Evaluating the gas mains replacement programme – preliminary findings

Presentation to capex Working Group

15 November 2010

- Context and motivation for the study
- Analysis of costs
- Analysis of benefits
- Annexe (detailed cost methodology)

We have been commissioned to evaluate the costs and benefits of continuing with the HSE's repex programme

Since 2001, the HSE has required GDNs to accelerate the replacement of all cast iron and ductile mains within 30 metres of buildings

Opportunity to re-examine the case for the programme

- HSE to review the programme in 2011
- Next price control starts in 2013 – need to agree repex allowances
- First chance to take stock of programme since 2006-07

Centrica keen to engage with industry – has commissioned Frontier to evaluate whether the programme is delivering "value for money"

We estimate the incremental costs associated with the accelerated programme…

…and weigh these against any incremental benefits, such as:

- fewer injuries and fatalities;
- reduced shrinkage

This is new territory: HSE has never formally considered the costs and benefits of programme

The *Pipeline Safety Regulations 1996* provided the framework for HSE's 2001 review…

Regulation 13

"The operator shall ensure that a pipeline is maintained in an efficient state, in efficient working order and in good repair"

Regulation 13A
(introduced following 1999 incident at Larkhall)

"(1)…the Executive shall approve…a programme…if it is satisfied that the programme…is suitable and sufficient for the period to which it relates

"…(5) The operator shall so far as is practicable comply with a programme approved under this regulation"

Means that HSE made 2001 decision on grounds of "practicability"– required replacement rate of 3,580km/year because this was close to the highest rate that Transco had achieved historically

…meant that HSE based decision on "practicability", not value for money

In 2001, HSE considered three possible timeframes:

25 yrs	✗ Would imply 4,300 km/yr – "not practicable"
30 yrs	✓ Fastest practicable option (3,580 km/yr)
35 yrs	✗ Practicable, but could be faster

HSE did look at costs, but did not formally base decision on them

Moreover, it is likely that the balance between the costs and the benefits will have changed since 2001…

Reported that the costs of the accelerated programme have increased since 2001…

In July 2010, Ofgem suggested that the costs of the programme may have doubled to £24 billion between 2003 and 2010…

…and questioned whether the programme was still "proportionate and sustainable"

…whereas the benefits of continuing with the accelerated programme are likely to be diminishing

GDNs have prioritised replacement of highest-risk mains

We understand that the first 25% of the replacement programme may have removed ~60% of the modelled risk …

…and little evidence of 'bathtub' effects to date

… providing an additional rationale for the study

- Context and motivation for the study
- Analysis of costs
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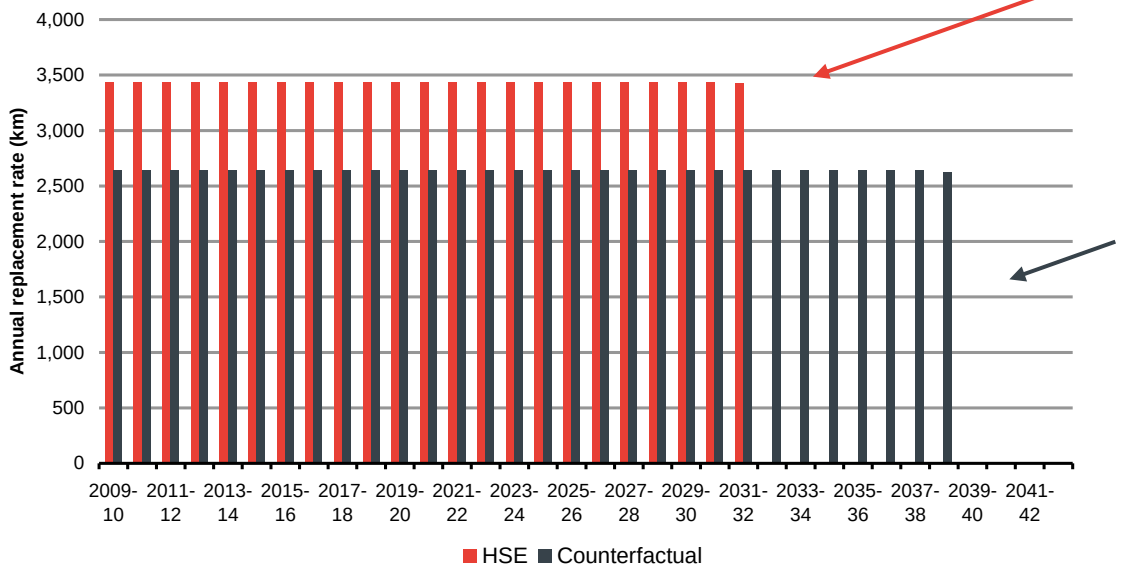
We consider the impact of continuing with the HSE's accelerated repex programme

HSE's 2001 review required programme to be completed by 2031-32

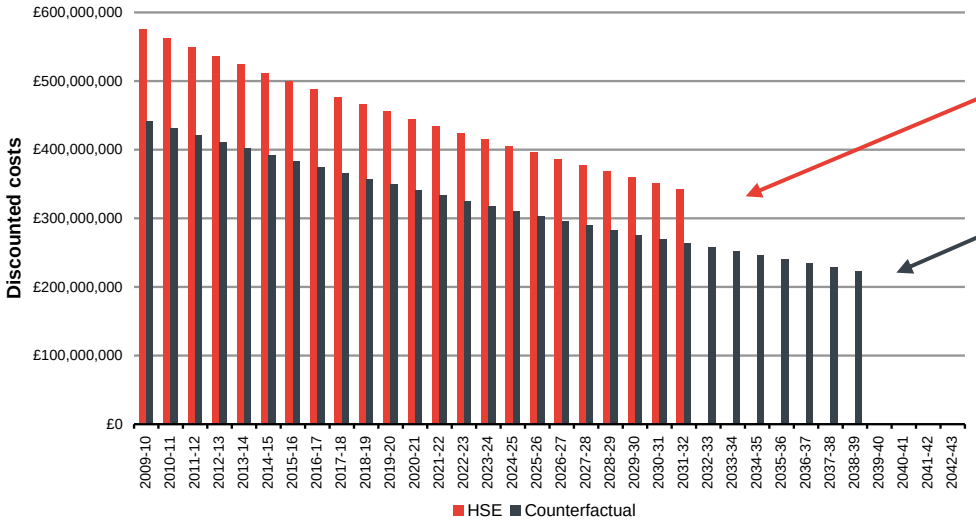
As of 2010, just over 79,000km of "at risk" mains still need to be replaced

