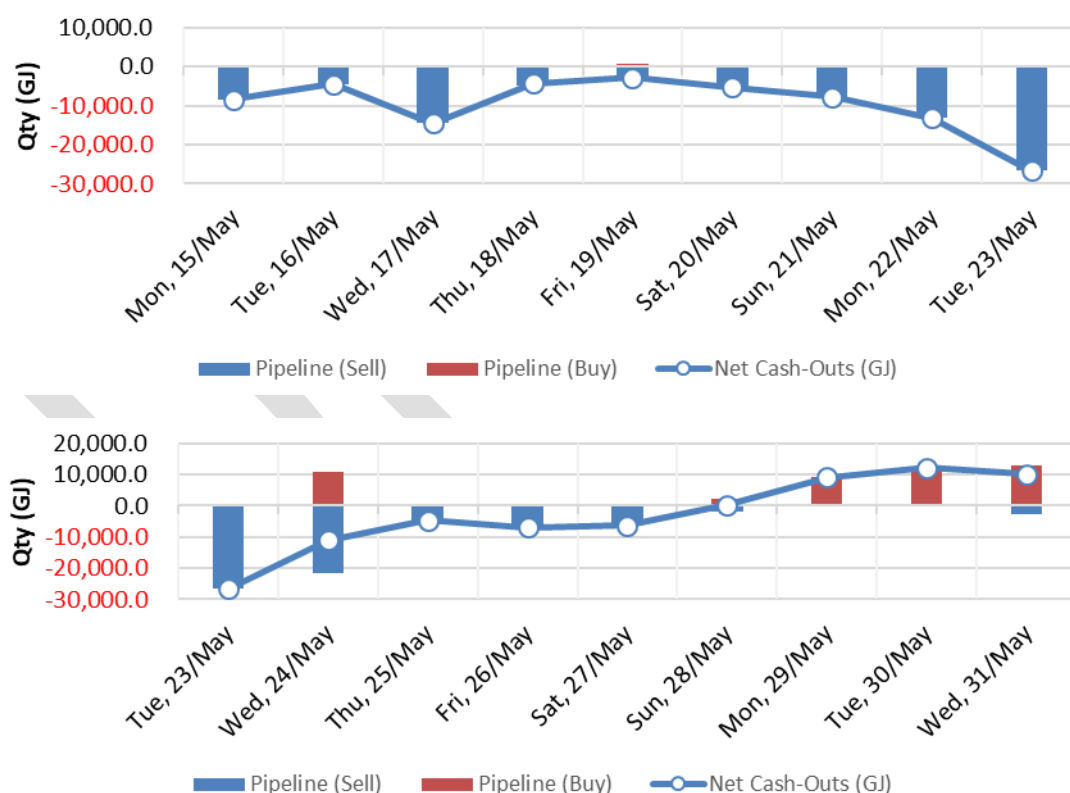


¹ See GIC “Review of Market-Based Balancing” November 2016, <http://gasindustry.co.nz/work-programmes/transmission-pipeline-balancing/current-arrangements/>

The MBB regime allows First Gas to apply an increment to the cash out price to further incentivise primary balancing. Since the introduction of MBB, the increment has been set at 3%. At a cash-out price of \$5/GJ, the increment adds \$0.15/GJ to encourage shippers to trade on their own behalf and balance their positions. Given the continued growth in negative cash outs in April and May 2017, First Gas elected to increase the increment to 10% (the maximum permitted under the MPOC). This decision was notified on 22 May 2017 (the day before the critical contingency). The effect of this change is to increase the effective cost of a \$5/GJ cash out from \$5.15/GJ to \$5.50/GJ.

Figure 3 provides some initial evidence that this change is having the desired effect. In the week leading up to 23 May, daily cash outs were consistently negative and increasing from Friday through to Tuesday (23 May). The incentive fee change took effect from Thursday 25 May, and cash outs since that date have been lower and trending positive. However, these trends should be treated with caution, since the change may have been influenced by critical contingency itself, warmer weather in the week following the event, or a combination of both. We will continue to actively monitor how cash outs respond to this change.

