



Shrinkage Leakage Model Review

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Gas Distribution Networks have an obligation under Special Condition 1F Part E of the License to review the Shrinkage and Leakage Model on an annual basis and to consult on the outcome of that review with other DN operators, gas shippers and interested parties.

Joint Gas
Distribution Network
submission

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Executive Summary

Gas Distribution Networks (GDNs) have an obligation under Special Condition 1F Part E of the Licence to review the Shrinkage and Leakage Model (SLM) on an annual basis and to consult on the outcome of that review with other DN operators, gas shippers and other interested parties.

The purpose of the SLM Review is to assess how the SLM can better achieve the objective set out in Special Condition 1F.13 of the Licence. This requires the SLM to be designed to facilitate the accurate calculation and reporting of gas shrinkage and gas leakage in, or from each, GDN operated by a Licensee.

As part of our ambition to increase stakeholder engagement and understanding we have taken the opportunity to pro-actively engage stakeholders as part of this publication with the view to understanding areas we should address and consider. The feedback we received is captured within this report with our associated commitments and responses to each.

Our licence obligation is to review the SLM to increase reporting accuracy however as a result of the stakeholder feedback we have incorporated additional elements to supplement understanding, increase awareness and to meet the stakeholder requirements.

The outcome of the joint GDNs 2015/16 SLM review is as follows:

Our Commitment	Further Detail	Owner	Next Steps
<p>We will investigate opportunities to use Smart Meter data to calculate leakage.</p>	<p>NIA proposal generated to determine required saturation of smart meters within networks to allow 'gas in' vs. 'gas out' calculations of leakage. The results will assist in determining how best we develop a project to help achieve our ambition that future leakage modelling would use smart metering data to determine actual losses, rather than reliance on current rates that were determined from the National Leakage Tests.</p>	<p>All DNs</p>	<p>Update in 2016 Shrinkage and Leakage Smart Metering Report.</p>
<p>We will propose a modification to AGI Venting calculations as a result of a successful asset collection exercise.</p>	<p>AGI Venting is calculated using a single value for each LDZ. This was determined as part of a report published in 1994 and is an area that both the DNs and stakeholders have identified as a potential improvement opportunity within the model.</p>	<p>NGGD</p>	<p>Raise modification to AGI venting calculation in 2016/17 with regular updates of progress at Shrinkage Forums.</p>

<p>We will continue to investigate the correlation between medium pressure leakage and system pressure.</p>	<p>Network innovation project commenced investigating the relationship between pressure and leakage on Medium Pressure systems and to identify the most appropriate methodology for estimating leakage from the UK's Medium Pressure gas supply networks.</p>	<p>NGGD</p>	<p>Potential modification to medium pressure modelling calculation in 2017/18 with regular updates of progress at Shrinkage Forums.</p>
<p>We will continue to investigate improvements to Own Use Gas and the associated modelling impact of using low carbon gas preheating equipment.</p>	<p>Complete the installation of the final 4 sites and continue collecting information for analysis. This will allow the model to be changed to an asset inventory calculation of leakage instead of a factor based approach.</p>	<p>NGN</p>	<p>Report results of initial tests in 2016/17 SLMR with progress updates at Shrinkage Forums.</p>
<p>We will develop proposals to better reflect the benefit of mains remediation in the model</p>	<p>Current leakage model does not reflect the reduction in leakage associated with mains remediation activities.</p>	<p>SGN</p>	<p>Proposals to be developed during 2016.</p>
<p>We will hold a periodic joint DN session to ensure continuity in accuracy of reporting.</p>	<p>Periodic joint DN review to ensure all data inputs into SLM and the calculation methodology continues to be used consistently.</p>	<p>All DNs</p>	<p>Scheduled for November 2015.</p>
<p>We will offer opportunities to increase industry awareness of shrinkage calculations.</p>	<p>DNs are keen to increase industry understanding of this complex area to promote ideas generation and collaborative working opportunities.</p>	<p>All DNs</p>	<p>Ongoing.</p>
<p>We will propose, as part of the 2016/17 SLMR, our future plans for reviewing Interference Damage rates.</p>	<p>Interference damage rates were last updated in 2004; we will consider the appropriate method for refreshing these rates and detail this in the next SLMR for consideration.</p>	<p>All DNs</p>	<p>Detail proposals for consideration as part of the 2016/17 SLMR.</p>

The outcome of this consultation will be submitted to the authority on 31 December 2015.