Implies that, going forward, a replacement rate of 3,440 km/year is required to meet HSE target



We compare HSE programme to a 'counterfactual' scenario in which the replacement rate is 2,650 km/year, in line with the historical average replacement rate for 1977-2001

We estimate that this will lead to a cost increase of >£700m over the remaining life of the programme…



Discounted cost of HSE programme	£10.3bn
Discounted cost of counterfactual programme	£9.6bn
Incremental cost	£735m

…to put this in context, predicted benefits from DN sales were £225m

We have made a number of assumptions in calculating these discounted incremental costs

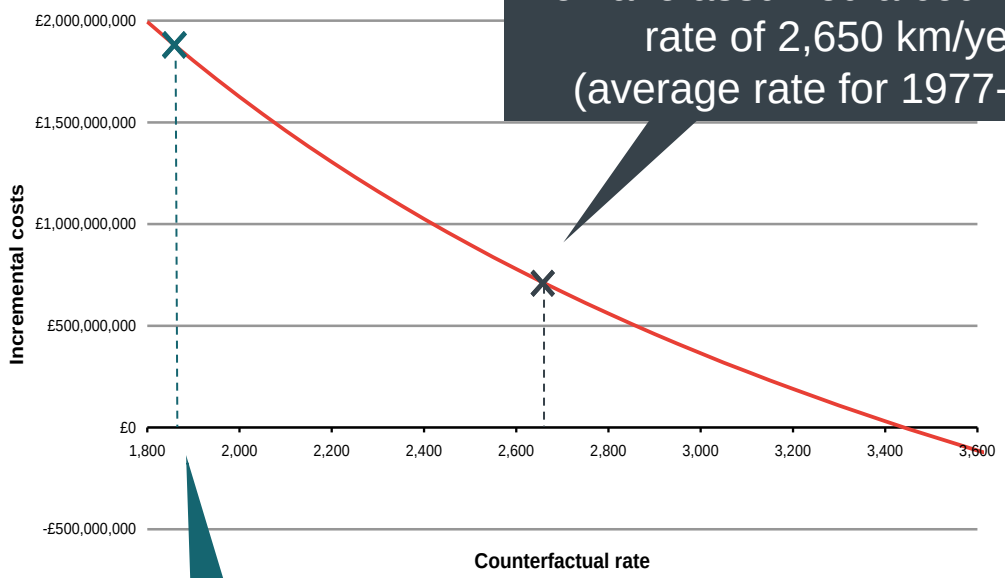
Counterfactual replacement rate	2,650 km/year	Based on average rate for 1977-2001	Too conservative? 1996-2001 rate just 1,840km/year
Discount rate	3.5%	Based on Green Book	
Real Price Effects	1.1% per annum	Based on DPCR5	Net effect is 1.1% per annum - too high?
Efficiency savings	0% per annum	Conservative assumption	
Service repex	44% of size of mains repex	Based on GDPCR1	

…though we have also studied the sensitivity of this cost estimate to variations in underlying assumptions

Counterfactual replacement rate (km/year)

Real price effects

Service repex



We have assumed a counterfactual rate of 2,650 km/year (average rate for 1977-2001)

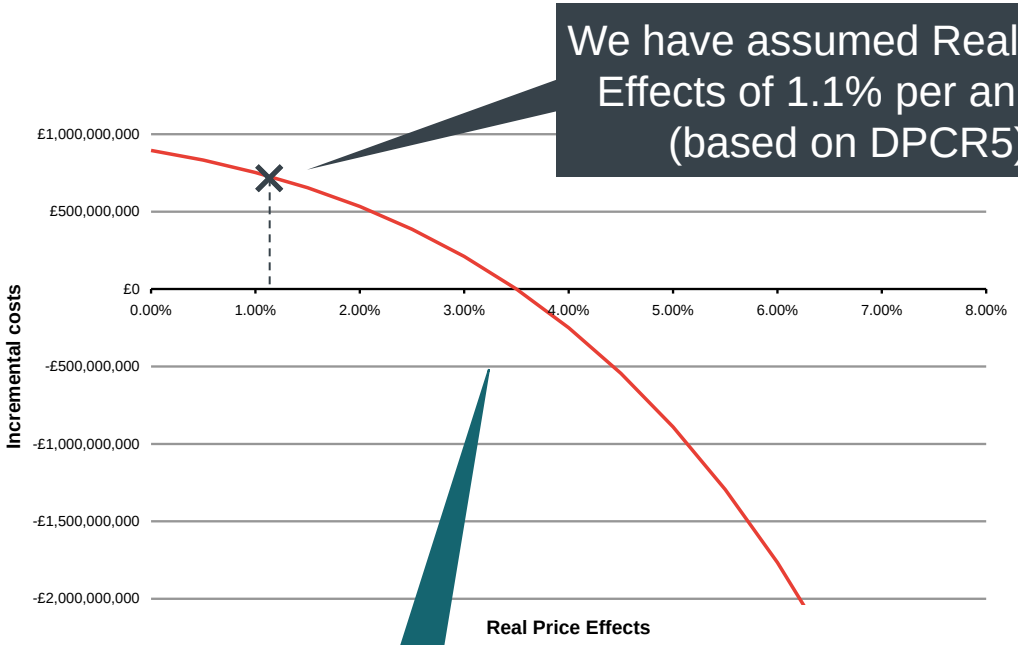
Using a rate of 1,840 km/year (the average rate between 1996 and 2001) would increase the incremental cost to £1.9bn

…though we have also studied the sensitivity of this cost estimate to variations in underlying assumptions

Counterfactual replacement rate (km/year)

