Neil Whalley
EHS Strategy
Northern Gas Networks

Your Ref:
Our Ref: NGN Spoil cost calculations
3 September 2020
CONFIDENTIAL

Dear Neil,

REVIEW OF NGN COSTS CALCULATIONS ASSOCIATED WITH EXCAVATED SPOIL FROM STREET WORKS

INTRODUCTION

The purpose of this project has been to review the assessments made by NGN about the likely financial impact of the withdrawal of RPS 211 has on the company. NGN has undertaken an assessment which they intend to submit to OFGEM, WSP is providing a third-party assessment of the calculations to ensure they are reasonable. Rather than recalculate the costs, WSP has undertaken a critical review of the calculations process and assumptions made by NGN to ensure that it covers an appropriate level of detail to enable such a high-level calculation to be made with sufficient level of certainty.

Any differences or concerns identified have been actively relayed back to NGN, through this letter report so that they can be considered for inclusion within their calculations. I have also included in Appendix A, the NGN Calculation Sheet, which I have reviewed and appendix B; my professional CV.

DOCUMENTATION REVIEWED

As part of this review the following documentation was provided by NGN and reviewed as part of the works.

- Street Works UK Case Study: Utilities Excavation Arisings: Identifying Waste Risks and Classifying Excavation Arisings, August 19, Version 0.4.
- Street Works UK, Utilities Excavation Arisings: Waste Classification Protocol, Version 1.1 7th February 2020
- RPS211 Excavation Spoil Disposal Cost Increase, Excel Spreadsheet, NGN 2020 (included in appendix A)
- Spoil sampling Trial Phases 1 & 2 laboratory results.
- Hazardous Waste Online Assessments of tarmac and soil samples
- Tipping price data for Mone Bros, Murray Brown and Underwood's.
- Current Lab testing rate charges for Chemtest

CALCULATION OF WASTE ARISINGS

NGN has assembled a comprehensive set of data within the spreadsheet for street works-based excavations for the period 2013 / 14 to 2019 / 20. The data is based on or derived from the Regulatory

Kings Orchard
1 Queen Street
Bristol
BS2 0HQ
Tel: +44 117 930 6200
wsp.com

Reporting Pack (RRP) data which is submitted annually to OFGEM and with which OFGEM would be familiar. Whilst there is some variation in the type of data collated over this time period, it does represent a large data set which is reasonable to use for this purpose.

Average data is derived over this time period for each of the nine categories, key amongst this data are:

1. Total excavation spoil (tonnes),
2. Total reinstatement aggregate (excluding surface finish materials) purchased (tonnes),
3. Total surface finish materials (tonnes) - includes tarmac, concrete, paving etc (calculated as item 1 minus item 2),
4. Tarmac / asphalt used (tonnes) - estimated based on the % tarmac/asphalt in a review of reinstatement records in 2019/20; and
5. Estimated tarmac / asphalt waste generated annually (tonne) (calculated as item 3 multiplied by item 4)

Point 4 uses an estimate of the amount of tarmac / asphalt, which is derived from two months (January and February 2020) data. It is composed of an extensive set of over 4,900 reinstatement records. These records include all the street works undertake in that year and include the location, type of works, amount of excavation undertaken, details of the surface and reinstatement. The data has been used to calculate the proportion of surface material identified as tarmac / asphalt which would be both excavated and reinstated. Whilst the figure for the proportion of tarmac / asphalt will invariably change on an annual basis, this approach is considered reasonable to base the assumption annual calculations of the amount of tarmac/asphalt.

Tom Wood of WSP, previously undertook a resource and waste review of NGN's operations, he has reviewed the spoil and aggregate data, calculations of surface materials, the assumptions made regarding proportional use of asphalt surface and agrees that this corresponds with the figures provided in the resources and waste review WSP completed.

DISPOSAL COSTS

The calculation provided by NGN states that all current excavation spoil discarded is classified as non-hazardous and meets the requirements of inert waste.

Inert waste has a strict definition according to Regulation 7(4) of the Landfill Regulations 2002 is waste that:

- Will not undergo any significant physical, chemical or biological transformations;
- Will not dissolve;
- Will not burn;
- Will not physically or chemically react;
- Will not biodegrade;
- Will not adversely affect other matter with which it comes into contact in a way likely to give rise to environmental pollution or harm to human health;
- Has insignificant total leachability and pollutant content; and
- Produces a leachate with an ecotoxicity that is insignificant (if it produces leachate).

Spoil is typically discarded by NGN to a recycling route (>99.9% in 2019 / 20), incurring waste handling charges, a very small amount (<0.1% in 2019 / 20) was discarded to landfill, thus incurring inert waste disposal costs and landfill tax. Inert waste qualifies for the lower rate of landfill tax, as shown in the Table 1. Non-hazardous waste typically attracts the standard rate of landfill tax, which as can be seen from Table 1, is considerably higher than that charged for the lower rate. The range of costs proposed by NGN for discarding inert waste to aggregate recycling is between £8.5 and £15 / tonne, which is reasonable and based on recent market data.

Currently under RPS 211, waste created by utilities companies or their contractors would be automatically classed as non-hazardous and would only be subject to the cheaper rate of landfill tax if proven to be inert.