Background

Gas Distribution Networks (GDNs) have an obligation under Special Condition 1F Part E of the Licence to review the Shrinkage and Leakage Model (SLM) on an annual basis and to consult on the outcome of that review with other DN operators, gas shippers and other interested parties.

The purpose of the SLM Review is to assess how the SLM can better achieve the objective set out in Special Condition 1F.13 of the Licence. This requires the SLM to be designed to facilitate the accurate calculation and reporting of gas shrinkage and gas leakage in, or from each, GDN operated by a Licensee.

As part of our ambition to increase stakeholder engagement and understanding we have taken the opportunity to pro-actively engage stakeholders as part of this publication with the view to understanding areas we should address and consider. The feedback we received is captured within this report with our associated commitments and responses to each.

Our licence obligation is to review the SLM to increase reporting accuracy however as a result of the stakeholder feedback we have incorporated additional elements to supplement understanding, increase awareness and to meet the stakeholder requests.

We value all feedback and representations; responses to this document are encouraged and should be received no later 11 December 2015. Communication should be directed to Matt Marshall or via the Joint Office (contact details below).

Contact: Matt Marshall, Shrinkage Specialist,
National Grid Gas Distribution
Email: matt.marshall@nationalgrid.com
Telephone: +44 (0) 7812 651792
Write to: Matt Marshall, National Grid, Block 2,
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Alternatively,
Joint Office: enquiries@gasgovernance.co.uk

We are specifically interested to understand the following:

1. What is the area(s) of shrinkage that is of particular interest to you and that you feel requires review or mention as part of this annual review process that isn't sufficiently captured within this document?
2. We make reference to timescales for refreshing leakage rates and our associated plans within this document, are you comforted that these reviews are both realistic (considering the efforts required to substantiate these) and timely?
3. Is there any feedback you would like to share regarding this or previous Shrinkage Leakage Model Review documents?

Stakeholder Engagement

The distribution networks are committed to listening to interested parties to understand the main topics that could be addressed as part of this review. We have proactively sought feedback prior to issuing this consultation document using various techniques and forums:

1. Shrinkage forum engagement with opportunities offered to those who regularly attend to give feedback and input into the content of this review.
2. Engagement sessions with interested parties to determine areas of most interest.
3. Industry communications distributed with the opportunity to engage on a personal (via face to face sessions) or anonymous level via a simple targeted survey.

We value all the feedback we have received from these channels and this has contributed significantly to the content and subjects contained within this initial consultation document. We are disappointed that we were unable to gather the views from more stakeholders.

You said...	Our commitment...
<p>...you would like confidence that the rates used within the model are still fit for purpose and reflective of actual losses.</p>	<p>We believe the rates used to calculate shrinkage are still reflective of actual losses, however, within this document we detail our future commitments for reviewing each of the main components of shrinkage.</p>
<p>...you would like a visible plan of when leakage model rates and assumptions will be refreshed.</p>	<p>We detail our commitments within this document for each of the main components of shrinkage. We remain committed to investigating the possibilities of further increasing the accuracy of leakage modelling using Smart Meter data.</p>
<p>...you would like to see a reform in the methods used to calculate AGI Venting in the leakage model and move away from the rates determined in the Watt Committee report.</p>	<p>National Grid is leading a project to determine detailed asset venting at each AGI which would allow a methodology change to be implemented.</p>
<p>...you would like a review of the methods used to calculate Own Use Gas shrinkage volumes.</p>	<p>Northern Gas Networks are leading a review of methods used to calculate OUG.</p>
<p>...you would like to understand how the mains replacement planning procedure works and how we determine what pipes to replace.</p>	<p>We will provide a presentation via the Shrinkage Forum in early 2016.</p>
<p>...you would like to understand in more detail the mechanics of the Shrinkage and Leakage calculations.</p>	<p>We have detailed the calculations and assumptions within this document at a level to broaden understanding and we continue to offer the opportunity for personal bespoke overviews to interested parties.</p>
<p>...we should take the opportunity in the report to demonstrate some of the areas of success made in reducing Shrinkage</p>	<p>We have added a section to this report specifically focusing on Shrinkage reduction successes.</p>

Overview of Shrinkage

Shrinkage refers to the gas which is lost from the transportation network. Under the Unified Network Code (UNC), gas distribution network companies are responsible for purchasing gas to replace the gas lost through Shrinkage.

