RUGBY FOOTBALL UNION

Kitchen Odour Risk Assessment

Twickenham Stadium – East Stand Extension

July 2016

Odour Assessment:
Twickenham Stadium – East Stand Extension

July 2016

Experts in air quality management & assessment

Document Control

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1 Introduction

1.1 This report sets out the odour risk assessment for the proposed redevelopment of Twickenham Rugby Football Union's (RFU) East Stand, in the London Borough (LB) of Richmond upon Thames. The proposed redevelopment involves increasing the hospitality offerings within the stand, providing 4 and 5-star lounges, which will be served by a number of new kitchens across multiple storeys of the stadium.

1.2 This odour risk assessment identifies the potential for impacts (such as annoyance) resulting from odours released from extraction systems at the proposed kitchen areas within the redeveloped East Stand.

1.3 The report describes the methodology and findings of the odour risk assessment, and identifies the level of odour abatement that will be required to minimise the risk of odour impacts resulting from the operation of the proposed kitchens. Where necessary (i.e. where a risk rating score differs between kitchens), the kitchens have been assessed separately due to the fact that each kitchen will be served by a separate extraction system.

1.4 The redevelopment of the East Stand will involve the introduction of the following lounges; all of which will have associated kitchens:

- St George's (Level 1) – High-end steak restaurant;
- The Union (Level 2) – High-end steak restaurant;
- Obolensky's and Wakefields (Level 3) – Various appetisers, including hot tapas, scotch eggs and 'Devils on Horseback';
- The Club House (Level 4a) – Premium, luxury, "small-plate" dining. There will be no fixed menu; food offerings will change with every match; and
- The Patch (Level 5) – Food will be "*a cross between a smokehouse and a rustic pizzeria*", and served to be eaten with the hands such as gourmet burgers, sandwiches etc.

2 Odour Assessment

2.1 Defra's Guidance on the 'Control of Odour and Noise from Commercial Kitchen Exhaust Systems' (Defra, 2005) contains an assessment procedure for identifying the potential risk of odour impacts from commercial kitchen operations. The results of this risk assessment can be used to determine a suitable level of odour abatement to be installed into a commercial kitchen.

2.2 The risk assessment for odours is split into the following four parts:

- dispersion;
- proximity to receptors;
- size of kitchen; and
- cooking type and grease loading.

2.3 Each part is given a risk rating score and the total risk rating denotes the level of odour abatement which is likely to be required to prevent the kitchens from causing odour nuisance impacts. The following sections of this report outline each part of the risk assessment in relation to the proposed restaurant.

2.4 It should be noted that where assumptions have been made these are clearly stated in the risk assessment and are based on the professional experience of Air Quality Consultants Ltd.

Dispersion

2.5 The risk rating for dispersion relates to the conditions under which kitchen extraction emissions are discharged. The relevant risk ratings described in the guidance are shown below. The risk score is shown in parentheses.

- VERY POOR (20) – Low level discharge, discharge into courtyard, or restriction on stack;
- POOR (15) – Discharge not low level, but below eaves, or discharge rate below 10 m/s;
- MODERATE (10) – Discharging 1 m above eaves at a rate of 10-15 m/s;
- GOOD (5) – Discharging 1 m above ridge at a rate of 15 m/s or more.

2.6 The risk ratings for dispersion for each kitchen are detailed in Table 1. The extract systems have been designed so that no vertical flues or stacks will be used to vent kitchen emissions; conventional, galvanised ducts will be used which emit odours through louvres. Furthermore, the ducts which exhaust emissions at roof level will be covered with mesh to ensure no insects or vermin enter the ductwork system and into the kitchen spaces.

