nationalgrid

Leakage Model Modification Draft Consultation

Proposed Revision of Low Pressure Service
Leakage and AGI Venting Calculations

Version 1.0

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Deadline for Response: To be discussed at the Shrinkage Forum to be held 6 January 2012

Target Audience: Shippers and any other parties with an interest in the estimation of emissions from gas distribution systems

Overview:

Gas Distribution Network Operators (GDNs) have an obligation under Special Condition E9 of their GT Licences to establish a Leakage Model and to consult with relevant shippers and other interested parties on any proposed modifications to it. The established National Leakage Assessment Model (Leakage Model) comprises a spreadsheet model and methodology documentation.

Special Condition E9 specifies that the Leakage Model shall facilitate the achievement of the accurate calculation of gas leakage from LDZs. Pursuant to this requirement, National Grid are proposing improvements to the Leakage Model to improve the accurate calculation of gas leakage in two aspects:

- Low Pressure Services
- Above Ground Installations

This document sets out details of the proposed changes, how they improve the calculation of gas leakage, and options for the timing of their implementation. The views of shippers and other interested parties on the proposals is sought.

Purpose of Document:

This document represents an initial stage in the fulfilment of the Licence obligation to consult on modifications to the National Leakage Model and gives interested parties a chance to review and inform the content of any formal modification proposal, which would be issued as a joint Distribution Network Operator proposal.

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Context

The Gas Distribution Price Control Review (GDPCR1) introduced new controls around the estimation of emissions from gas distribution systems; these controls being brought in to support the Shrinkage Incentive and the introduction of an Environmental Emissions Incentive.

Special Condition E9 of the GDN Licences introduced a number of obligations on Distribution Network Operators (GDNs), including:

- establishment of a leakage model;
- annual report of emissions;
- consultation on modifications to the leakage model

Associated Documents

GDN Licences, Special Condition E9.

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Summary

Special Condition E9 of the GT Licences requires GDNs to establish and maintain a Leakage Model and to regularly review the Leakage Model. National Grid has identified two potential improvements to the Leakage Model in respect of the Low Pressure Service and Above Ground Installation (AGI) venting calculations.

The GT Licences require that GDNs consult with shippers, and any other interested parties, on any proposed modifications to the leakage model. This document represents an initial stage in the fulfilment of this obligation and gives interested parties a chance to review and inform the content of any formal modification proposal, which would be issued as a joint Distribution Network Operator proposal.

The GT Licences also require GDNs to appoint an Independent Expert to review the Leakage Model and the proposed allowed leakage volumes and report on this review.

1. Introduction

1.1 Background

The 2008-2013 Gas Distribution Price Control Review (GDPCR1) introduced new controls around the estimation of emissions from gas distribution systems, these controls being brought in to support the introduction of the new Environmental Emissions Incentive. The new regime created an incentive for GDNs to reduce leakage.

The establishment of baselines for gas distribution leakage was a fundamental part of GDPCR1 in respect of Environmental Emissions. Ofgem requested GDNs to provide an estimate of leakage for the five year period covered by GDPCR1; this estimate was to include the impact of any initiatives for which specific funding would be available through the PCR settlement. For example, GDNs adjusted the leakage estimates to account for the impact of the mains replacement programme. Ofgem used the GDNs' submissions as a basis for setting the allowed leakage volumes for the Environmental Emissions incentive for the five years of GDPCR1.

GDN GT Licence Special Condition E9 (SCE9) covers the Environmental Emissions Incentive, the obligations around the Leakage Model, and the control mechanism on the Leakage Model to ensure that it accurately calculates leakage and, where reasonably practicable, is consistent across GDNs. Furthermore, SCE9 requires GDNs to review the model to ensure it achieves these objectives, to consult on changes to the model, to ensure that changes preserve the environmental emissions incentives, to appoint an independent expert to review the model and to submit a report to the Authority.