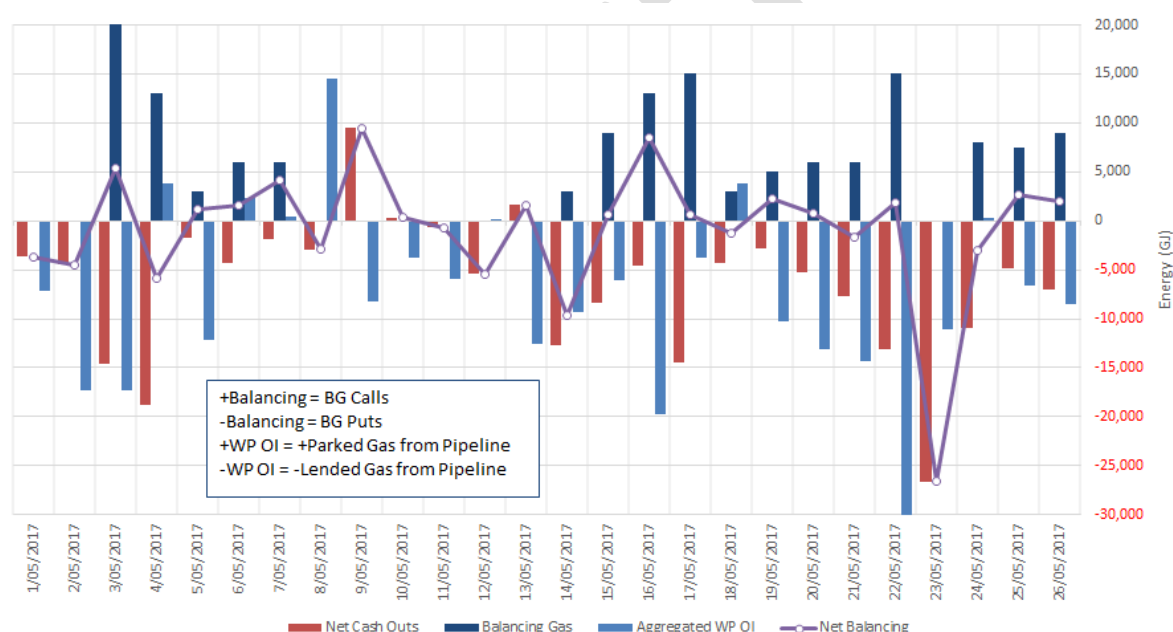
Figure 3: Cash outs in week prior to 23 May (top graph) and after 23 May (bottom graph)



In its role as balancing agent, First Gas has been much more active in buying gas in April and May to maintain physical linepack and system pressure. In April, First Gas purchased a total of 47 TJ (79% of cash-outs for the month). Up until 23 May, First Gas had purchased a total of 125 TJ (102% of cash-outs).

Notwithstanding this heightened level of balancing activity, First Gas had difficulty keeping up with the volume of daily cash-outs occurring on 22-23 May. This was in part due to the lack of available volume on the emsTradepoint market – the only “approved trading platform” under the MPOC. This is illustrated in the graph below which shows operational imbalance (cash outs) and balancing gas transactions for May. The purple line tracks the net impact on linepack from negative cash outs and the balancing gas purchases made by First Gas. This illustrates that the imbalances were generally being replenished by balancing gas purchases made the following day, with the net position of cash-outs minus gas purchases never exceeding 10 TJ until 23 May. On that day, the negative imbalance increased to 26 TJ.

Figure 4: Operational imbalance and balancing actions (19 May 2017 to 26 May 2017)



The challenge of keeping up with cash-outs had been identified by First Gas and led to a decision to turn off the Mokau Compressor on 22 May (the day before the critical contingency). This resulted in a decrease in target linepack from 304 TJ to 261 TJ under the current MPOC Balancing Standard Operating Procedures. At the time that decision was made, actual linepack was roughly in line with the target level. However, negative shipper cash outs at midnight meant that First Gas began 23 May with linepack of around 250 TJ (around the low linepack threshold for the Maui pipeline). The effect of cash-outs occurring at midnight is that First Gas attempts to replenish gas the day after it has been taken, which can have physical impacts when cash outs are significant.

The linepack position improved from midnight until the Pohokura Production Station commenced scheduled maintenance at 6:37am, due to Pohokura pre-packing the line in anticipation of a scheduled outage (described further below). Linepack then fell sharply due to the loss of Pohokura supply. As shown above, during this time-period shippers continued negative imbalance was also reducing linepack.