Table 1: Dispersion Risk Ratings

Kitchen	Restaurant Level	Efflux Velocity (m/s)	Discharge Location	Approximate Height of Discharge (m)	Risk Rating
St George's	2	5 – 5.5	Level 2 inner concourse	7.6	**Poor (15)**
The Union	2	5 – 5.5	Level 2 inner concourse	7.6	**Poor (15)**
Obolensky's and Wakefields	3	5 – 5.5	Level 4 out of front of stadium building	18.0	**Moderate (10)**
The Club House	4a	5 – 5.5	Open roof areas at either end of the extension	25.6	**Moderate (10)**
The Patch	5	5 – 5.5	Open roof areas at either end of the extension	25.6	**Moderate (10)**

2.7 Based upon the criteria stipulated in the guidance, the risk ratings for dispersion for the proposed extract systems range from POOR to MODERATE. However, the actual height of discharge in relation to the nearest sensitive locations (i.e. residential properties) should be considered. The lowest level discharge, 7.6 m above ground level, is higher than the first storey windows of the nearest residential buildings, whilst the roof top discharge (at 25.6 m), although below the highest point of the supporting stadium façade, is considerably higher than any of the surrounding sensitive properties. These points have been taken into consideration when assessing the overall risk rating of the restaurants (see Paragraph 2.16). A diagram showing the duct extract locations is presented in Figure 1.

2.8 It should be noted that where kitchen odours are released into an inner concourse, the point of release has been assumed to be the entrance to the concourse, rather than the terminus of the extraction vents. This is because attendees and staff of the stadium are not considered as sensitive receptors in this assessment, as kitchen odours are not likely to detriment the expected level of amenity for a sports stadium.