1.2 Current Leakage Model

The basic methodology used to estimate leakage in the current Leakage Model dates back to 1992[1] and estimates leakage in the following categories:

i) Low Pressure Mains

ii) Low Pressure Services

iii) Medium pressure Mains and Services

iv) Above Ground Installation (AGI) Leakage

v) Above Ground Installation Working Losses (Routine Venting)

vi) Interference Damage

In 2009, the low-pressure service methodology was updated to take account of replacement of steel services with PE services. However, the scope of the previous modification was limited to include service replacement from 2006/07 onwards, as this was the 'base year' on which the leakage allowances for the incentives were based. The original model assumptions were based on the relative populations of steel and PE services in the early 1990s. As there had been a significant amount of service replacement carried out in the intervening years up to 2006/07 that has not been accounted for, the original assumptions were out-of-date. The model change was progressed through the process outlined within SCE9 and was subject to consultation, '*Leakage Model Modification Consultation No. 01'*.

[1] The principles of the low-pressure mains and service leakage calculation, which accounts for approximately 80% of the current leakage estimation, have been unchanged since 1992, with the exception of a change to part of the service calculation in 2009, which was subject to consultation under the process set out in SCE9. An estimate of Medium Pressure leakage and Interference Damage were added in the late 1990s. In 2003, the leakage rates were updated and an estimate of AGI Leakage and Working Losses incorporated. In 2006, the Interference Damage calculation was updated to incorporate specific large gas release events. The last two updates were communicated to shippers and Ofgem via the Shrinkage Forum.

1.3 Purpose of this Document

This draft consultation introduces two potential modifications to the Leakage Model for review by interested parties prior to any formal modification proposal being issued.

1.4 Responding to this Document

We would welcome comments on all aspects raised within this consultation document, and in particular on the specific questions highlighted within the document.

There will be an opportunity to discuss all aspects raised in this consultation at the Shrinkage Forum, which has been arranged for Friday 6 January 2012[2].

Responses to this document can also be sent to:

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1.5 Independent Review

GDNs have an obligation, in line with SC E9 paragraphs 11 – 13, to appoint an Independent Expert to review the Leakage Model and the proposed allowed leakage volumes and provide a report of that review, including the implications of the proposed changes, within 28 days[3] of the close of the consultation.

It is expected that GL Noble Denton would be appointed as the Independent Expert to review any final modification proposal. GL Noble Denton was appointed as Independent Expert, via a tender process, for the previous model modification, of which part of this proposal is an extension. GL Noble Denton has previously had significant involvement in the creation of the leakage model, which has been used nationally since the early 1990s to estimate leakage, and its application.

[2] Shrinkage Forum details can be found on the Joint Office web site via the following URL: http://www.gasgovernance.co.uk/SF/060112

[3] Special Condition E9 paragraph 9(b)

2. Overview of Regulatory Regime

2.1 Leakage Model Obligations

Under SCE9, GDNs are obliged to establish a Leakage Model[4] that facilitates the achievement of the objectives[5]:

(a) the accurate calculation and reporting of gas leakage from each of the LDZs operated by the licensee; and

(b) being consistent with, and where reasonably practicable, identical to Leakage Models used by other DN Operators.

SCE9 also requires that any modification to the established leakage model be approved by the Authority and that shippers and other interested parties should be consulted. The consultation should set out the proposed modification to the Leakage Model and whether the allowed leakage baseline volumes (used within the environmental emissions incentive) should be revised and allow consultees a period of not less than 28 days in which to make representations.[6]

In addition to the consultation process, GDNs have an obligation to appoint an independent expert to review the Leakage Model and the proposed allowed leakage volumes and provide a report of that review.[7]

2.2 Allowed Leakage Volumes

The allowed leakage volumes applicable for the Environmental Emissions Incentive, for each year from 2008/09 to 2012/13 and for each LDZ, are set out in SCE9 Annex P of the relevant Gas Transporter Licence.

SCE9 requires that, when a modification is proposed, the GDNs propose revised allowed leakage volumes that retain the incentive properties of the environmental emissions incentive at the same level as those applicable prior to the proposed change.

The proposed revised allowed leakage volumes are shown within Appendix A.