Following the removal of RPS 211, with greater waste analysis, characterisation and waste acceptance criteria testing, then more spoil is likely to be identified as non-hazardous and hazardous, rather than inert as previously. The cost for the disposal of non-hazardous waste to landfill will be higher than that provided in the calculation by NGN. If more waste is disposed of to a non-hazardous waste landfill rather than accepted as inert for recycling or disposal to an inert waste landfill, then the actual costs are likely to be higher than those presented.

Landfill tax rates are likely to keep increasing annually in line with recent trends, which since the 2018 budget have been based on increases in the Retail Prices Index, these have been around 3%.

Table 1. Actual and assumed rates of landfill tax for the standard rate and lower rate

Date of change	Standard rate (£/tonne)	Lower rate (£/tonne)
1 April 2017	84.4	2.70
1 April 2018	88.9	2.80
1 April 2019	91.3	2.90
1 April 2020	94.1	3.00
1 April 2021	96.7	3.10
1 April 2022 (assumed increase)	99.4	3.20
1 April 2023 (assumed increase)	102.2	3.30
1 April 2024 (assumed increase)	105.1	3.40
1 April 2025 (assumed increase)	108.0	3.50

NGN has provided evidence for the cost of removal of hazardous waste from a project from 2017, this provided a cost of £265 per tonne. The cost provided by NGN would consist of haulage from the site to landfill (and return), landfill and waste carrier administration charges, landfill tax and disposal charges.

In 2017 when the quote was obtained by NGN (2017), landfill tax for hazardous waste was charged at £84.4 per tonne. For the cost calculation over the 2021-2025 period, a rate of disposal for hazardous waste was calculated using the 2017 figure of £265 but adjusted for the 2020 rate of landfill tax of £94.1, which equated to a cost £274.75 per tonne.

This value is expected to be lower than the likely value over this period, given that landfill tax increases annually for both the standard and lower rates of tax, by the Retail Prices Index. The latest rates from the HMRC are for April 2021, however it can be expected that a similar rate of annual increase of about 3% would occur. Based on the figure provided by NGN, the average all in cost over this period for hazardous waste disposal to landfill would be closer to £282.9 for hazardous waste.

Recent enquiries would suggest hazardous waste could be disposed of at a rate of £70-100 per tonne, with the additional £94 landfill tax, administration costs of £25 and travel costs (assumed 50-mile round journey) of about £65, which would equate to £254-284. Both these costs and those provided by NGN are relatively high compared to the typical costs associated with contaminated land remediation project, these costs are considered reasonable where disposal volumes of hazardous material are small as would be expected from Street Works excavations.

Table 2. Estimated all in rates of disposal landfill tax for the standard rate and lower rate

Year	Estimated rate for hazardous landfill disposal between 2021-2025 (£/tonne)	Estimated rate for non-hazardous landfill disposal between 2021-2025 (£/tonne)
1 April 2021-22	277.3	137.00
1 April 2022-23 (assumed increase)	280.0	139.60
1 April 2023-24 (assumed increase)	282.8	142.31
1 April 2024-25 (assumed increase)	285.7	145.09
1 April 2025-26 (assumed increase)	288.6	147.95
Average value	*282.9*	*150.89*

In their calculations NGN has assumed that no waste will fail the designated Waste Acceptance Criteria for Hazardous. Given the high organic content of asphalt/bitumen in both the tarmac and some samples of spoil and sub-base, some of the samples are likely to fail the Waste Acceptance Criteria for Hazardous waste landfill. This may require some additional treatment or require an alternative disposal option.

Other options do exist for asphalt waste containing coal tar, it can in some cases be recycled under the Environment Agencies Regulatory Position Statement 075 or it can be shipped to Rotterdam for thermal treatment. The first option is still relatively new and has generally been applied where large amounts of material needs to be re-used, such as a re-surfacing project undertaken on the A66 between Little Burdon and Newton Grange.
(https://www.wrap.org.uk/sites/files/wrap/WRAP%20RE%20Case%20Study%20-%20Tar%20Bound%20Planings.pdf.)

PREVALENCE OF HAZARDOUS SPOIL IN NGN NETWORK AREAS

WSP supported NGN in their part of the Street Works UK trial to sample material excavated from NGN's works across their region and the data provided by NGN on this has been reviewed. The Street Works UK sampling trial findings (V0.4, February 2020) document has also been reviewed as part of this work and we can confirm that the data presented by NGN in their calculation is representative of the that reported.

SAMPLING AND TESTING REQUIREMENTS

NGN has chosen to adopt the analytical suite (Table 3) used by Street Works UK in their trial which is listed on pages 18-20 of the Street Works UK sampling trial findings (V0.4, February 2020) and also proposed in Street Works UK Utilities Excavation Arisings: Waste Classification Protocol (V1.1, February 2020).

Table 3. Analytical suite used by Street Works UK and proposed in the calculations by NGN

Sub-Base / Soil and Stone Analysis	
Moisture Content	Copper
Arsenic	Selenium
Cadmium	Zinc
Chromium	pH
Chromium Hexavalent	PAH – Speciated (EPA 16)
Lead	TPH (C6 – C40)
Mercury	Asbestos Screen / ID
Nickel	Asbestos Quantification (where applicable)
Mixed Wastes	
Moisture Content	Selenium
Arsenic	Zinc
Cadmium	pH
Chromium	Alkali Reserve (where applicable)
Chromium Hexavalent	PAH – Speciated (EPA 16)
Lead	Phenols – Total Monohydric (where applicable)
Mercury	TPH (C6 – C40)
Nickel	Asbestos Screen / ID
Copper	Asbestos Quantification (where applicable)
Asphalt Wastes	
PAH – Speciated (EPA 16)	
Phenols – Total Monohydric (where applicable)	
GCMS Broadscan Investigation (where applicable)	

WSP views this suite a likely minimum suite, a point also highlighted by Street Works UK, so this is likely to provide a conservative minimum cost, which is reasonable for use in their calculations.