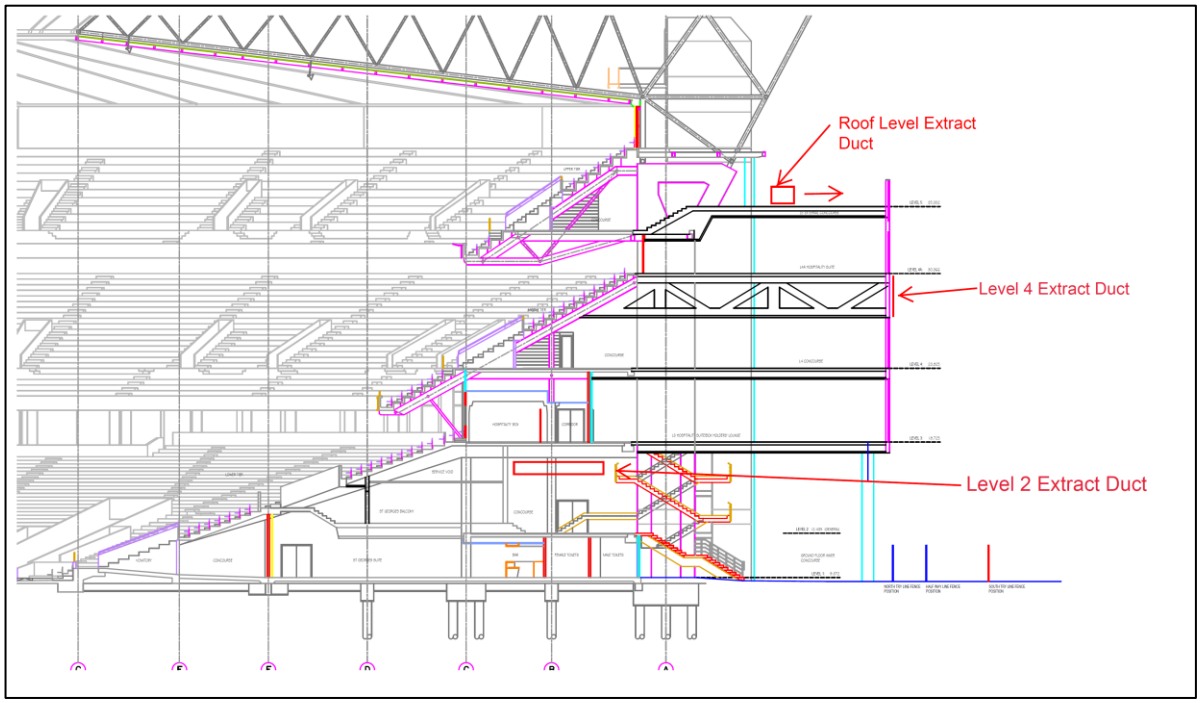

Figure 1: Kitchen Duct Extract Locations

Image adapted from an elevation drawing provided by ME Consulting Engineers Ltd

Proximity to Receptors

2.9 The risk rating for proximity to receptors relates to the distance between the point of discharge of kitchen emissions and the nearest sensitive receptor locations. Sensitive receptor locations may be residential properties, commercial premises or frequently used public open spaces. In the case of this assessment, Twickenham Stadium itself is not considered to be a sensitive receptor (for the reason stated above). The relevant risk ratings described in the guidance are shown below. The risk score is shown in parentheses. For the purpose of this assessment, it is assumed that the proposed development has been built and is operational.

- CLOSE (10) – Closest sensitive receptor is less than 20 m from kitchen discharge;
- MEDIUM (5) – Closest sensitive receptor is between 20 and 100 m from kitchen discharge;
- FAR (1) – Closest sensitive receptor is more than 100 m from kitchen discharge.

2.10 The risk rating for the proximity to residential properties is judged to be MEDIUM for all of the kitchens; there are residential properties situated within 100 m of Twickenham's East Stand, however, none are located within 20 m (see Figure 2). It should be noted that immediately downwind of the East Stand (see Figure 3 for a windrose of the study area, which indicates that prevailing winds are southwesterly, with few other significant components) the land is predominantly commercial and industrial, and thus is less sensitive to odour impacts than residential properties. There are estimated to be less than 10 residential properties within 100 m

of the extraction vents, and this has been taken into consideration when assessing the overall risk rating of the restaurants (see Paragraph 2.16).

Figure 2: Location of Nearest Sensitive Receptor Locations

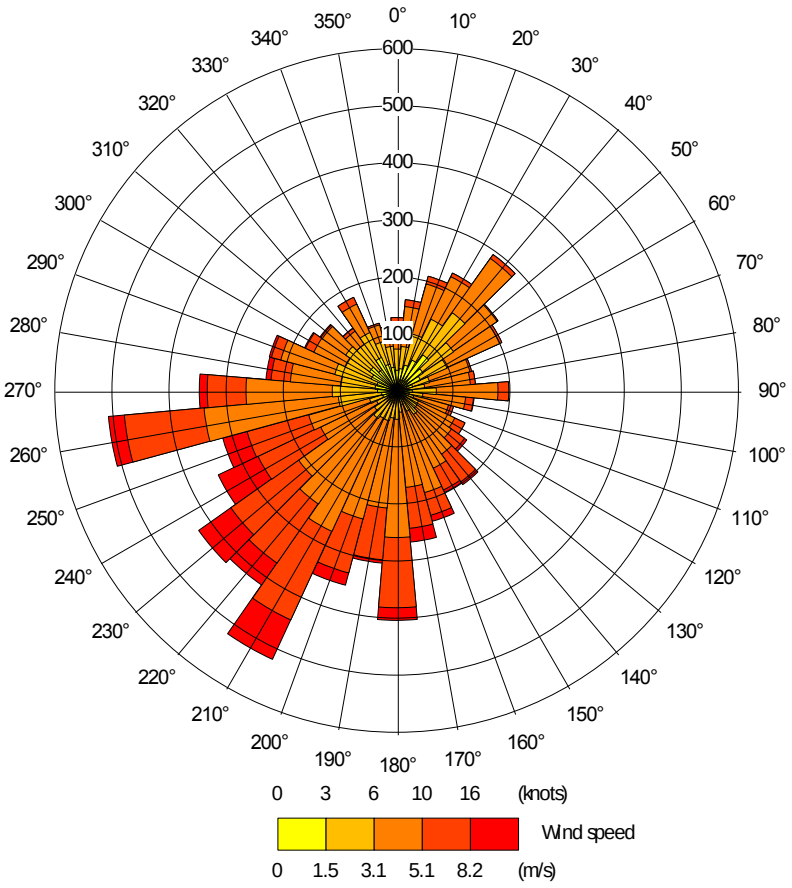

Figure 3: 2014 Windrose for Heathrow Airport (the closest meteorological station to Twickenham RFU)