Scheduled outage at the Pohokura Production Station

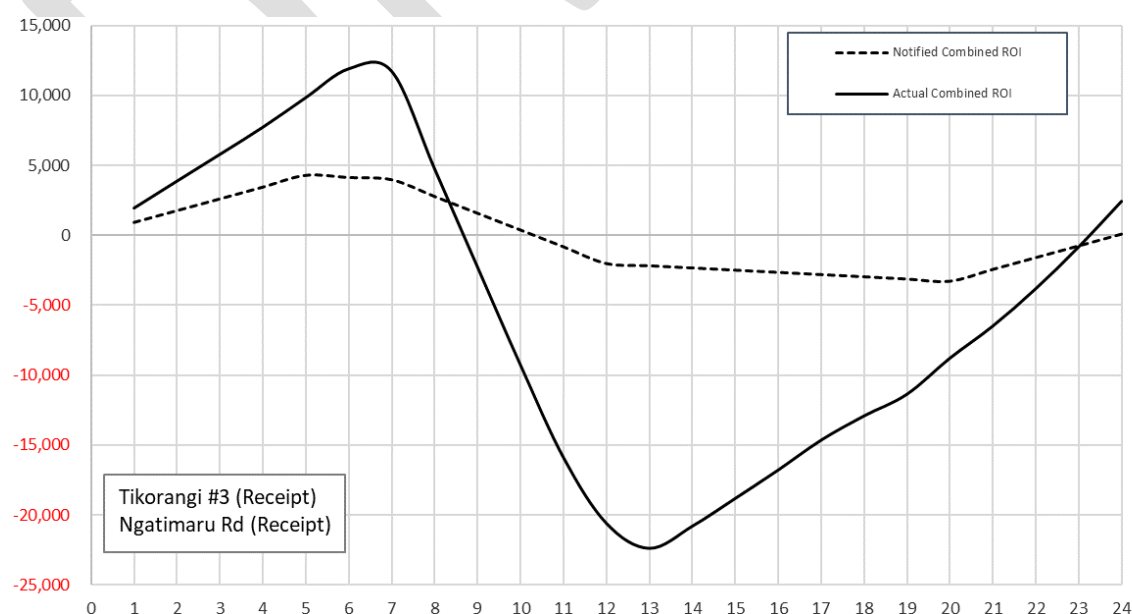
On the morning of 23 May, the operator of the Pohokura Production Station (SENZL) undertook scheduled maintenance at the plant. This reduced the injection of gas into the transmission system in the hours leading up to the declaration of the critical contingency event and during the event. Pohokura influences gas quantities at three welded points: Ngatimaru Road Receipt, Tikorangi 2 and Tikorangi 3.

SENZL notified First Gas on Friday, 19 May of the scheduled outage, but did not provide its planned hourly rate of gas injection for 23 May. As discussed below, there is no obligation under the MPOC to notify of such an event or provide a flow profile unless the party is requesting relief from potential peaking charges.

Todd Energy notified a profile for Tikorangi 3 that reflected the expected impact of the outage. The expected profile would see the injection of elevated quantities of gas from Tikorangi 3 between midnight and 5am, before the scheduled outage began. Todd Energy then planned to decrease injections from 7am to create an accumulated negative difference against its scheduled quantity of around 2 TJ at midday. This negative position was expected to grow (at a slower rate) until 8pm, when the accumulated difference would reach -3.5 TJ. Gas injections would then ramp up to eliminate that difference and end the day having injected an amount equal to its approved nominations.

The difference between the notified profile (flat for Ngatimaru Rd and profiled for Tikorangi 3) and actual flow is shown in Figure 5. This shows that the outage and flow profile at Pohokura had a greater impact on linepack than anticipated. This position was recovered in the afternoon and evening, and by the end of 23 May Pohokura had flowed the gas that had been nominated.

Figure 5: Hourly Injection Impact from Pohokura Production Station on 23 May (planned and actual)



In terms of relative contribution to the critical contingency event, the scheduled outage at Pohokura is less significant than the shipper imbalances described above, but is still material. The difference between planned and actual injections from Pohokura was around 10 TJ at the time the critical contingency was declared, and grew to around 20 TJ by 1pm. In comparison, shippers were in the process of accumulating a combined negative imbalance of 26 TJ.

Under the MPOC, there is no requirement for producers to notify First Gas of scheduled outages unless they are requesting relief from peaking charges or interrupting gas flow at a welded point. In this case, SENZL was not requesting any such relief (although gas flow was arguably being interrupted). Therefore, it had no contractual obligation to send its intended profile to First Gas ahead of the scheduled outage.

We will continue to work with Producers to enable the proactive sharing of scheduled outage information even when it may not strictly be required under the operating codes.

Other relevant facts

Two other events are relevant to the response of First Gas to the events leading to the critical contingency on 23 May.