We estimate Shrinkage using an industry approved methodology and engineering model. The model applies pre-determined leakage rates but is updated annually for a number of activity based factors. The methodology used to determine Shrinkage quantities continues to evolve; this document details the DNs collective thoughts of how we can continue to improve the methodology and accuracy of the calculations. As part of this consultation, and throughout the annual lifecycle of the Shrinkage process, DNs are always interested in understanding where shippers and other interested parties believe elements of the methodology can be improved and would welcome this feedback.

Shrinkage is comprised of three elements (leakage, theft of gas and own use gas), of which leakage contributes around 95% of the total quantity. Detail of how each element is calculated is found later in this document.

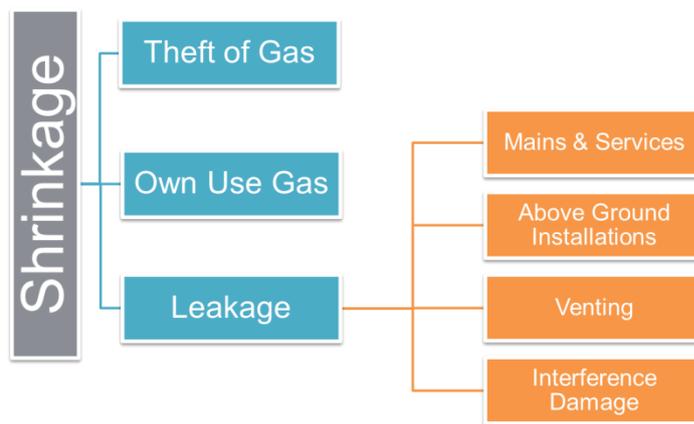


Figure 1: Breakdown of shrinkage also demonstrating the component parts of leakage

The Joint Office of Gas Transporters regularly host Shrinkage Forums throughout the year, the forum is open to all interested parties and attendance is strongly encouraged for those persons with an interest in gas distribution shrinkage. The Shrinkage Forum is an opportunity to connect with colleagues from the gas distribution and shipper community and share opinions, ideas and increase understanding.

Further information relating to the Shrinkage Forum can be found at:

www.gasgovernance.co.uk/SF

Components of Shrinkage

The engineering model calculates shrinkage using a series of leakage rates and assumptions. Our stakeholders told us that there was a knowledge gap in the industry of the methods used to determine shrinkage volumes. This section details each of the components of shrinkage which includes leakage assumptions, % influence of each component on the total volume, the calculation methods and our commitments to increasing accuracy in each area.

In 2002/03 a National Leakage Test (NLT) project was commissioned to repeat the leakage tests undertaken in 1992, these rates are used to determine leakage from low pressure mains and services and medium pressure mains. The leakage rates were determined using the pressure decay method, which was chosen as the leakage is deduced from an accurately measured drop in pressure. The project involved sampling 849 pipes and the results showed that in most cases the leakage rate for particular groups of mains were lower than found in 1992, principally in polyethylene, spun cast and pit cast iron material types.

Our stakeholders have told us that there is an appetite in the industry for refreshment of the leakage rates determined as part of the 2002/03 tests. Wales and West are leading our investigations into understanding the saturation levels and requirements of Smart Meter data to determine a robust 'gas in' vs. 'gas out' calculation of leakage. We are fully committed to embracing this new opportunity for even greater accuracy in the calculation of leakage and envision that this would supersede those rates determined in the NLT.

The DNs continue to undertake trials of advanced pipe remediation technologies which allow pipes to be repaired in situ; this avoids costly and disruptive replacement activities but could also have the benefit of introducing a new material category which does not leak.

Low Pressure Mains Leakage

Weighting: circa 60% of leakage.

Background: Leakage from low pressure mains is estimated by applying the leakage rates determined from the NLT programme carried out in 2002/03 to the mains asset records.

Calculation method: Asset length (km) x annual leakage rate x average system pressure correction¹ x Monoethylene Glycol² correction (where applicable).