Size of Kitchen

2.11 The risk rating for size of kitchen relates to the volume of food prepared by the kitchen and is described in terms of the capacity of the restaurant or take-away. The relevant risk ratings described in the guidance are shown below. The risk score is shown in parentheses.

- LARGE (5) – More than 100 covers or a large-sized take-away;
- MEDIUM (3) – Between 30 and 100 covers or a medium-sized take-away;
- SMALL (1) – Less than 30 covers or a small take-away.

2.12 The proposed hospitality areas will cater for a total of up to 6,500 covers at any one time. The hospitality areas are thus judged to be LARGE in terms of the size of the kitchens.

Cooking Type and Grease Loading

2.13 The risk rating for cooking type and grease loading relates to the type of cooking methods employed in the kitchen and the type of food prepared. The relevant risk ratings described in the guidance are shown below. The risk score is shown in parentheses.

- VERY HIGH (10) – Pubs (those serving a high level of fried food), fried chicken, burgers or fish and chips;
- HIGH (7) – Kebab, Vietnamese, Thai or Indian;
- MEDIUM (4) – Cantonese, Japanese or Chinese;
- LOW (1) – Most pubs, Italian, French, Pizza or Steakhouse.

2.14 The proposed kitchens will serve a variety of cuisines; menus will be changed regularly, as frequently as every match in The Club House and St George's suite, and thus it is difficult to assign a cooking type to the kitchens. However, the high-quality food on offer, coupled with a focus on utilising high-quality raw ingredients to serve mostly traditional English pub food, suggests that the grease loading of all the kitchens will be LOW.

Risk Assessment Summary

2.15 The odour risk assessment summary is shown in Table 2 for the proposed East Stand kitchens.

Table 2: Restaurant Kitchen Odour Risk Assessment Summary

Criteria	Risk Rating	Risk Score[1]	Description	Comments
Dispersion	Moderate to Poor	10-15	Discharge not low level, but below eaves, or discharge rate below 10 m/s *or* Discharging 1 m above eaves at a rate of 10-15 m/s	The efflux velocity at the extract points is anticipated to be <10 m/s, and will exhaust emissions horizontally. Discharging of emissions will vary in height, however all ducts will discharge above roof eaves of nearest residential properties.
Proximity to Receptors	Medium	5	Closest sensitive receptor is between 20 and 100 m from kitchen discharge	The nearest residential receptor is located approximately 40 m from the East Stand. There are no sensitive receptors within 20 m of any extract duct.
Size of Kitchen	Large	5	More than 100 covers or a large-sized take-away	All of the restaurants will have the capacity to each serve well over of 100 covers.
Cooking Type and Grease Loading	Low	1	Most pubs, Italian, French, Pizza or Steakhouse	The type of cuisine served by the restaurants will vary, sometimes as frequently as every match; however the general onus of all of the restaurants is to serve high quality food, freshly prepared on-site. The grease loading of all the kitchens is thus judged to be low.
TOTAL RATING	**High**	**21 - 26**	**A HIGH level of odour abatement required for each kitchen.**	

[1] Total Risk Score of <20 = Low to Medium Risk, 20 to 35 = High Risk; and >35 = Very High Risk.

2.16 The overall odour risk rating of all of the proposed kitchens is 'High', however, the score is at the lower end of this scale. This denotes that it would require a high level of odour control to eliminate the risk of odour impacts at nearby sensitive locations.