The costs provided by NGN for the chemical analysis are based on actual costs provided by Chemtest to NGN on recent projects, including the 2019 Street Works UK spoil sampling trial, WSP has reviewed these costs and believe them to be realistic current market costs for the analysis of asphalt and spoil.

Costs do not appear to be included for the Inert Waste Acceptance Criteria testing, this is required in order to dispose of material to inert landfill, should that be required.

We do, however, hold our view that these are likely to be minimum costs. This is due to the requirement of more extensive analytical suites on some sites and also due to the likely development and adoption of new method for the analysis of coal tar as described below.

It should also be pointed out that in the commercial chemical analysis market there is no industry standard or recognised method which provides a reliable assessment of the presence of coal tar in soils or asphalt, each laboratory has developed its own approach. ALS has recently developed a coal tar suite which was priced at £350 per sample, whilst not definitive, it provides more information than those suggested by Street Works UK. Should such a suite be supported by the regulator then

the analysis costs being quoted by NGN, could be considerably less than future costs for the analysis.

Whilst forensic methods to identify coal tar have been developed and published in academia, they are not commercially available, mainly because the equipment required is very expensive and offering this service is not commercially viable. It is, however, possible that such methods could be adopted and if so, could increase the cost of analysis in future, over the period between 2021 and 2025.

ASSUMPTIONS BASED ON THE NUMBER OF EXCAVATIONS AND SAMPLING FREQUENCY

The appropriate protocols for analysing waste are described in Appendix D of the hazardous waste technical guidance (WM3). The spoil generated during NGN's works, comes from numerous small excavations to access pipes for insertion or repair, the spoil material being either tarmac or sub-base primarily, which would be more homogenous in nature. Whilst on large contaminated land remediation projects sample frequencies of 1 sample for 400-500 tonnes (1 per 200-250m^3), may be expected. Standard greenfield highway construction earthworks testing frequencies are typically 1 per 4,000 tonnes (1 per 2,000m^3). Street works spoil stockpiles will be much smaller by comparison and as a result the sampling frequency is likely to be higher than on projects handling much larger amounts of material.

Based on the data collected by NGN on their Street Works, a typical excavation would generate a spoil sample of 2.9 tonnes (Estimated value). The estimated total annual spoil excavation (189,576 tonnes) was then divided by 2.9 tonnes to estimate the typical number of NGN excavations per year undertaken by NGN; estimated at 65,371.

Gas mains replacement projects typically contribute the majority (85%) of the annual excavation spoil for NGN projects, the remainder of the spoil coming from gas emergency and connections projects. This is clarified in the calculation's spreadsheet. NGN has identified during their projects that a typical mains replacement project using insertion would generate 22 excavations over a typical 150m section. This data was then used to derive the total number of site works per year by dividing the estimated number of excavations by 22, giving a figure of 2,989 work sites. This would equate to each work site having 63 tonnes of waste.

NGN has calculated that one sample of tarmac and one sample of spoil would be required from each work site volume of 63 tonnes. In addition to that, one sample for WAC analysis was assumed to be taken from each work site. This sample frequency is reasonable as a conservative estimate for the amount of material and would meet the requirements of procedures outlined in hazardous waste technical guidance (WM3), assuming all the material types generated are similar in character (homogenous), if not then more samples may be required. If both the tarmac and spoil are requiring landfill disposal then additional WAC samples may be required.

To further refine the sampling NGN has calculated the sampling requirement based on the percentage of samples which were identified as hazardous in their portion of the Street Works UK trial, this was Asphalt/Tarmac 16.7% and mixed waste (sub-base & spoil) 7.5%.

Whilst these percentages may be reflective of the trial results, it would be assumed that in order to know if the tarmac and spoil is hazardous or non-hazardous, then chemical analysis would need to be undertaken on all 2,989 samples for them to be characterised, although only samples to be disposed of as hazardous or inert would need additional WAC testing, which would be equivalent to the figure NGN have used. This would significantly increase the cost of analysis.

COST IMPACT ANALYSIS

The cost impact analysis uses the data described above to work out the amount of hazardous and non-hazardous waste generated in an assumed average year in tonnes. Waste disposal costs are then generated from these tonnages by multiplying them by the costs described for discarding hazardous waste and inert waste discarded for recycling for total mixed waste (spoil and sub-base) and tarmac.

It is likely, as identified earlier in this report, that there will be non-hazardous material that will not be suitable for recycling which may have to be discarded of to landfill at the rates shown in Table 2. These rates are significantly higher than those suggested by NGN for inert recycling, it is however, not possible to quantify the amount that would fit into this category. An opportunity may also exist for some hazardous and non-hazardous waste to be treated at a soil treatment centre. This could treat the waste from hazardous to non-hazardous or make non-hazardous waste inert and suitable for reuse or recycling. Where such an approach is taken, costs may be saved on landfill tax if waste disposal is minimised.