[4] Special Condition E9 paragraph 3
[5] Special Condition E9 paragraph 4
[6] Special Condition E9 paragraph 9(a)
[7] Special Condition E9 paragraph 11

3. Proposed Service Leakage Model Modifications

In the original Leakage Model, there were a number of assumptions regarding the population split of steel and polyethylene (PE) services:

- one-third of all services on a mixed material network are steel;
- the percentage of steel services attached to PE mains is 18.7097%; and
- PE services are assumed to be evenly distributed between PE and metallic mains, by length.

These assumptions were used in the creation of the leakage model in 1992 and are, therefore, significantly out-of-date leading to an inaccurate assessment of service leakage. In addition, these assumptions were based on analysis at a national level and do not reflect the particular characteristics of the LDZs where they are now applied.

It has been GDN policy to replace, rather than reconnect, steel services following work on a main; however, in the early years of mains replacement reconnection of a steel service was allowed if found not to leak when tested. This has led to a significant reduction in the number of steel services. The current Leakage Model does not reflect this and therefore over-estimates leakage.

The Leakage Model recognizes four categories of low pressure service connection, each of which has a leakage rate determined from the National Leakage Tests (NLT); however, the 2002/03 NLT determined that both steel and PE service connections to PE mains have a zero leakage rate:

- Steel service connections to metallic mains – 10.6m^3/annum/service leakage
- PE service connections to metallic mains – 2.2m^3/annum/service leakage
- Steel service connections to PE mains – zero leakage
- PE service connections to PE mains – zero leakage

Each year, GDNs replace approximately 3,500km of metallic main with PE. During this process, steel services are 're-laid' with PE and connected to the new PE main and existing PE services are 'transferred' to the new main.

In 2009, the GDNs proposed a modification to the Leakage Model to facilitate the inclusion of the reduction in emissions associated with service replacement. The revised methodology effectively 'fixed' the number of steel services assumed at the time the incentive allowances were set in 2006/07 and subtracted from this the cumulative number of services replaced in subsequent years. However, the assumed populations in 2006/07 were based on the original out-of-date assumptions. This consultation proposes a methodology that will correct for this. In addition, the current methodology only takes account of the leakage reduction associated with those services that have been 're-laid', where, clearly, there is an additional leakage reduction associated with transferred services.

The proposed modification to the low pressure service leakage calculation is twofold:

- Establish a better estimate of the current service population for each LDZ
- Take account of the leakage reduction associated with service transfers

3.1 Establishment of Current Service Populations

The proposal is to use the latest three years mains replacement mains lengths, service relays and transfers data[8] to determine the proportion of each type of service connection to metallic mains over this period for each LDZ and to deem this representative of the overall population of service connections to metallic mains for the LDZ. The level of replacement done over a three year period provides a substantial sample of connections, which will lead to a statistically valid estimate of the population; details are provided in Appendix B.1.2.

[8] As reported for the 2008/09, 2009/10 & 2010,11 RRP Submissions

All service connections to PE mains have zero leakage and therefore the steel/PE service mix of such connections does not matter for leakage derivation purposes. For completeness, we propose to utilise data on the mix from the 2002/03 National Leakage Tests (NLT).

This will establish new values for the four service categories for the base year, which will be 2010/11. For the subsequent years, the population values will be derived from these base year values along with the known year-on-year service replacement and relay numbers, in the same manner as at present. The methodology is set out in detail in Appendix 0B.1.

It is the Proposers' view that this methodology will produce an improved estimate of current service populations that reflects the latest data for each LDZ, thus increasing the accuracy of the leakage model and better facilitating the accurate calculation of leakage in accordance with Special Condition E9 paragraph 4(a).