Odorant spill at the Pokuru Compressor Station

On the morning of 23 May, Gas Control received notification of a potential major gas leak near Te Awamutu. Subsequent investigations established that the issue was an odorant leak at First Gas' Pokuru Compressor Station. An odorant leak is a serious issue because not only is the chemical used flammable and toxic in concentrated form, it is also likely to prompt a raft of gas leak reports where there is none. Accordingly, the on-duty gas controller was liaising with the First Gas Field Services team responding to this issue and communicating with emergency services responding to the incident.

During the time that control room staff were responding to the odorant leak emergency, the CCO also made contact to discuss the Maui linepack situation. Gas control advised the CCO that Pohokura had a planned outage between 07:00 and 11:00, and noted the need for the CCO to be brief due to the odorant emergency that was also occurring. The need to respond to the odorant leak meant that the First Gas SCADA system was not switched to "event mode" (where SCADA information is provided more frequently) until approximately an hour after the initial discussion.

While event mode would normally be activated more quickly following a request from the CCO, we do not consider that this delay resulted in materially different outcomes on 23 May.

It is highly unusual for two critical events such as the odorant leak and a potential critical contingency to occur concurrently. The situation was exacerbated by the fact that some control room representatives were involved in training and weren't immediately available to respond (as would typically be the case). However, when the full facts of the dual emergencies became clearer, First Gas mobilised the necessary operational resources to the control room so that both emergencies could be managed in accordance with the standard policies and processes.

Communications fault at Huntly Power Station

The critical contingency event also occurred at the time of an ongoing communications issue with Huntly Power Station (HPS) that prevented real-time HPS SCADA information being provided to the First Gas control room. The cause of the issue was damage to a fibre cable

located on the HPS premises. First Gas operational personnel emphasised the importance of restoring real-time communications as a priority to Genesis Energy (the owner of the HPS).

The unavailability of communications at HPS did not have any adverse impact on linepack management or the cause or duration of the critical contingency event. First Gas remained in close contact with HPS personnel, and maintained good visibility of gas demand at HPS during the course of the communications outage.

5. ACTIONS AVAILABLE TO FIRST GAS

As will be clear from the description above, First Gas was managing linepack in the days leading up to the critical contingency event. However, it is important to consider what other options may have been available in these circumstances. The following subheadings explore three sets of tools that can be taken to respond to low linepack events such as this.

Procuring more gas to increase line pack heading into 23 May

On 22 May, First Gas bid for and secured 15 TJ of gas from the wholesale spot market. On 23 May, First Gas bid for gas and asked the market broker to obtain offers on our behalf, but no gas was offered on the market or available through the broker.

In addition to these actions, First Gas could have:

- Further increased the price of its bids on the market. First Gas has a trading protocol that guides our interactions with the market. The guidance in this protocol could have involved more rapid escalation of bids or exploration of alternative means to source gas when physical conditions require.
- Sought to obtain gas from other sources (e.g. under bilateral contracts). However, we did not explore this option on the day due to time constraints and did not have standing arrangements in place.
- Used non-Maui linepack, storage and contracted gas volumes to manage through the event. This action would likely have had only a limited impact given the smaller quantities of storage and gas supply available.

Curtailling nominations under the MPOC

Under Section 15.1 of the MPOC, First Gas has the ability to curtail the Scheduled Quantity (and consequently individual Shippers nominations) at Maui Pipeline Welded Points during certain circumstances, such as contingency events or emergencies. First Gas has published “Standing Operating Procedures” (SOPs) that provide further detail on how First Gas intends to carry out MPOC curtailments if the need arises.

On 22 May and 23 May, a number of “Flow to Scheduled Quantity” notifications were issued to Welded Points (and their associated Shippers) in accordance with the SOPs. These notices are a pre-cursor to potential curtailment, and are designed to give the affected parties an opportunity to take corrective action before being curtailed. SENZL at the Pohokura Production Station received a flow to scheduled quantity notice on the morning of 23 May.

Initiating curtailment at the Pohokura Production Station on the morning of 23 May as a result of flowing below Scheduled Quantity was considered. Due to the linked (“daisy-chained”) nature of Maui Pipeline Nominations between Receipt Point and Delivery Point, this would have also reduced Delivery Point nominations and ideally reduced demand at those Delivery

Points. However, the preference was for Pohokura to pack-back its intra-day imbalance, rather than curtail a party who is (or will be) injecting gas into the pipeline and consequently move the imbalance to the Delivery Welded Points that have less physical control and ability to respond.

First Gas also could have curtailed all Large Delivery Points in accordance with the SOPs on 22 May or 23 May. However, we would then be faced with the same potential issue referred to above, that demand side nominations are curtailed (with little or no actual physical demand response) leading to a corresponding reduction in Receipt Point Nominations (who are generally in a better position to respond and impact pipeline pressures).