It is expected that a significant amount of material will still be disposed of as inert, which can then be recycled into secondary aggregate, and re-used in street works. However, following the introduction of regular chemical analysis post the withdrawal of RPS211, the occurrence of hazardous substances, in particular asbestos, may be found in the waste material, which may reduce the amount of available for recycling and for later re-use.

The production of recycled aggregate is governed by REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals). REACH prohibits the manufacture, placing on the market and use of any article or product to which asbestos has been intentionally added. Recycled aggregates, which fall under the definition of ‘articles’ under REACH, where asbestos is found to be present are deemed to have had asbestos intentionally added, “subject to evidence to the contrary being adduced in any proceedings”. There is no de minimis concentration of asbestos set in law (no minimal concentration). Asbestos was found in a small number of samples in the study undertaken by NGN and Street Works UK, so the impact on aggregate recycling may be limited.

CONCLUSIONS

In conclusion, following a review of the data, the information provided by NGN provides a reasonable estimate of the future cost impact on the company.

The costs for disposal of excavation spoil, subbase and tarmac are likely to be higher than that estimated by NGN over the five-year period, due to:

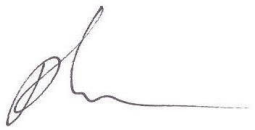
- The requirement to dispose of material unsuitable for recycling as inert material, is likely to increase, which would attract the higher rate of landfill tax; and
- Landfill tax escalation.

The cost of analysis estimated by NGN over the five-year period is likely to be substantially higher due to:

- The requirement to analyse all waste, not just hazardous waste; and
- Improvements in analytical procedures to analyse coal tar which may be promoted by the environmental regulator.

I hope this review is clear in its comments and I'm happy to explain any aspects further, should you find that useful.

Yours faithfully



Russell Thomas
Technical Director
Encl.
Appendix A NGN RPS211 Excavation Spoil Disposal Cost Increase Spreadsheet
Appendix B Russell Thomas CV

APPENDIX A - NGN RPS211 EXCAVATION SPOIL DISPOSAL COST INCREASE SPREADSHEET

Assessment of Potential Additional Excavation Spoil Disposal Costs as a result of removal of RPS 211

Network: NGN

RIIO-1 Excavation Data

	13/14	14/15	15/16	16/17	17/18	18/19	19/20	Average	Data Source
Total excavation spoil (t)	171,034	185,650	174,506	192,953	189,224	202,932	210,736	189,576	Annual RRP data
Total excavation spoil (t) - unplanned/emergency works	Unknown	Unknown	21062.39	35,655	30,544	33,049	29,128	29,888	Annual RRP data - emergency reinstatement contractor data (USSL), remainder is planned (Repex works)
Total excavation spoil (t) - planned works (Repex or connections)	Unknown	Unknown	153,444	157,298	158,680	169,883	181,608	164,182	Annual RRP data
% spoil from unplanned/emergency works	Unknown	Unknown	12.1	18.5	16.1	16.3	13.8	15.4	
% spoil from planned works (Repex or connections)	Unknown	Unknown	87.9	81.5	83.9	83.7	86.2	84.6	Calculated from RRP data
Total reinstatement aggregate (excluding surface finish materials) purchased (t)	132,477	127,939	131,891	136,465	136,390	133,770	142,063	134,428	Annual RRP data
Total surface finish materials (t) - includes tarmac, concrete, paving etc	38,556	57,711	42,615	56,488	52,834	69,162	68,673	55,148	Difference between excavation spoil disposed and reinstatement aggregate purchased in annual RRP data
Tarmac/asphalt used (t) - estimated based on review of reinstatement records	24,428	36,564	27,000	35,789	33,474	43,819	43,509	34,941	Estimate based on NGN reinstatement data - see tab
% tarmac/asphalt used in reinstatement	63.4	63.4	63.4	63.4	63.4	63.4	63.4	63.4	
Estimated tarmac/asphalt waste generated annually (t)	24,428	36,564	27,000	35,789	33,474	43,819	43,509	34,941	Based on estimate that 63.6% of reinstatement materials purchased is tarmac/asphalt and assumption that reinstatement surface finish is always like-for-like, therefore tonnage of tarmac/asphalt purchased for use in reinstatement is equivalent to tonnage originally excavated

Assumptions

Disposal Costs

Currently 100% of excavation spoil is classified as non-hazardous and meeting the requirements of inert waste. Spoil is typically discarded to recycling (>99.9% in 2019/20) thus incurring waste handling charges, or landfill (<0.1% in 2019/20) thus incurring inert waste disposal cost rates (incurring lower rate of landfill tax)

Current excavation spoil recycling cost range (£/t)	High	Low	Average
	15	8.5	11

Total estimated average annual cost of spoil recycling £2,085,340

Hazardous excavation spoil disposal cost rate including container and haulage based on quote received in October 2017 265 £/t

Landfill tax at time of quote (standard rate as applicable to contaminated material)	84.4 £/t	https://resource.co/article/landfill-tax-201617-set-%C2%A38440-9956
Landfill tax as of April 2020 (standard rate as applicable to contaminated material)	94.15 £/t	https://www.gov.uk/government/publications/rates-and-allowances-landfill-tax/landfill-tax-rates-from-1-april-2013
Hazardous excavation spoil disposal cost rate for use in calculation	274.75 £/t	24.97727273 times more expensive that current

Assume 100% of hazardous waste meets hazardous waste disposal criteria, ie 0% of waste is WAC failing. Assume all non-hazardous spoil meets requirements of inert waste and thus suitable for recycling or disposal at lower rate of landfill tax as current, with no spoil classified as non-hazardous waste and requiring landfill disposal at standard rate of landfill tax.