3.2 Leakage Reduction Associated with Service Transfers

Following the establishment of new service populations for the base year, 2010/11, the leakage model will have an estimate of the number of services in each of the four categories:

- Steel service connections to metallic mains
- PE service connections to metallic mains
- Steel service connections to PE mains
- PE service connections to PE mains

The current model takes account of re-laid services each year by subtracting these from the number of 'steel service connections to metallic mains' category but does not take into account transferred services in a year. There appears no good reason to ignore transferred services. It is proposed, therefore, that the annual updating methodology should include the impact of transferred services; this being achieved by subtracting the number of service transfers from the 'PE service connections to metallic mains' category. The number of service re-lays and transfers will be added to the 'PE service connections to PE mains' category[9]. Detailed analysis of the methodology is included in Appendix B.

It is the Proposers' view that this change improves the accurate calculation of leakage in accordance with Special Condition E9 paragraph 4(a).

[9] Again, this is for completeness, as these service connections have a zero leakage rate

4. Proposed Above Ground Installation Venting Model Modification

Currently, the leakage model assumes a fixed level of venting from Above Ground Installations. This level is that quoted in a 1994 Watt Committee report; however, the quoted value is single value for the UK and its derivation is unknown. The leakage model allocates this value across the thirteen LDZs based on the number of AGIs that typically have routinely venting equipment[10]. As the derivation of the AGI Venting estimate is unknown, this remains unchanged in the leakage model each year.

It is proposed that site-specific data be used to estimate the amount of AGI venting for each LDZ. The advantages of this are that the estimate would be reflective of current equipment in each LDZ and would have a known derivation. The venting estimate would be 'activity' based, i.e. it would be linked to specific equipment, and as such, it would be possible to reflect changes associated with any replacement activity.

However, steady-state venting is not the only venting that takes place at AGIs. Equipment that routinely vents also has additional venting when physically controlling actuator movement. The associated level of this venting is very difficult to determine as it depends on the number of control actions taking place. It is proposed that a 25% uplift to steady-state venting be applied to account for this; however, given that this is only an arbitrary value, it is considered that this volume should not form part of the incentive. Therefore, this level of venting could either be included as a fixed element within the leakage model or simply omitted.

The proposed AGI Venting calculation is shown in detail in Appendix B.3

It is the Proposers' view that this is a better methodology for estimating steady-state AGI Venting leakage that improves the accurate calculation of leakage in accordance with Special Condition E9 paragraph 4(a).

[10] Gas Holders, NTS and LTS offtakes

5. Implementation

There are three options to consider with regard to the timing of implementation of the proposed changes:

5.1 Implementation within the current price control period (GDPCR1)

If the proposed changes were to be implemented within GDPCR1:

- GDNs would need to propose a revision to the allowed leakage baseline volumes, referred to as $LB_{t,i}$ in the GDN Licences for the relevant remaining year(s) of GDPCR1. The possible revised volumes are included in Appendix A
- The revised model would apply to the next leakage assessment, which would be that for the 2011/12 formula year, if approval were to be obtained before end July 2012, and would be that used for the Shrinkage Proposal and Assessment and Adjustment processes.

5.2 Implementation for the next price control period (RIIO-GD1)

If the proposed changes were to be implemented in time for RIIO-GD1:

- GDNs would need to include an estimate of the impact of the changes within their final business plan submissions in April 2012
- The existing allowed leakage volumes for the GDPCR1 period would be consistent with the current model and, hence, there would be no need to propose new volumes for this period.

5.3 Split implementation

Two changes to the methodology are proposed. If there are valid reasons, it is possible that implementation of the two changes could be at different times.

6. Assessment of Modifications against Relevant Objectives

The proposed modification to the Leakage Model needs to be considered against the relevant GT Licence objectives:

i) Special Condition E9.4: The Leakage Model shall facilitate the achievement of the following objectives –

(a) the accurate calculation and reporting of gas leakage from each of the LDZs operated by the licensee; and

(b) being consistent with, and where reasonably practicable, identical to Leakage Models used by other DN Operators.