Recommended Odour Abatement System

2.17 This section of the report briefly outlines the odour control measures that would need to be installed on the kitchen extract systems at the East Stand to provide optimal odour abatement and minimise the risk of odour impacts at surrounding properties.

2.18 The odour control measures suggested are those recommended within Defra's guidance on odours from commercial kitchens (Defra, 2005) for kitchens with a 'High' odour risk assessment score.

2.19 The guidance outlines that abatement systems that offer a 'High' level of odour control may include:

"1. Fine filtration or electrostatic precipitation (ESP) followed by carbon filtration (carbon filters rated with a 0.2-0.4 second residence time).

2. Fine filtration or ESP followed by UV ozone system to achieve the same level of control as 1"

2.20 In addition to this, the guidance states that the flue shall:

1. Discharge the extracted air not less than 1 m above the roof ridge of any building within 20 m of the building housing the commercial kitchen.

2. If 1 cannot be complied with for planning reasons, then the extracted air shall be discharged not less than 1 m above the roof eaves or dormer window of the building housing the commercial kitchen. Additional odour control measures may be required.

3. If 1 or 2 cannot be complied with for planning reasons, then an exceptionally high level of odour control will be required.

2.21 The extract ducts will release emissions to the atmosphere horizontally, and well below the roof ridge of the stadium building; however, it is not considered necessary to require an increased level of mitigation in this instance for a number of reasons. The extract ducts are all located at heights well above the roof eaves of the nearest residential properties, which are located at least 40 m away, and in most cases well over 100 m. Another point to consider, which isn't covered within the Defra guidance, is that the proposed kitchens will operate far less frequently than a 'standard, high street' restaurant. Odour annoyance is influenced, amongst numerous other factors, by the frequency of which the odour is detected. The proposed kitchens, which will only operate intermittently to coincide with events at the stadium, are much less likely to generate a justifiable cause for annoyance. Coupled with the fact the land to the east (i.e. downwind) of the East Stand is occupied predominantly by commercial and industrial properties, it is considered that a High level of odour control would be required in this instance.

3 Odour Abatement System

3.1 In accordance with the recommended odour abatement systems identified in paragraph 2.19, and following discussions with the client, the following odour abatement system has been identified as the most effective and feasible option that will be installed at each of the proposed kitchens. It is

judged that the system identified in Table 3 will offer a suitable level of odour abatement to minimise the potential for odour impacts at nearby sensitive locations.

3.2 It should be noted that the odour abatement system should be specified, designed and installed by a suitably qualified contractor. It is imperative that, following commissioning, the system manufacturer/supplier provides comprehensive information regarding the maintenance of the system to ensure that optimal odour abatement performance is maintained during each restaurant's operation.

Table 3: Recommended Odour Abatement System

Abatement Stage	System	Comment
Particle Filtration	**Fine filtration system to protect odour removal system**	A fine filtration system will be required to remove any particles or grease, to protect the odour removal system. The system will be installed in an accessible location to facilitate cleaning and changing of filters.
Odour Removal	**Carbon Filtration / UV Ozone**	Following particulate removal, any residual gaseous odours will be removed using a carbon filtration *or* UV ozone system. If carbon filtration is used, a minimum residence time of 0.2-0.4 seconds will be achieved in accordance with the best practice guidance. The system will be installed in an accessible location to facilitate maintenance and filter changes.
Emissions Discharge	**High Level Discharge**	The current design of the extraction discharge points (see Figure 1) is considered sufficient in this case due to the distance from, and the relative height to the windows of, the nearest residential properties.

3.1 It is of AQC's professional judgement, and based upon extensive experience in the assessment of odours from commercial kitchen outlets, that carbon filtration systems offer significantly better levels of odour abatement than similarly specified UV ozone systems. The use of carbon filtration on the kitchens' extract systems has thus been assumed for the following sections of this report.