Prevalence of Hazardous Spoil in NGN Network Areas

Steet Works UK sampling trial findings (V0.4, February 2020)

	NGN data (Particpant 3)			UK Wide (report page 24)	
	% Non-haz	% Hazardous		% Non-haz	% Hazardous
Mixed waste (sub-base and spoil)	92.5	7.5		84.23	15.77
Tarmac	83.3	16.7		81.28	18.72
Sub-base	Not sampled	Not sampled		78.37	21.63
Combined mixed waste and sub-base	n/a	n/a		81.3	18.7

Sampling and Testing Requirements

Laboratory testing rates		Source
Assume future testing suites would be as per those undertaken during Street Works UK 2019 sampling trial (see report page 18) and as contained in latest version of Street Works UK Utility Excavation Arisings Waste Classification Protocol (V4.0, Feb 2020, Section 7.4)		
Asphalt testing (PAHs and phenol)	19.4 £ per sample	Lab rates from Chemtest for NGN participation in Streetworks UK sampling trial
Mixed excavation waste testing	50.2 £ per sample	Lab rates from Chemtest for NGN participation in Streetworks UK sampling trial
Hazardous WAC	125 £ per sample	Lab rates from Chemtest

Streetworks UK Waste Classification Protocol does specify testing frequencies for excavation spoil

Typical spoil per NGN excavation	2.9 tonnes	Based on sample NGN reinstatement data for Jan and Feb 2020 - see tab
Typical number of NGN excavations per year	65764 No.	
Planned projects (Repex) produce 85% of total spoil typically (see Row 11)		
	Excavations per length inserted	
Repex projects, typical number of excavations per typical 150m insertion length (street/work site)	22 (site)	Email from NGN Commercial Team - see tab
Total number of work sites per year based on typical number of excavations per insertion	2989	

Assuming one sample of asphalt and one sample of spoil is sufficient to characterise a work site also 1 WAC sample per material type per contaminated site to enable disposal, minimum numbers of samples required per year based trial findings:

Asphalt	499 samples per year based on NGN trial data	560 samples per year based on UK wide trial data
Spoil	224 samples per year based on NGN trial data	559 samples per year based on UK wide trial data
WAC	723 samples per year based on NGN trial data	1119 samples per year based on UK wide trial data

Cost Impact Analysis

		Using NGN sample data			Using national data sample data		
Typical year	Tonnes	Hazardous (t)*	Non-hazardous recycled/disposed as inert waste (t)*		Hazardous (t)*	Non-hazardous recycled/disposed as inert waste (t)*	
Total waste	189,576	n/a	n/a		n/a	n/a	
Total mixed spoil and subbase	134,428	10,082	124,346		25,138	109,290	
Total tarmac	34,941	5,835	29,105		6,541	28,400	
Total surface finish materials that are not tarmac/asphalt, assume 100% disposal as non-hazardous	20,208	0	20,208		0	20,208	
Total tonnage		15,917	173,659		31,679	157,897	
Cost		£4,373,241	£1,910,251	£6,283,492	£8,703,778	£1,736,872	£10,440,650
Current disposal and recycling average cost				£2,085,340.01			£2,085,340.01
Additional annual disposal cost				£4,198,152.38			£8,355,309.70
Annual laboratory testing costs (additional)				£111,364.64			£178,740.62
Total annual additional cost				£4,309,517.02			£8,534,050.32
Total additional cost over 5 years of RIIO-2 (disposal and testing)				£21,547,585.10			£42,670,251.58

* See assumptions on line 31

Financial Implications to NGN	
Current annual disposal and recycling cost	£2,085,340.01
Forecast testing, disposal and recycling cost annually	£6,394,857.03
Additional annual testing and disposal cost	£4,309,517.02
Additional cost over RIIO-2	£21,547,585.10
Implications for all GDNs	
Additional annual testing and disposal cost	£64,047,869.23
Additional cost over RIIO-2	£320,239,346.16

Assumes all 8 networks have similar excavation volumes to NGN. NGN estimate based on NGN data, other 7 seven networks assumed to be equal to national data

APPENDIX B - RUSSELL THOMAS CV

Russell Thomas

Professor, Technical Director, BSc, PhD, CBIOL FRSB MIENVSc CEnv MSCI MIGEM EngTech

CAREER SUMMARY

Russell Thomas is a Technical Director is responsible for the delivery of contaminated land and innovation projects within the Ground and Water team. He holds visiting academic positions at two world class academic Institutions, the University of Strathclyde and the University of Manchester.

Russell is acknowledged as one of the leading specialists in the investigation, understanding and remediation of Gasworks in the world, with over 24 years' experience in this field. During this time Russell has worked closely with the all the major UK gas companies, the National Gas Archive (UK), Historic England and has been a long-standing member of the Institution of Gas Engineers and Managers (IGEM). Through his unique experience Russell has obtained an in-depth knowledge of former gasworks sites and has built up his own gas archive. He has been involved in the investigation of several hundred former gasworks site worldwide, including projects in the UK, Europe, USA and Australia. His knowledge has been tested on television, as an expert witness and as invited speaker at conferences and academic courses.