Implementation of this proposal will better facilitate this relevant objective, in particular the accurate calculation and reporting of gas leakage. The proposed modification would result in an improved estimate of leakage for each LDZ that reflects the latest data within each LDZ.

ii) Standard Special Condition A11.1 (d): so far as is consistent with sub-paragraphs (a) to (c) the securing of effective competition: (i) between relevant shippers; (ii) between relevant suppliers; and/or (iii) between DN operators (who have entered into transportation arrangements with other relevant gas transporters) and relevant shippers;

Implementation of this Proposal will better facilitate this relevant objective, in particular the securing of effective competition between relevant shippers. Implementation of this proposal will improve the accuracy of the leakage estimation, leading to an improved distribution of costs under the RbD process.

7. Consultation Questions

Respondents' views are sought on all aspects of the proposals but in particular, on the following:

i) Should data from the latest three years of mains replacement be used to determine the mix of service populations for a new base year (2010/11)?

ii) Should the low pressure service leakage model reflect the impact of service transfers so as to improve the accuracy of the leakage calculation?

iii) Should site-specific equipment and manufacturers data be used to provide an estimate of steady-state venting at Above Ground Installations?

iv) Should an uplift factor of 25% on the steady-state venting estimate be applied to account for non-steady-state venting or is some other factor, or omission of the factor, more appropriate?

v) Should the proposals be implemented:

   a. Within the current price control period and beyond?

   b. Only from the start of the next price control period?

   c. Split implementation of the two proposals?

vi) If the proposals are implemented within the current price control period, are the revised allowed leakage volumes appropriate to maintain the incentive properties of the environmental emissions incentive at current levels?

vii) Is it appropriate to engage GL Noble Denton as the Independent Expert to review the Leakage Model and the proposed allowed leakage volumes and then provide a report of that review?

Appendix A Proposed Revised Allowed Leakage Volumes for Environmental Emissions Incentive

The table below shows the proposed revised allowed leakage volumes for the Environmental Emissions Incentive consistent with the proposed modifications. Details of the derivation of these values can be found in Appendix B.4.

GDN	LDZ	Combined		LP Service Modification Only		AGI Venting Modification Only	
		2011/12	2012/13	2011/12	2012/13	2011/12	2012/13
National Grid Gas Distribution	EA	249	247	251	248	267	266
	EM	367	363	345	340	403	401
	NT	329	323	328	323	369	365
	NW	455	447	424	415	486	481
	WM	354	348	358	351	367	363

Appendix B Supporting Analysis

B.1 Determination of service populations for new base year (2010/11)

B.1.1 Proposed methodology for application within the Leakage Model

Each year, GDNs replace in the order of 3500km of metallic main. When replacing a main, it is policy to not reconnect steel services, i.e. any steel service connections to the original main are replaced, or 're-laid', with PE services. Any PE services that were connected to the original main are transferred to the new main. Data regarding the level of mains replacement and any associated service 're-lays' or 'transfers' is included within the regulatory reporting to Ofgem. It is proposed to use this data to estimate the relative service populations over the past three years, thereby setting a new baseline from which the forward replacement and transfer of services can be taken into account in the same way as that in the current methodology.

The table below shows a summary the mains replacement data for the last three years:

GDN	Length of main replaced (km)	Number of Relays	Number of Transfers	Relays /km	Transfers /km
East of England	2,156	90,053	95,468	42	44
London	1,071	44,180	33,615	41	31
North West	1,783	79,465	55,842	45	31
West Midlands	1,199	60,801	41,609	51	35

To determine the relative populations of service connections to PE mains, we propose to use data relating to PE mains from the 2002/03 National Leakage Tests:

Number of Tests	Length of Main Tested (km)	Number PE Services	Number Steel Services	Total number Services	PE Service %	Steel Service %
81	7,039	770	14	784	98.20%	1.80%

To determine the baselines:

i) the number of steel services per km of metallic main = service 're-lays' / length of main replaced

ii) the number of PE services per km of metallic main = service 'transfers' / length of main replaced

iii) the number of steel services in each low pressure network = the number of steel services per km of metallic main x the length of metallic main in the network

iv) the number of PE services in each low pressure network = the number of PE services per km of metallic main x the length of metallic main in the network

v) the number of service connections to PE mains[11] in each low pressure network = total number of services – number of steel services

vi) the number of PE service connections to PE mains = the number of service connections to PE mains x PE Services %

vii) the number of steel service connections to PE mains = the number of service connections to PE mains x steel services %