Real price effects

Service repex



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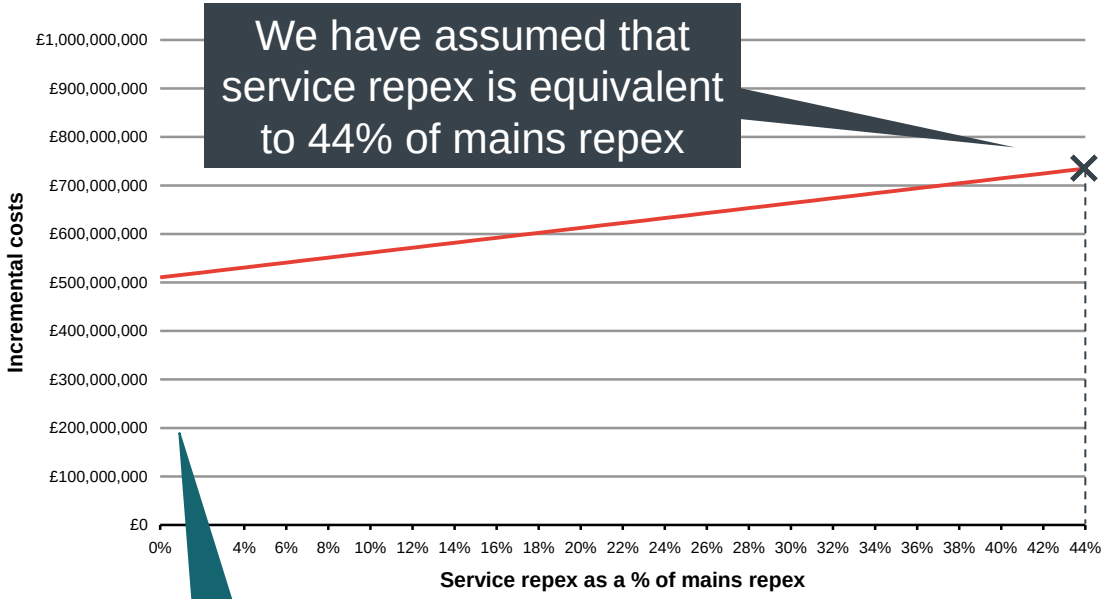
Counterfactual replacement rate (km/year)

Real price effects

Service repex



Reducing assumed amount of service repex would reduce incremental cost of HSE programme

However, even if we were to exclude service repex from the analysis altogether, the incremental cost would still exceed £500m

- Context and motivation for the study
- Analysis of costs
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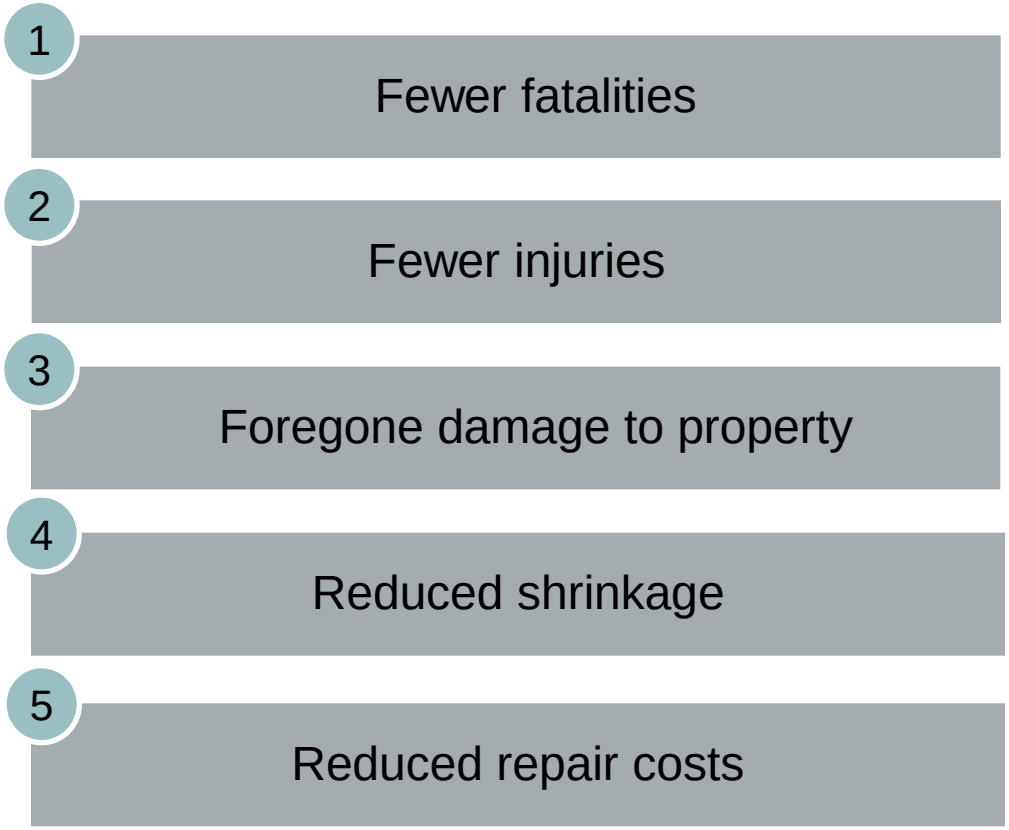
We have looked at a wide range of benefits associated with the HSE's accelerated programme…



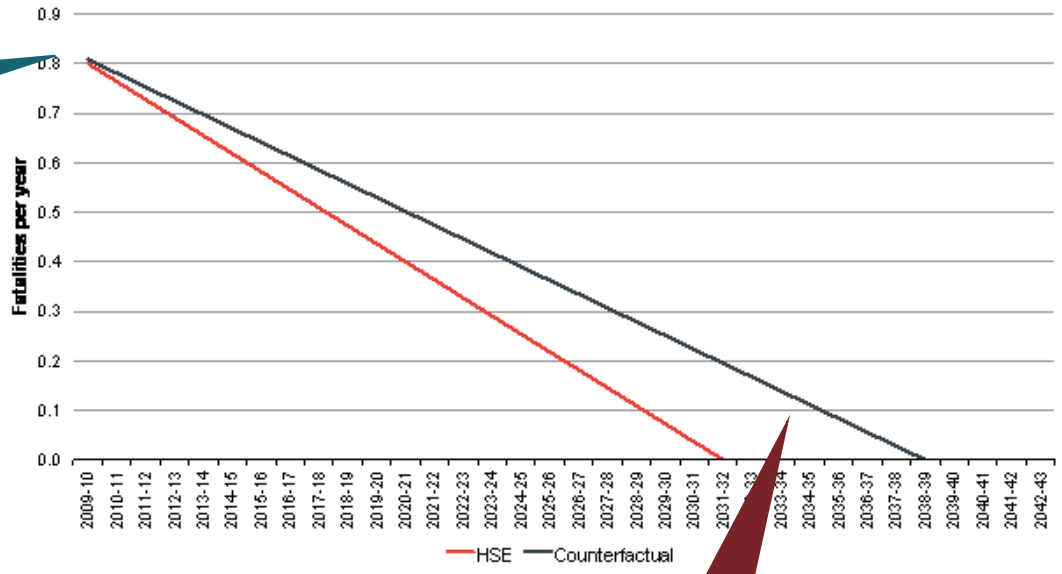
… we consider each of these benefits in turn