Rates: 11 rates from 25 categories based on materials and diameters

Low Pressure Service Leakage

Weighting: circa 18% of leakage.

¹ Leakage rates were determined at 30mbarg pressure so require correction if pressures are greater or lower than this amount. The lower the average system pressure the less an asset will leak.

² Lead yarn joints leak less if Monoethylene Glycol is saturated in the gas, MEG treatment only impacts spun cast and pit cast assets. The higher the MEG saturation the greater the leakage reduction.

Background: Leakage from low pressure services is estimated by applying the leakage rates determined from the 2002/03 NLT, which provided an average leakage rate for each service classification.

Calculation method: Asset category x annual leakage rate.

Rates: 4 rates/categories (steel and PE service connections to PE or metallic mains)

Medium Pressure Mains Leakage

Weighting: circa 8% of leakage.

Background: Medium pressure (MP) leakage is estimated by applying the LP leakage rates at 30mbarg to the MP mains asset profile. The rationale for this is that the number of public reported escapes per km of MP main is of a similar order to that of the LP system.

Therefore, it is inferred that the mains must be leaking at a similar rate. Systems operating at higher pressures are constructed and tested to an appropriately higher level of integrity.

Unlike Low Pressure mains the calculation method for Medium Pressure mains doesn't include average system pressure correction. To improve the accuracy of the calculation a pressure related calculation of leakage may be better, which would also facilitate a mechanism for achieving and reflecting leakage reduction through effective pressure management. To achieve this it would be necessary to establish MP specific leakage rates; however, isolating sections of the MP system to undertake pressure decay tests is difficult due to the strategic importance of these mains to security or supply, even under low demand periods.

National Grid have raised a Network Innovation Allowance (NIA) project to investigate the relationship between pressure and leakage on MP systems and to identify the appropriate methodology for estimating leakage from the UK's MP gas supply network. This will result in a probable modification to leakage modelling methodology to allow the pressure related impact on the MP system to be realised within the model. This project is in its infancy and National Grid would expect to update the shrinkage community at Shrinkage Forums as and when applicable, along with future publications of documents such as this.

Calculation method: Asset length (km) x annual leakage rate.

Rates: 6 rates

Above Ground Installation Leakage

Weighting: circa 8% of leakage.

Background: The leakage from AGIs was determined via a national testing programme in 2002/03, which established average leakage rates for five types of AGI.

Calculation method: Asset quantity x annual leakage rate.

Rates: 5 leakage rates (gas holders, NTS offtakes, LTS offtakes, district governors, service governors)

Above Ground Installation Venting

Weighting: circa 5.5% of leakage.

Background: AGI Venting rates were determined as part of a 1994 Watt Committee Report, the derivation of this value is unknown and is a single fixed value for each LDZ.

GDNs have initiated site surveys (of which some are now complete) in support of a project raised by National Grid to review venting rates of the most commonly used pneumatic control equipment. If a modification to calculation methodology was successful, this would allow the venting estimation to move to an activity based calculation.

Calculation method: Fixed annual leakage volume per LDZ.

Rates: Fixed annual leakage volume per LDZ.

Interference Damage

Weighting: circa 0.5% of leakage.

Background: Interference damage is the gas escaping into the atmosphere as part of an unplanned escape usually caused by third party damage. Interference damage is split into two categories, above and below 500kg of gas released and is calculated using assumed leakage rates per incident together with an average response and repair time (for below 500kg incidents). The rates for interference damage calculations were refreshed in 2004.

Calculation method: Multiple scenarios

>500kg interference damages: If quantity of gas released is known the actual quantity is used, otherwise a value of 500kg is used.

<500kg interference damages: (Split between Mains or Service damage)

No. incidents x leakage rate x predetermined response/fix time

Rates: Multiple scenarios

>500kg interference damages: If quantity of gas released is known the actual quantity is used, otherwise a value of 500kg is used.

<500kg interference damages (Mains): No. incidents split 95:5 between low pressure and medium pressure incidents. Different leakage rate and response time for low pressure and medium pressure.

<500kg interference damages (Services): No. incidents split 50:50 between severed and punctured services. Different leakage rate and response time for severed and punctured services.

Theft of Gas

Weighting: circa 4% of shrinkage.