B.1.2 Worked Example

For Cambridge network in Eastern (EA) LDZ, which is part of East of England Network:

Metallic Length = 256km; Total Number Services = 59,321

Number Steel Service Connections to Metallic Mains = Relays/km x Metallic Length
= 42 x 256

[11] The current leakage model identifies the leakage associated with service connections to both metallic and PE mains. However, the 2002/03 National Leakage Tests determined the leakage from service connections to PE mains to be zero. For completeness, it is proposed to maintain the service connections to PE mains within the current leakage model, albeit that this will return zero leakage.

	=	10, 752
Number PE Service Connections to Metallic Mains	=	Transfers/km x Metallic Length
	=	44 x 256
	=	11,264
Total no. service connections to metallic mains	=	10,752 + 11,264
	=	22,016
Total no. service connection to PE mains	=	59,321 – 22,016
	=	37,305
Number PE service connections to PE mains	=	37,305 x 98.2%
	=	36,634
Number steel service connections to PE mains	=	37,305 x 1.8%
	=	671

In summary:

No. Steel service connections to metallic mains	No. PE service connections to metallic mains	No. PE service connections to PE mains	No. steel service connections to PE mains	No. steel service connections to PE mains
10,752	11,264	36,634	671	59,321

B.2 Calculating the Impact of Service Population Movement

The annual service workload activity is recorded, on an LDZ basis, and reported to Ofgem through the regulatory reporting process. The leakage model currently uses this information to estimate the impact of replacement of steel services with PE. It achieves this by apportioning the total LDZ service replacement workload by the proportion of steel services within each constituent network within the LDZ. It is proposed to extend this methodology to take account of the impact of the service transfer activity. The proposed revised methodology to capture the leakage reduction for both service transfers and replacement activity is shown in the worked example below.

B.2.1 Worked Example

Assume that:

- the total number of steel and PE services connections to metallic mains in the LDZ for the baseline year (2010/11) is 255,000 & 270,000, respectively, calculated using the methodology above for each network within the LDZ;
- 20,000 steel services are replaced in 2011/12 and 25,000 in 2012/13, i.e. 45,000 in total by 2012/13;
- 25,000 PE services are transferred in 2011/12 and 30,000 in 2012/13, i.e. 55,000 in total by 2012/13; and
- there are now 60,000 consumers attached to the network

The number of services in 2012/13 for the Cambridge network, using the service populations calculated in B.1.2 above, would be calculated as:

i) Number of steel services connections to metallic mains

= Baseline No. – No. Replaced in LDZ x % of Service Category
= 10,752 – 45,000 x 10,752 / 255,000
= 10,752 – 45,000 x 4.2%
= 10,752 – 1,897
= 8,855

ii) Number of PE service connections to metallic mains

= Baseline No. – No. Transferred in LDZ x % of Service Category
= 11,264 – 55,000 x 11,264 / 270,000
= 11,264 – 55,000 x 4.2%

= 11,264 – 2,295
= 8,969

iii) Number of steel service connections to PE mains

= Base year number
= 671

iv) Number of PE service connections to PE mains

= Total no. connections – All other service connections
= 60,000 – (8,855 + 8,969 + 671)
= 41,505

B.3 Proposed methodology for determining AGI Venting leakage

There are two pieces of equipment at AGIs that typically vent gas under steady-state conditions, Positioners and Controllers. These pieces of equipment are designed to work with compressed air; however, they were adapted to work with compressed gas, as this was readily available on site. Each AGI has a number of Positioners and Controllers and there are usually more Controllers than Positioners.