We estimate that HSE's accelerated programme will save three more lives

On average, there were 1-2 fatalities per annum before 2001 (we assume 2)…

…but first 25% of the programme has removed ~60% of modelled risk

Implies 0.8 fatalities per year as of 2009-10

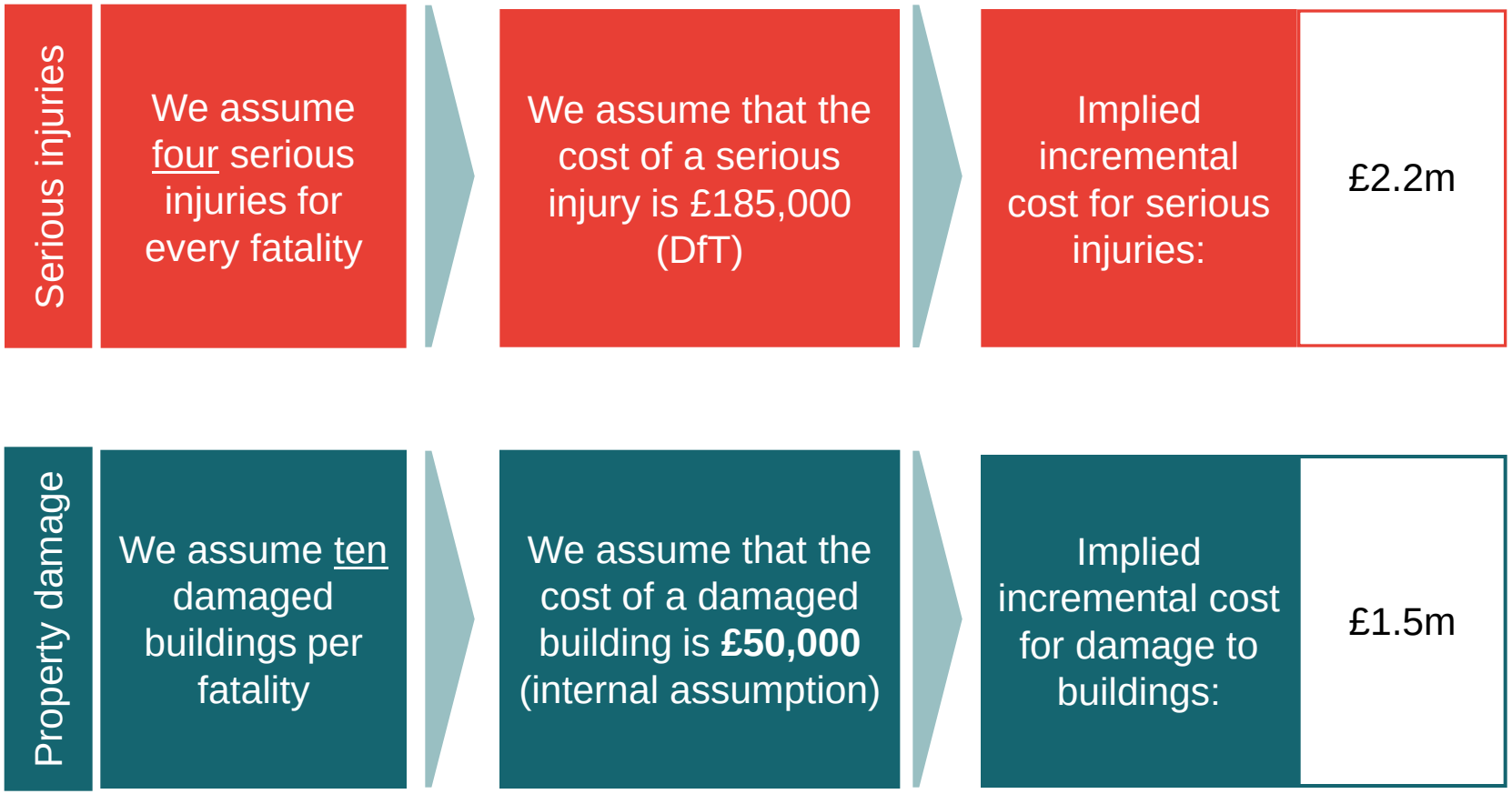


We assume that there will be a linear reduction in fatality risk as the remaining "at risk" mains are replaced (conservative assumption - in reality may be quadratic)

Area between two lines shows number of lives saved as a result of continuing with the accelerated programme

Using DfT standard value-of-life figure of £1.6m, this implies a total benefit of £4.7m

We have used a similar approach to estimate the reduction in serious injuries and damage



The accelerated mains replacement programme is likely to result in a more rapid reduction in shrinkage

Shrinkage estimates reported in GDPCR1 suggest that the accelerated repex programme will reduce shrinkage by 62 GWh per year

Shrinkage volumes forecast in December 2007 final proposals…

	Shrinkage volume (GWh)			
	2009-10	2010-11	2011-12	2012-13
LDZ	Total	Total	Total	Total
East Anglia	286	286	286	285
East Midlands	409	409	408	406
North Thames	396	393	390	386
North West	501	488	484	480
West Midlands	403	393	391	388
Yorkshire	296	292	288	283
Northern	234	230	227	224
Scotland	284	278	272	266
South East	445	433	421	409
Southern	303	298	292	286
Wales North	64	61	60	59
Wales South	170	163	157	153
South West	299	292	285	278
	4,090	**4,016**	**3,960**	**3,904**

…do GDNs now have more accurate shrinkage numbers?