Background: Shrinkage includes an element of theft deemed 'transporter responsible'. This is currently estimated by applying a fixed 0.02% factor to throughput. However, the absolute level of theft, by its nature, is impossible to establish.

Calculation method: 0.02% of throughput.

Own Use Gas

Weighting: circa 2% of shrinkage.

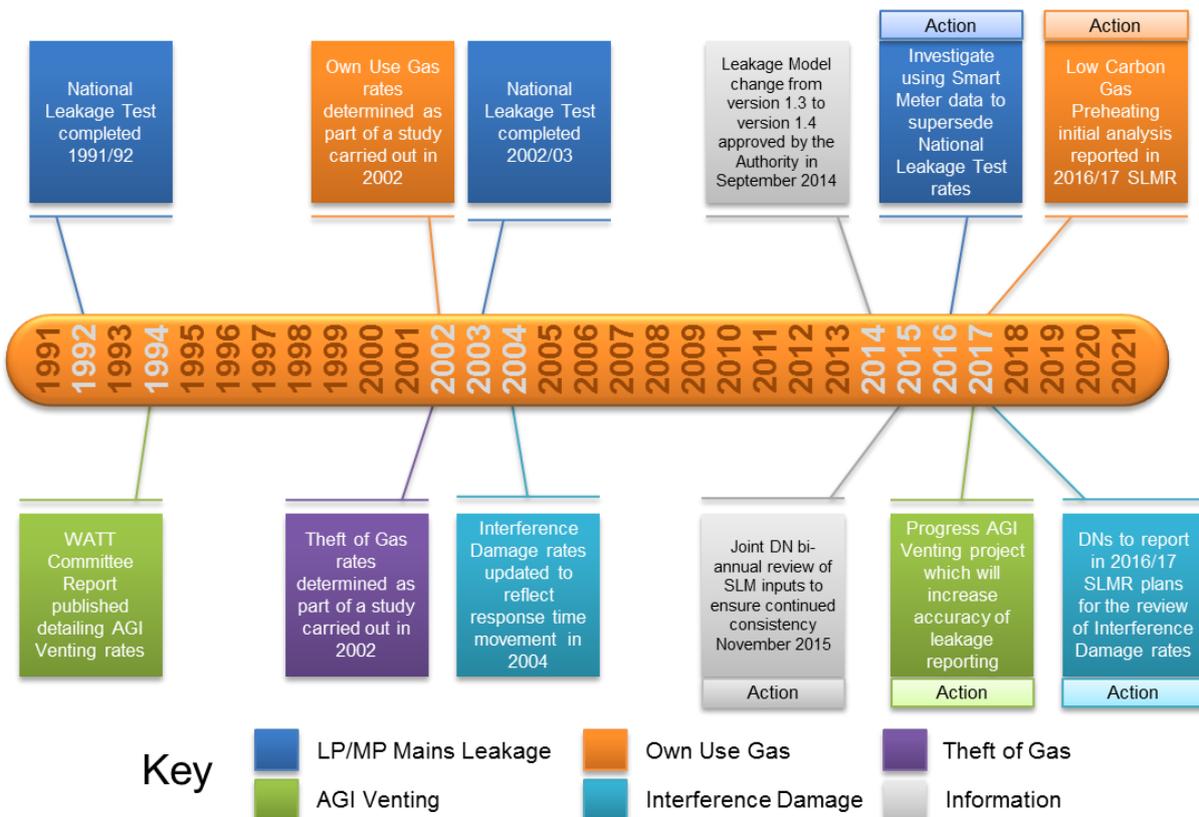
Background: Own Use Gas refers to gas used by the transporter for operational purposes, primarily pre-heating, but which does not pass through a meter. This is currently estimated by applying a fixed 0.0113% factor to throughput, which was established by a study carried out in 2002.

Northern Gas Networks have made significant progress investigating Low Carbon Gas Preheating. This involves installing and monitoring the operational efficiency of a representative sample of preheating technologies. 8 sites are currently live with data being reported for the past few months; the final 4 sites are currently under construction. To determine a robust data sample we would need to operate each of the 12 sites through a full heating season, with expected timescales for initial data analysis of the sample late 2016.

Calculation method: 0.0113% of throughput.

Shrinkage Components Timeline

The timeline below demonstrates the continued evolution of shrinkage methodology and our commitments to address each of the elements.