His international reputation is highlighted in comments made by US Gasworks expert Allen Hatheway "For me, Russell is the prime "go-to" science/technology/historical gasworks/coal-tar consultant in the UK, for historical operational knowledge of the British Gas Industry and for its environmental legacy for creating contaminated land". Russell has chaired the Institution of Gas Engineers and Managers prestigious History Panel for the past two years and is also co-editor of Historic Gas Times and regular contributor to Gas International.

He has been a trusted advisor to blue chip companies such as National Grid and NGN and public bodies such as Historic England and the BBC. With the support of CL:AIRE and National Grid, Russell authored an eBook on the History and Development of the British Gas Industry, which has become an important source of information for those working on former gasworks sites. Russell has recently authored a detailed report on behalf of Historic England on the history and heritage of the manufactured gas industry in England, including a desk study identifying over 3600 former gas sites, each of which he has located, reviewed their history and current condition.

In both his current and previous roles, Russell has pioneered the application of research and innovation to contaminated land impacts faced from our industrial past. Whilst some of this has focussed on the gas industry, other research has focussed on environmental assessment and remediation of chromium and mercury and recent research funding has been invested into geospatial data tools and the use of artificial intelligence to solve brownfield problems. Our research led solutions have had a wider impact, verified by the winning of four industry awards developing sustainable technologies for cleaning polluted land, environmental forensics and improved methods in human health risk assessment. Russell is Technical Director for the Ground Risk and Remediation group's innovation program, sponsoring UK academic research at the University of Manchester, University of Strathclyde, Nottingham University, Cranfield University and the British Geological Survey. He is a WSP representative to the European Network NICOLE and a new member of their Innovation working Group.

19 years with WSP

25 years of experience

Area of expertise

Oil and Gas Industry

Contaminated Land Assessment

Language

English

Basic French

Russell Thomas

Professor, Technical Director, BSc, PhD, CBIOL FRSB MIENVSc CEnv MSCI MIGEM EngTech

Research and Innovation

Environmental Forensics

EDUCATION

BSc (Hons) Microbiology and Biotechnology, University of Sunderland, UK	1993
PhD Biodegradation of Complexing agents used in the Nuclear fuel industry, University of Birmingham, UK	1997

PROFESSIONAL MEMBERSHIPS

Visiting Professor University of Strathclyde, Civil & Environmental Engineering	current
Visiting Lecturer University of Manchester, Earth and Environmental Sciences	current
Chartered Fellow of the Royal Society of Biology	current
Chartered Member of the Society of the Environment	current
Member of the Institution of Gas Engineers and Manager	current
Chair Institution of Gas Engineers and Manager History Panel	current
Member of the Society of the Chemical Industry	current
Member of the Newcomen Society	current

PROFESSIONAL HISTORY

Technical Director - WSP	2010 - present
Principal Scientist - WSP	2001 – 2010
Senior Scientist - British Gas Research and Development/Advantica	1997 - 2001

PROFESSIONAL EXPERIENCE

Innovation

National Grid Property Holdings Ltd, Assessment of Dermal Bioaccessability of Polycyclic Aromatic Hydrocarbon (PAH) in soil, UK

2014-2022

Innovation Technical Specialist

This research project has been a long running investigation in understanding the bioaccessability of organic contaminants called Polycyclic Aromatic Hydrocarbons which are found in oils, tars and widespread throughout the environment from anthropogenic sources. The project has been undertaken in collaboration with the British Geological Survey and National Grid Property over the past thirteen years. The first phase of the work developed an award winning method for assessing the bioaccessability of PAH from ingested soil, the method has been published in high quality journals and can be procured from commercial laboratories. The current phase of works is developing a method to assess the dermal bioaccessability of PAH compounds in soils. Russell project managed, been the industrial supervisor to the project and student and has co-authored the numerous papers which have come from the research study. The project is currently planned to continue to 2022 and involves collaboration with Prof. Ravi Naidu of the University of Newcastle, Australia.

Russell Thomas

Professor, Technical Director, BSc, PhD, CBIOL FRSB MIENVSc CEnv MSCI MIGEM EngTech

Confidential Contracting Clients, Gasworks Technical Support, UK

2017-ongoing

Gasworks Technical Specialist

Russell has been providing adhoc technical support on complex former gasworks sites in the UK. The issues covered include subjects such as ground conditions, below ground structures, assessment of gasholders prior to demolition, refurbishment, heritage liaison.

National Grid Property Holdings Ltd, Environmental Forensics, UK

2009 – 2017

Innovation Technical Specialist

Russell led two innovation projects focussed on environmental forensics for our client National Grid Property. These projects were undertaken in collaboration with Prof. Robert Kalin at the University of Strathclyde (where Russell is a visiting Professor) and specialist commercial forensics laboratories. The first project looked at the application of major ion chemistry and isotopes to investigate the presence of ammonia in groundwater at former gasworks sites across the UK. The second project has developed a GC X GC ToFMS based method for the analysis of coal tar. This method has been proven and published for use as a forensic diagnostic tool and has more recently included the first comprehensive analysis of coal tar ever published. The use of these tools has provide combined savings to the client over £1.2m on three projects to date. This project has published nine peer reviewed journal papers and won two awards. A new phase of this work is planned for 2020.