Average annual reduction in shrinkage forecast during GDPCR1 = 62 GWh

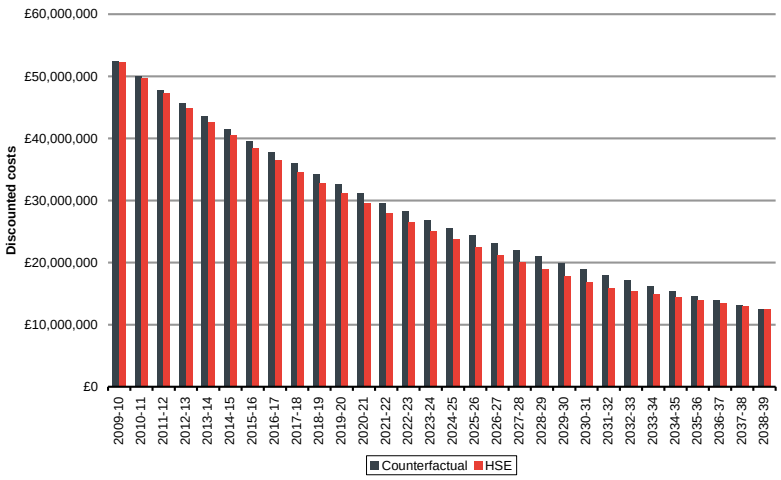
Extrapolating forward linearly, this implies a ~35% reduction in total shrinkage over the course of the repex programme

Again, this is a conservative assumption. In reality, the forecast reductions in shrinkage during GDPCR1 reflect changes in pressure management as well as repex. Therefore unlikely that the repex programme alone will really reduce shrinkage by as much as 35%

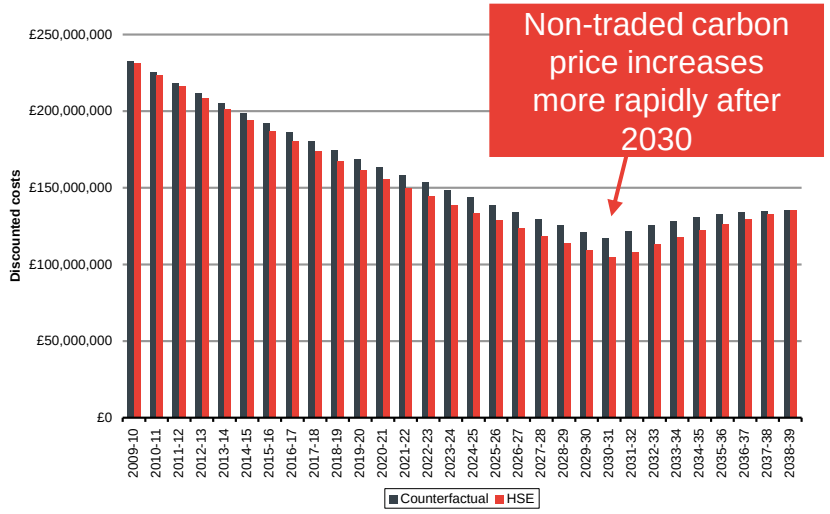
A 35% reduction would in turn imply that shrinkage would fall at the slower rate of 48 GWh per year under the counterfactual programme

This allows us to estimate both the environmental and private benefits from reducing shrinkage

Private benefits



Environmental benefits



We have used a day ahead gas price of £13.94/MWh. (*Source: Argus*). We have assumed this price stays constant over time.

We have assumed that there is 1169tCO2e per GWh of Natural Gas (*Source: GDPCR*). The non-traded carbon price increases from £51/tCo2e to £122/tCO2e over the next 30 years (*Source: DECC*).

Incremental private benefits = £38.8m

Incremental environmental benefits = £220.2m

The accelerated replacement programme could also reduce repair work costs by £32m

Repair work costs reported in GDPCR1 suggest an annual reduction of £1.4m

GB repair costs forecast in Dec 07 final proposals:

£m	2008/09	2009/10	2010/11	2011/12	2012/13
Repairs	83.8	82.2	80.8	79.3	78.1

5.9% reduction over the price control period equates to annual reduction of £1.4m

We have assumed that 50% (£0.7m) of the annual reduction in repair costs can be attributed to the replacement programme and 50% to other factors – but would welcome views on this

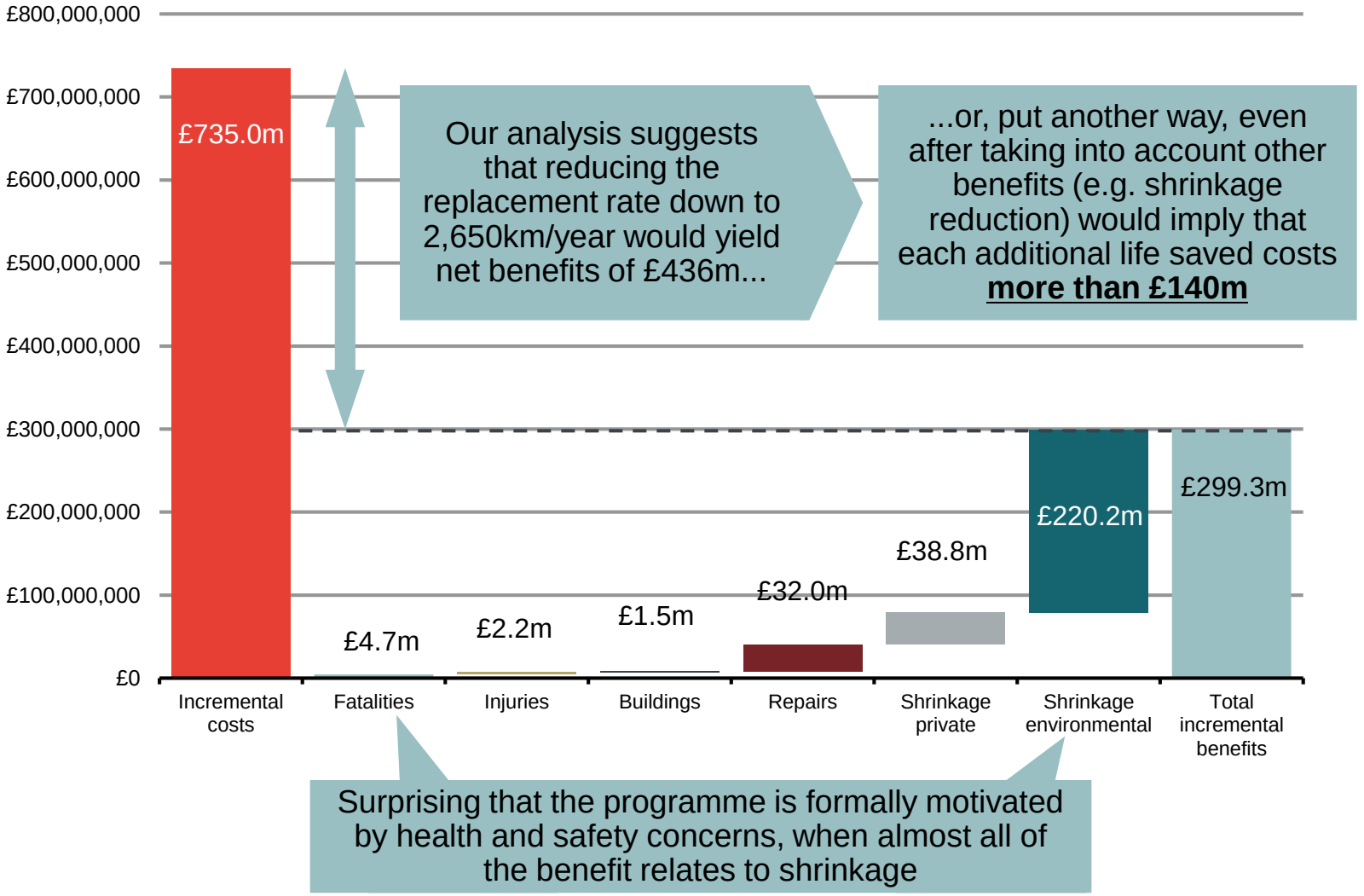
Extrapolating this annual £0.7m cost reduction forward implies that the replacement programme will reduce annual repair costs by £15.7m