Successes in Reducing Shrinkage

Shrinkage forms the majority of a gas distribution network companies' business carbon footprint and accounts for around 1% of Great Britain's total greenhouse gas emissions. As such reducing losses aligns with achieving the UK government's emissions target and contributes to reducing customer bills.

Each DN continues to see incremental improvements in shrinkage reduction; the main component of this is from our mains replacement programme; however we have made progress in a number of areas which have seen a positive impact in reducing Shrinkage:

- Implementation of pressure profiling systems that automatically manage low pressure governor settings in line with customer requirements. This ensures networks run at the optimum levels to minimise lost gas, while at the same time achieving security of supply. Furthermore, continuous review of established profiling systems is carried out to ensure they remain relevant to other changes taking place on the LP network.
- Installation of new, and the replacement of any obsolete clocking systems to allow differential within day pressure settings on those networks where it may not be economically justified to install full pressure profiling.
- Focused approach to improving levels of mono-ethylene glycol saturations with the associated impact of reduction in Leakage from impacted material joint types.
- Introduction of more sophisticated management information to help support the management of networks, and allow early identification of underperforming areas and actions identified to resolve any issues.
- Reinforced governance around the management of temporary modifications to pressure settings.
- Optimisation of pressures on all-PE networks.

Our Commitments

As part of this review the DNs are making the following commitments.

Our Commitment	Further Detail	Owner	Next Steps
<p>We will investigate opportunities to use Smart Meter data to calculate leakage.</p>	<p>NIA proposal generated to determine required saturation of smart meters within networks to allow 'gas in' vs. 'gas out' calculations of leakage. The results will assist in determining how best we develop a project to help achieve our ambition that future leakage modelling would use smart metering data to determine actual losses, rather than reliance on current rates that were determined from the National Leakage Tests.</p>	<p>All DNs</p>	<p>Update in 2016 Shrinkage and Leakage Smart Metering Report.</p>
<p>We will propose a modification to AGI Venting calculations as a result of a successful asset collection exercise.</p>	<p>AGI Venting is calculated using a single value for each LDZ. This was determined as part of a report published in 1994 and is an area that both the DNs and stakeholders have identified as a potential improvement opportunity within the model.</p>	<p>NGGD</p>	<p>Raise modification to AGI venting calculation in 2016/17 with regular updates of progress at Shrinkage Forums.</p>
<p>We will continue to investigate the correlation between medium pressure leakage and system pressure.</p>	<p>Network innovation project commenced investigating the relationship between pressure and leakage on Medium Pressure systems and to identify the most appropriate methodology for estimating leakage from the UK's Medium Pressure gas supply networks.</p>	<p>NGGD</p>	<p>Potential modification to medium pressure modelling calculation in 2017/18 with regular updates of progress at Shrinkage Forums.</p>
<p>We will continue to investigate improvements to Own Use Gas and the associated modelling impact of using low carbon gas preheating equipment.</p>	<p>Complete the installation of the final 4 sites and continue collecting information for analysis. This will allow the model to be changed to an asset inventory calculation of leakage instead of a factor based approach.</p>	<p>NGN</p>	<p>Report results of initial tests in 2016/17 SLMR with progress updates at Shrinkage Forums.</p>

We will develop proposals to better reflect the benefit of mains remediation in the model	Current leakage model does not reflect the reduction in leakage associated with mains remediation activities.	SGN	Proposals to be developed during 2016.
We will hold a periodic joint DN session to ensure continuity in accuracy of reporting.	Periodic joint DN review to ensure all data inputs into SLM and the calculation methodology continues to be used consistently.	All DNs	Scheduled for November 2015.
We will offer opportunities to increase industry awareness of shrinkage calculations.	DNs are keen to increase industry understanding of this complex area to promote ideas generation and collaborative working opportunities.	All DNs	Ongoing.
We will propose, as part of the 2016/17 SLMR, our future plans for reviewing Interference Damage rates.	Interference damage rates were last updated in 2004; we will consider the appropriate method for refreshing these rates and detail this in the next SLMR for consideration.	All DNs	Detail proposals for consideration as part of the 2016/17 SLMR.

The outcome of this consultation will be submitted to the authority on 31 December 2015.