Homes England, Independent review of the formation of a white precipitate, Former coking works, Midlands

2019

Technical specialist

Russell undertook an independent review of the remediation of a former Coke Ovens, Chemical Works and Colliery complex in the Midlands. Russell was asked by the client to undertake an independent review of the site information provided to ascertain the source of a white precipitate and the likely cause. The report was used to settle a legal dispute between the two side and was very well received by the client.

Wakefield Council, Data Review of the Former Crigglestone Colliery and Coke ovens complex, UK

2017-2018

Technical Specialist

Data Review of the Former Crigglestone Colliery and Coke ovens complex. Russell was asked by the council to undertake a review of the sites development. Russell Identified the previous operations undertaken on the site which may pose a risk to current users of the site. The review was successfully used for the council to apply for funding to undertake a full intrusive investigation.

Helsinki Municipal Authority, Suvilahti Gasworks Redevelopment, Finland

2017-2018

Gasworks Technical Specialist

Russell Thomas

Professor, Technical Director, BSc, PhD, CBIOL FRSB MIENVSc CEnv MSCI MIGEM EngTech

Russell has acted as a technical advisor to the Helsinki Municipal authority. These works have included the preparation of a technical review of the Suvilahti gasworks redevelopment and remediation project being undertaken in the Helsinki harbour area, working with WSP Finland.

Part 2A Expert Witness, Confidential Site Midlands

2016-2017

Gasworks Technical Specialist

Provision of expert witness statement and evidence in a planning enquiry regarding a former gasworks site which had been redeveloped in the 1970's for housing, but had since been determined as contaminated land.

Jemena, Review of Remediation technologies used in Europe, Australia

2015

Gasworks Technical Specialist

Russell provided a review of the remediation technologies current in use in Europe for the remediation of former gasworks sites. The report highlighted any country trends used both in regulatory approaches and the application of risk assessment, but also the actual technologies employed.

Heritage / Stakeholder Communications

Historic England, Report on the Manufactured Gas Industry - an Archaeological and Architectural Assessment, UK

2017-2019

Technical Expert Gas Industry

Russell has prepared this authoritative 1000-page, 5 volume report on the history of the gas industry in England, which includes a detailed description of the different gas making processes used. This document is also valuable in any country outside of England which used British gas making technologies (e.g. Australia). The report series also includes the new guidance on assessing gasworks for the English Heritage regulator – Historic England. This involves an extensive desk study of >3600 identified former gas sites, all the known former gasworks sites in England.

National Grid Property Holdings Ltd, Educational Materials for Schools, UK

2018-2019

Reviewer/Contributor/Technical Expert Gas Industry

Technical review and contributor to the production of educational materials to be used by schools in Key Stage 1 & 2 educational syllabus. The resources explain the role: past, present and future of the gas industry in everyday life.

National Grid Property Holdings Ltd, Capturing Voices, UK

2018-2019

Interviewer/Technical Expert Gas Industry

The project has been collating an oral history of the gas industry and has involved Interviewing former gas workers and preparing materials for the events which have coinsided with the National Grid Property Gasholder decommissioning program.

National Grid Property Holdings Ltd, History Gas Industry in Norwich, UK

Russell Thomas

Professor, Technical Director, BSc, PhD, CBIOL FRSB MIENVSc CEnv MSCI MIGEM EngTech

2018-2019

Author/Technical Expert Gas Industry

Preparation and publishing of a booklet commemorating the long history of the gas industry in Norwich, England as part of the gasholder decommissioning programme undertaken by National Grid Property in the city.

BBC, Antiques Road Trip, UK

2018

Technical Expert Gas Industry

Preparation of script and historical fact checking, presented section with Charlie Ross on gas manufacture including conducting an experiment on making gas from coal.

October Films/Chanel 5, How the Victorians Built Britain, UK

2018

Technical Expert Gas Industry

Writing and editing of the script narrative and was a technical expert interviewed by Michael Burke.

AWARDS

WSP People Award – "We are Locally Dedicated with International Scale" People Award, 2019

NICOLE Innovation Award – 2nd Prize, Forensic Investigation of Coal Tar, 2017.

Best Scientific Advancement or Verification Award – Brownfield Briefing Awards. Assessment of the Bioaccessability of Carcinogenic Polycyclic Aromatic Hydrocarbons in soil, 2013

Best Scientific Advancement or Verification Award – Brownfield Briefing Awards. Application of Environmental Forensic Methods for the Characterisation of coal tars and Coal Tar Related contamination, 2012.

SELECTED PUBLICATIONS

Cave, M.R., Wragg, J., Beriro, D.J., Vane C., Thomas, C., Riding, M. Taylor, C., An Overview of research and development themes in the measurement and occurrences of Polyaromatic Hydrocarbons in dusts and particulates, Journal of Hazardous Materials 360 373–390, 2018)

Thomas, R.A.P. The development of the manufactured gas industry in Europe, Craig, J., Gerali, F., MaCaulay, F. & Sorkhabi, R., R. (eds) History of the European Oil and Gas Industry. Geological Society, London, Special Publications, 465, 137-164, 14 May 2018, https://doi.org/10.1144/SP465.14

Thomas, R.A.P. The History of the Gas Industry in Norwich, Private Publication by National Grid, 2018.