Annual Venting Rate is calculated as:

$$\dot{V} = \frac{\dot{v}_{ss}}{35.366} \times \frac{P_{Act}}{P_{ref}} \times 60 \times 24 \times 365 \times N$$

Where

$\dot{V}$ is the total annual venting rate for the equipment type at the AGI

$\dot{v}_{ss}$ is the steady - state venting rate for the equipment type in scf/min

35.366 is the conversion from scf to scm

P_{Act} is the actual operating pressure of the control system

P_{ref} is the specified operating pressure at which the quoted venting rate is applicable

N is the number of units of the equipment type at the AGI

A typical calculation is shown below. Venting rates are quoted at a specified operating pressure. The pneumatic control systems at AGIs tend to operate at 70psi and a linear relationship is assumed for venting.

Equipment Type	Steady-state venting rate (scf/min)	Specified operating pressure (psi)	Mean operating pressure (psi)	Venting rate per device (scm/day)	Number of units on site	Annual venting rate (scm/yr)	25% uplift for non steady-state conditions (scm/yr/site)
Positioners	0.20	20	70	28.5	5	52,016	65,020
Controllers	0.05	20	70	7.1	9	23,407	29,259
					Total	75,423	94,279

B.4 Determination of revised Allowed Leakage Volumes consistent with proposals

To determine revised allowed leakage volumes for the environmental emissions incentives consistent with the proposed modifications, the output of the proposed revised model has been compared to that of the original leakage model that was used to determine the current incentive allowed leakage volumes[12].

[12] These can be found in Special Condition E9 Annex P of the Gas Transporters' Licences

B.4.1 Impact of Changes to the Low Pressure Service Calculation

The impact of reflecting the new service populations has been estimated by comparing the revised leakage model output with that of the original model using 2010/11 data.

To estimate the impact of reflecting the leakage reduction associated with the movement in the service population has been estimated using the lengths of planned mains replacement and the relative proportions of service connections to metallic mains (shown Appendix B.1.1).

- The impact of service replacement is calculated as:
  - Mains Replacement Length x 'Relays/km' x Leakage Rate
- The impact of service transfers is calculated as:
  - Mains Replacement Length x 'Transfers/km' x Leakage Rate
- For estimating the impact in 2012/13, the total length of replacement from 2010/11 is taken into account, as it is a cumulative impact in the model.

GDN	LDZ	2010/11 – Service Leakage (GWh)			Impact of taking account of movement in service populations (GWh)		Combined Impact (GWh)	
		Original Model	Revised Model	Change	2011/12	2012/13	2011/12	2012/13
National Grid Gas Distribution	EA	51	35	-16	-2	-3	-17	-19
	EM	78	45	-33	-2	-5	-35	-38
	NT	82	44	-38	-2	-3	-40	-41
	NW	89	60	-29	-3	-7	-31	-35
	WM	64	53	-11	-2	-4	-13	-16

B.4.2 Impact of Changes to the AGI Venting Calculation

GDN	LDZ	No. Sites	Estimated Venting (scm p.a.)		Impact		
			Original Model	Revised Model	Volume (scm)	Energy (GWh)	%
National Grid	EA	14	1,434,601	1,319,908	-114,693	-1	-8%
	EM	36	1,353,090	3,394,048	2,040,958	23	151%
	NT	17	1,556,868	1,602,745	45,877	1	3%
	NW	50	1,817,705	4,713,955	2,896,250	31	159%
	WM	13	1,565,020	1,225,628	-339,392	-4	-22%

B.4.3 Impact on Environmental Emissions Allowed Leakage Volumes

Period	LDZ	Original Allowed Leakage Volume	Impact Of Modifications		Revised Allowed Leakage Volume		
			LP Service	AGI Venting	Combined	LP Service Mod Only	AGI Mod Only
2011/12	EA	268	-17	-1	249	251	267
	EM	380	-35	23	367	345	403
	NT	368	-40	1	329	328	369
	NW	455	-31	31	455	424	486
	WM	371	-13	-4	354	358	367
2012/13	EA	267	-19	-1	247	248	266
	EM	378	-38	23	363	340	401
	NT	364	-41	1	323	323	365
	NW	450	-35	31	447	415	481
	WM	367	-16	-4	348	351	363