There is a facility in the MPOC to enable either Receipt Point or Delivery Point nominations to be kept whole rather than both sides being reduced equally. This is known as releasing MPOC “Mismatch”, which needs to be repaid by a Shipper over a notified period and within certain limits or they will otherwise face financial consequences. This asymmetrical reduction in Scheduled Quantities between Receipt Points and corresponding Delivery Points may assist in addressing some of the potential anomalies associated with the “daisy chain” curtailments discussed above. However, we understand that earlier instances of Mismatch being released on the Maui Pipeline (around 2006-2008) resulted in significant industry disputes.

Increasing incentives for primary balancing

To address the systematic negative imbalance observed during April and May, First Gas could have:

- **Increased the increment applied to cash outs.** As described above, First Gas elected to increase this increment from 3% to 10% on 22 May. This could have been done earlier, as conditions in April suggested it was warranted.
- **Tightened the tolerances for meeting primary balancing obligation.** First Gas currently provides a tolerance (known as a ROIL) of 1.5 TJ of aggregate imbalance at each welded point (this was reduced from 2 TJ to 1.5 TJ in October 2016). This could have been reduced further to 1 TJ.

6. RECOMMENDATIONS ARISING FROM THIS REVIEW

It is difficult to conclude whether taking the actions listed above (either individually or in some combination) would have avoided the critical contingency on 23 May. However, our assessment is that we should take learnings out of this event to minimise the likelihood of a similar set of circumstances giving rise to critical contingencies in the future.

The table below presents both near term and long term actions recommended from this review. Near term actions are important to action quickly given that we are heading into winter (a time of relatively high demand for gas, particularly for electricity generation). Longer term recommendations need to enable First Gas to respond effectively to changing industry dynamics, including a potential increase in peaking power stations with peaky demands for gas transmission.

Table 1: Recommendations arising from this review

Recommended Actions for First Gas		
Near term actions	Expand tools to consistently manage Maui linepack to a target of 300 TJ or above	Amend Balancing Standard Operating Procedures to formalise increased flexibility linepack and processes to be followed to achieve this
		Fully update and revise trading protocol to support higher priced purchases ahead of cash outs, when required
		Negotiate bilateral contracts with counterparties that provide access to gas in situations where linepack is declining and First Gas is unable to access gas at reasonable prices via the market
		Review existing gas control processes to use system-wide line pack (including non-Maui) to avoid critical events where possible
	Improve First Gas processes to escalate issues and change from “normal” processes to “event” processes	Define triggers for escalating decisions and processes to include situations when: <ul style="list-style-type: none"> Level of balancing actions indicates that abnormal shipper behaviour is influencing ability to manage line pack Significant production station outages have been notified or appear possible that could use more than 30% of daily line pack tolerance First Gas is not able to operate the system in the desired mode (e.g. Mokau on)
		Alert senior management of change to “event” mode and involve in decision-making
		Increase level of communication between operations and commercial teams to resolve situation
		Incorporate the above actions formally in SOP revisions
	Explore improvements to First Gas’ ability to model or simulate pipeline conditions	Invest in forecasting models that allow scenarios to be tested (e.g. extended production outage, simultaneous increase in peak demands)
		Improve information on gas injection/use facilities to feed into forecasting model
		Enhance OPNs and improve lines of communications with gas producers
	Increase incentives on shippers to balance their own positions	Monitor ongoing impact of increase incentive from 3% to 10% of cash out price
		Assess a further decrease the ROIL at MPOC welded points from 1.5TJ to 1TJ
Longer term actions	Improve incentives for primary	Remove First Gas from current position as buyer and seller of gas of last resort, and encourage shippers to trade gas to balance their positions

Recommended Actions for First Gas		
	balancing in new code (GTAC)	Ensure level of running mismatch fees for unauthorised use of daily and hourly pipeline storage are sufficiently high to drive desired behaviour, integrated with a formal park and loan service. Consider how limits on pipeline storage should be set to avoid critical contingencies
	Improve information flows from producers to First Gas	Require notification and approval of scheduled maintenance in major delivery and receipt point ICAs
		Enable or require profiled/hourly nominations under the new code for parties that can materially influence linepack over short timeframes (such as peaking power stations)
	Coordinate review of CC thresholds (note was an action from 2016 CC performance review)	Review the threshold points (location and set point) in schedule 1 of the CCM Regulations with a view to recommending they be changed