Gallacher, C., Lord, R., Taylor, C., Thomas, R., and Kalin, R., Comprehensive database of Manufactured Gas Plant tars - Part A Database., Rapid Communications in Mass Spectrometry, 10 May, 2017 DOI: 10.1002/rcm.7901

Gallacher, C., Lord, R., Taylor, C., Thomas, R., and Kalin, R., Comprehensive database of Manufactured Gas Plant tars – Part B Aliphatic and Aromatic compounds, Rapid Communications in Mass Spectrometry, 10 May., 2017

Russell Thomas

Professor, Technical Director, BSc, PhD, CBIOL FRSB MIENVSc CEnv MSCI MIGEM EngTech

Gallacher, C., Lord, R., Taylor, C., Thomas, R., and Kalin, R., Comprehensive database of Manufactured Gas Plant Tars – Part C Heterocyclic and hydroxylated PAHs, Rapid Communications in Mass Spectrometry, 10 May., 2017

Gallacher, C., Lord, R., Taylor, C., Thomas, R., and Kalin, R., Comprehensive composition of Creosote using two-dimensional gas chromatography (GCxGC-TOFMS), Chemosphere 178, Mar 13, 2017

Florentino Moyano Jiménez & Russell Thomas, William Richards and the Unrecorded Success Abroad: A British Engineer in the Spanish Gas Industry in the Nineteenth Century. The International Journal for the History of Engineering & Technology, 86:2, 124-146, DOI: 10.1080/17581206.2016.1223934

Darren J. Beriro, Mark R. Cave, Joanna Wragg, Russell Thomas, Gareth Wills, Frank Evans, A review of the current state of the art of physiologically-based tests for measuring human dermal in vitro bioavailability of polycyclic aromatic hydrocarbons (PAH) in soil, Journal of Hazardous Materials 305 (2016) 240–259.

Colosimo,F., Thomas, R., Lloyd, J.R., Taylor, K.R., Boothman, C., Smith, A.D., Lord, R., and Kalin R.M., Biogenic methane in shale gas and coal bed methane: A review of current knowledge and gaps, International Journal of Coal Geology 165 (2016) 106–120

Thomas. R.A.P., Gasworks Profile A: The History and Operation of Gasworks, CL:AIRE 2014, ISBN 978-1-905046-26-3, 2014.

Thomas. R.A.P., Gasworks Profile B: Gasholders and their Tanks, CL:AIRE 2014, ISBN 978-1-905046-26-3, 2014.

Thomas. R.A.P., Gasworks Profile C: Water Gas Plants, CL:AIRE 2014, ISBN 978-1-905046-26-3, 2014.

Thomas. R.A.P., Gasworks Profile D: Producer Gas Plants, CL:AIRE 2014, ISBN 978-1-905046-26-3, 2014.

Mark R. Cave, Joanna Wragg, Christopher H. Vane, Russell Thomas and Gareth Wills, Measurement and Modelling of the Ingestion Bioaccessibility of Polyaromatic Hydrocarbons in Soils, accepted for publication in Environmental Technology & Innovation, 2014.

Watts M. P., Coker V.S., Parry S., Patrick R.A.D., Thomas R, Kalin R & Lloyd J.R. Biogenic nano-magnetite and nano-zero valent iron treatment of alkaline Cr(VI) leachate and chromite ore processing residue. Applied Geochemistry, 2014.

Watts M. P., Coker V.S., Parry S., Thomas R, Kalin R & Lloyd J.R. Effective treatment of alkaline Cr(VI) contaminated leachate using a novel Pd-bionanocatalyst; impact of electron donor and aqueous geochemistry. Applied Catalysis B: Environmental, January, 2015.

C. Gauchotte-Lindsay, L.A. McGregor, A. Assal, R. Thomas and R.M. Kalin. Highlighting the Effects of Co-eluting Interferences on Compound-Specific Stable Isotope Analysis of Polycyclic Aromatic Hydrocarbons by Using Comprehensive Two-Dimensional Gas Chromatography ChemPlusChem 2014, 79, 804–812.

C. Gauchotte-Lindsay, P. Richards, L.A. McGregor, R. Thomas, R.M. Kalin, A one-step method for priority compounds of concern in tar from former industrial sites: Trimethylsilyl Derivatisation with comprehensive two-dimensional Gas chromatography, Journal of Chromatography A, 2012

Laura A. McGregor, Caroline Gauchotte-Lindsay, Niamh Nic Daeíd, Russell Thomas and Robert M. Kalin, Multivariate Statistical Methods for the Environmental Forensic Classification of Coal Tars from Former Manufactured Gas Plants, Environmental Science and Technology, 2012

Laura A. McGregor, Caroline Gauchotte-Lindsay, Niamh Nic Daéid, Russell Thomas, Paddy Daly and Robert M. Kalin Ultra resolution chemical fingerprinting of dense non-aqueous phase liquids from manufactured gas plants by reversed phase comprehensive two-dimensional gas chromatography, Journal of Chromatography A, Volume 1218, Issue 29, 22 July 2011, Pages 4755-4763

Mark R. Cave, Joanna Wragg, Ian Harrison, Christopher H. Vane, Tom Van de Wiele, Eva De Groeve, Nathanail CP, Ashmore M, Russell Thomas, Jamie Robinson, Paddy Daly. Comparison of Batch Mode and

Russell Thomas

Professor, Technical Director, BSc, PhD, CBIOL FRSB MIENVSc CEnv MSCI MIGEM EngTech

Dynamic Physiologically Based Bioaccessibility Tests for PAHs in Soil Samples, Environ Sci Technol. 2010 Apr 1; 44 (7):2654-60.