Note that these figures exclude emergency services provision – might the replacement programme affect this as well?

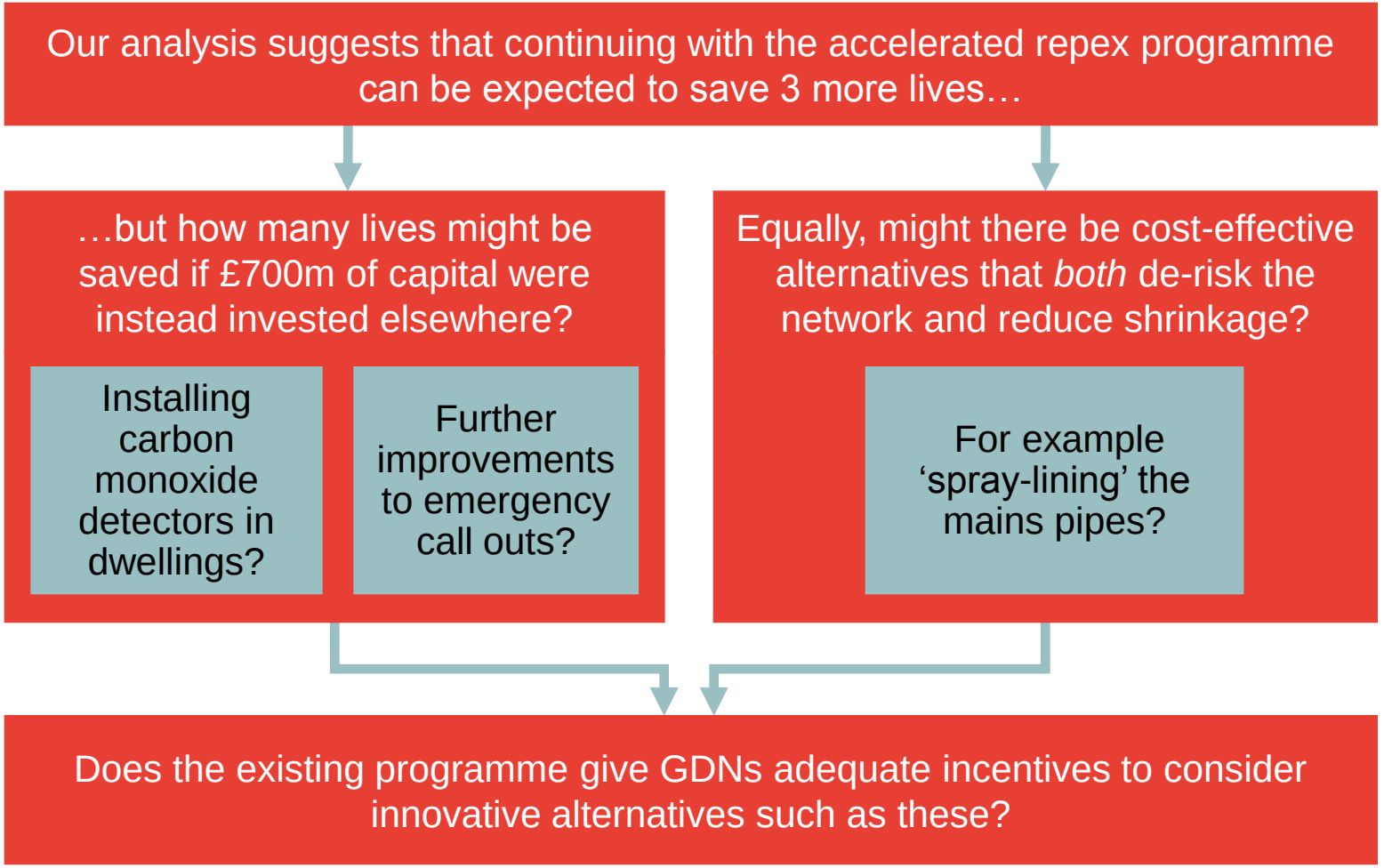
An overall reduction of £15.7m would in turn imply that repair work costs would fall at the slower rate of £0.5m per year under the slower counterfactual programme

This implies that switching from the accelerated programme to the counterfactual programme would increase total future repair work costs by **£32m** in discounted terms

Putting this all together, the incremental costs would appear to be much larger than the incremental benefits



There would therefore appear to be a strong economic case for slowing down the programme



We would welcome comments on our methodology and preliminary findings

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- Context and motivation for the study
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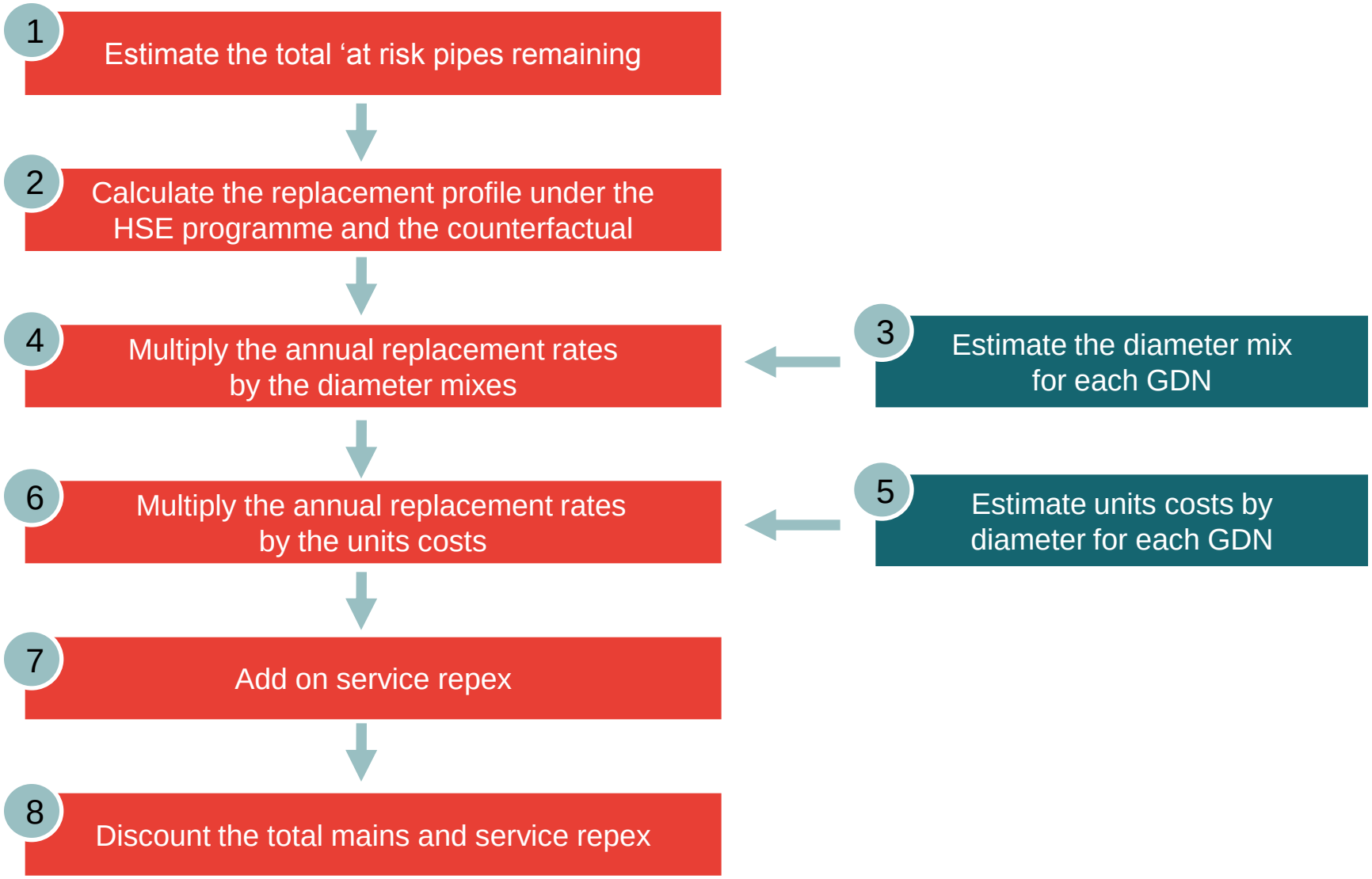
Overview of steps



Step 1

1

Estimate the total length of ‘at risk’ mains remaining in 2009-10

101,800km - 22,674km = 79,126km

Length of ‘at risk’ mains in 2001

(revised up from original estimate of 91,000km)

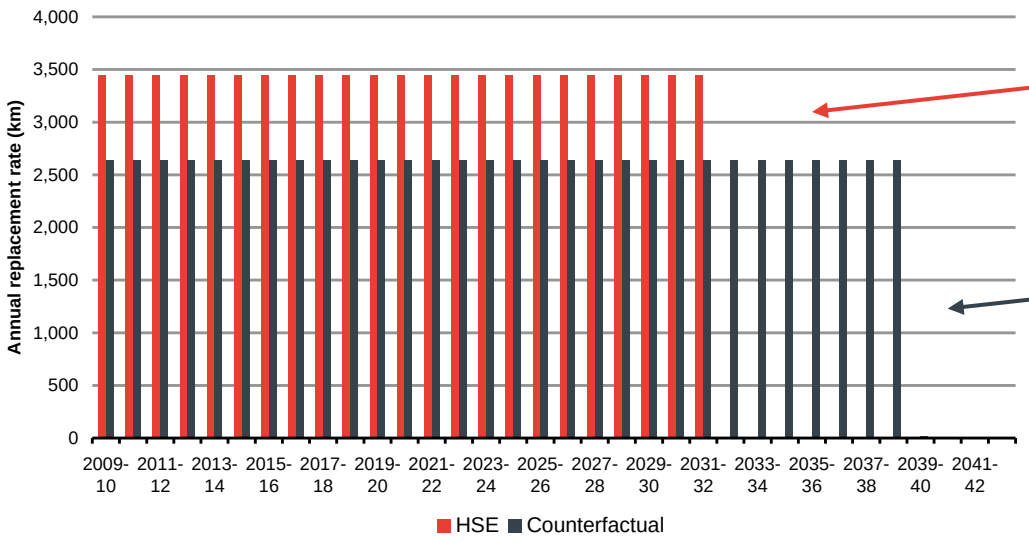
Length of ‘at risk’ mains replaced between 2001 and 2009

(as reported by Transco / GDNs)

Step 2

2

Calculate the replacement profiles for the HSE programme and the counterfactual



Replacement rate (3,440 km/year) required to finish programme by 2031-32

Counterfactual replacement rate (2,650 km/year) based on historical average (1977-2001)

Source: HSE (2001)

- In reality, there are a whole range of counterfactual rates that could be used. We consider the impact of varying the counterfactual rate in Slide 9.
- To keep our cost-benefit analysis simple, we have assumed that there is no winding down period at the end of the replacement programme. Introducing a winding down period should not have a significant impact on our estimates.

Step 3

3

Estimate the “at risk” diameter mix for each GDN (based on GDPCR 2012-13)

	</=3"	4-5"	6-7"	8-9"	10-12"	>12-18"	>18-24"	>24"	Total
EoE	0.7%	9.7%	2.9%	1.2%	1.3%	0.7%	0.3%	0.1%	16.9%
Lon	0.5%	3.7%	1.9%	0.8%	0.8%	0.5%	0.3%	0.2%	8.8%
NW	1.8%	5.9%	2.3%	1.1%	1.0%	0.8%	0.2%	0.1%	13.3%
WM	0.6%	4.4%	1.9%	1.1%	0.7%	0.5%	0.1%	0.0%	9.4%
NoE	1.6%	8.2%	3.0%	0.5%	0.6%	0.4%	0.0%	0.0%	14.2%
Scot	0.9%	3.6%	1.8%	0.6%	0.5%	0.1%	0.1%	0.0%	7.8%
SoE	0.7%	10.5%	4.1%	1.6%	1.2%	0.4%	0.4%	0.1%	19.1%
W&W	1.0%	4.8%	2.1%	1.5%	0.6%	0.3%	0.0%	0.0%	10.4%
Total	7.8%	50.9%	20.0%	8.6%	6.7%	3.8%	1.6%	0.5%	100.0%

Important note: this approach assumes that the same diameter mix will be replaced each year

However, in reality, GDNs are prioritising the replacement of small-diameter mains

Implies that relying on 2012-13 mix may underestimate the proportion of remaining “at risk” mains that have large diameters

Step 4

4

Multiply the diameter mixes (from step 3) by the overall replacement rates (from step 2)

HSE

	</=3"	4-5"	6-7"	8-9"	10-12"	>12-18"	>18-24"	>24"	Total
EoE	24	334	99	43	44	24	12	3	583
Lon	18	126	64	29	28	19	10	7	302
NW	62	204	78	39	36	28	8	3	458
WM	21	151	66	39	25	16	3	2	324
NoE	54	284	102	17	20	13	1	0	490
Scot	31	125	63	22	17	5	5	1	269
SoE	24	360	142	56	40	15	15	4	656
W&W	36	166	74	52	22	11	0	0	359
Total	270	1,750	687	297	232	131	55	19	3,440

This means that W&W will replace 166 kilometres of 4-5 inch pipes each year for the next 23 years

=3,440*1.5%

Counterfactual

	</=3"	4-5"	6-7"	8-9"	10-12"	>12-18"	>18-24"	>24"	Total
EoE	18	256	76	33	34	18	9	2	447
Lon	14	97	49	22	22	14	8	5	231
NW	48	157	60	30	28	22	6	2	351
WM	16	116	50	30	19	12	3	1	248
NoE	41	218	78	13	15	10	1	0	375
Scot	24	96	48	17	13	4	4	1	206
SoE	18	276	109	43	31	12	12	3	503
W&W	27	127	56	40	17	8	0	0	275

=2,650*1.5%

Step 5

5

Estimate unit costs by diameter (from GDCPR)

	</=3"	4-5"	6-7"	8-9"	10-12"	>12-18"	>18-24"	>24"
EoE	£62.3	£68.1	£95.8	£177.1	£247.5	£358.8	£501.5	£618.9
Lon	£76.5	£83.5	£117.5	£217.3	£303.6	£440.2	£615.3	£759.3
NW	£62.1	£67.8	£95.4	£176.5	£246.6	£357.6	£499.9	£616.9
WM	£62.8	£68.5	£96.4	£178.4	£249.2	£361.4	£505.1	£623.4
NoE	£59.8	£65.3	£91.9	£170.0	£237.5	£344.4	£481.3	£594.0
Scot	£62.5	£68.2	£96.0	£177.6	£248.1	£359.8	£502.8	£620.5
SoE	£66.4	£72.5	£102.0	£188.8	£263.7	£382.4	£534.5	£659.6
W&W	£59.3	£64.7	£91.0	£168.4	£235.3	£341.2	£476.9	£588.5

£ per metre

2008/09 data - we assume annual Real Price Effects of 1.1% for future years (from DPCR5) and no ongoing efficiency improvements

- We have considered the impact of varying the Real Price Effects in Slide 10.

Step 6

6

Multiply the unit costs (from step 5) by the diameter replacement rates (from step 4)

HSE

	EoE	Lon	NW	WM	NoE	Scot	SoE	W&W	Total undiscounted repex
2009-10	£69.2m	£54.7m	£57.1m	£40.3m	£44.0m	£30.0m	£81.0m	£37.4m	£413.7m

Counterfactual

	EoE	Lon	NW	WM	NoE	Scot	SoE	W&W	Total undiscounted repex
2009-10	£53.1m	£41.9m	£43.7m	£30.9m	£33.7m	£23.0m	£62.1m	£28.7m	£317.2m

These calculations are repeated for each year until all 'at risk' pipes have been replaced

Step 7

7

Estimate service repex

Figures for HSE (2009-10)	EoE	Lon	NW	WM	NoE	Scot	SoE	W&W	Total undiscounted repex
Mains repex	£69.2m	£54.7m	£57.1m	£40.3m	£44.0m	£30.0m	£81.0m	£37.4m	£413.7m
Service repex	£30.5m	£24.1m	£25.1m	£17.7m	£19.3m	£13.2m	£35.7m	£16.4m	£182.0m
									£595.7m

A large proportion of service repex is closely linked to mains replacement

(*Efficiency case for carrying out mains and services repex simultaneously*)

→ Therefore follows that accelerating the mains replacement programme will also accelerate service repex

→ Last price control review forecast that total service repex would be 44% of the size of mains repex

→ Our model therefore adds 44% onto total mains repex to account for service repex

- We have considered the impact of varying the ratio of service repex to mains repex in Slide 11. We still have a few outstanding questions that we need to consider:
  - Some service repex is carried out independently following gas escapes – is this material?
  - Is service repex more closely associated with smaller diameter mains? If so, will changes in the diameter mix being replaced lead to changes in the ratio of service repex to mains repex over time?

Step 8

8

Apply discount factor to identify present value of each year's total cost

HSE programme repex

Figure for 2009-10	EoE	Lon	NW	WM	NoE	Scot	SoE	W&W	Total undiscounted repex	Total discounted repex
Mains repex	£69.2m	£54.7m	£57.1m	£40.3m	£44.0m	£30.0m	£81.0m	£37.4m	£413.7m	£399.7m
Service repex	£30.5m	£24.1m	£25.1m	£17.7m	£19.3m	£13.2m	£35.7m	£16.4m	£182.0m	£175.9m
									£595.7m	£575.6m

Counterfactual programme repex

Figure for 2009-10	EoE	Lon	NW	WM	NoE	Scot	SoE	W&W	Total undiscounted repex	Total discounted repex
Mains repex	£53.1m	£41.9m	£43.7m	£30.9m	£33.7m	£23.0m	£62.1m	£28.7m	£317.2m	£306.4m
Service repex	£23.4m	£18.5m	£19.2m	£13.6m	£14.8m	£10.1m	£27.3m	£12.6m	£139.6m	£134.8m
									£456.7m	£441.3m

We have assumed a discount rate of 3.5%, as the Green Book recommends

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