4 Odour Abatement System Maintenance Procedure

4.1 In order to ensure the proposed odour abatement systems work efficiently and effectively, it is important to adhere to a stringent service and maintenance regime. The maintenance procedures for different components of the kitchen extraction system are set out below, and a summary of the maintenance schedule is presented in Table 4.

Kitchen Canopy

4.2 The kitchen canopies should be inspected and cleaned on a daily basis. Thorough internal and external cleaning of the whole kitchen canopy should be carried out on a twice-weekly basis.

4.3 Kitchen canopies can be cleaned with a mild detergent or specific stainless steel cleaner.

Particulate/Grease Filter

4.4 The particulate/grease filters should be checked on a 3-monthly basis and replaced as necessary (or as per manufacturer recommendations).

Activated Carbon Filter

4.5 The carbon filters will be changed in accordance with the manufacturer's requirements.

4.6 It is general best-practice that, following an initial period of use (defined by the manufacturer), a sample of carbon from the filter is sent to a manufacturer-recommended laboratory for analysis. This will provide an indication of when the unit will require changing, and can thus be used as the basis for setting the frequency of carbon media changes.

Extract Ductwork and Fans

4.7 General best-practice maintenance for kitchen extract systems is as follows. It should be noted, however, that any system-specific maintenance procedures provided by the manufacturer should be used in preference:

- The first few metres of the extraction ductwork above the kitchen extract hoods will need to be cleaned in the traditional method of scraping the ductwork clean to remove the fat and grease. Appropriate hatches will be installed to ensure adequate access.
- The remaining ductwork should be cleaned using a mechanical rotary brush to spin, dislodge and move the contaminant within the ductwork to allow an air vacuum unit to collect it. This will result in fewer access panels being needed that will restrict access for a visual verification of cleaning being completed.

4.8 Extract ductwork should be checked and cleaned on an annual basis, or as required. Any damaged sections of ductwork will be replaced.

4.9 The fans should be checked approximately every 3 months (or as per manufacturer recommendations) and cleaned to remove any grease deposits that have accumulated on the fans.

4.10 Table 4 provides a tabulated, best-practice summary of the kitchen extraction system cleaning and maintenance schedule for the proposed restaurants.

Table 4: Kitchen Extraction System Maintenance Schedule Summary

System Component	Maintenance Required	Frequency
Kitchen Canopy	Check and clean external surfaces	Daily
	Clean internal and external surfaces.	Twice-weekly
Extract Ductwork	First few metres scraped to remove fat and grease, remaining ductwork cleaned using rotary brush and vacuum unit.	Annually
Fans	Check and clean.	3-monthly
Carbon Filtration	Check bag filters.	3-monthly
	Check carbon filter and change as required.	Check after 1st 2-months of use, then change as indicated by carbon test results
	Inspect and clean outside of the unit.	3-monthly
	Check seals.	3-monthly

4.11 The cleaning frequencies set out in Table 4 will be periodically reviewed once the kitchens are in operation. Cleaning frequencies may be increased or decreased accordingly.

4.12 All inspection, cleaning and maintenance carried out on the kitchen extraction systems should be recorded in a maintenance record log, as described in the next section of this report.

5 Cleaning and Maintenance Records and Reporting

5.1 In order to ensure the cleaning and maintenance schedule is adhered to and is reportable, a series of cleaning and maintenance logs and records should be kept.

5.2 Two main records will be kept up to date; the first is a weekly cleaning log to record the routine inspection and cleaning required for the kitchen canopy; the second is a maintenance record log for the less frequent cleaning and maintenance tasks, such as particulate and carbon filter replacement.

5.3 The routine weekly cleaning should be kept in a log, in a format similar to that presented in Table 5. The log should be kept either electronically, or in hard copy form, or both. When routine cleaning is completed, the log is marked with initials or signed.

Table 5: Example Routine Weekly Cleaning Log

W/C Date:		**Cleaning Log (initial in box when cleaning complete)**						
Component		**Mon**	**Tue**	**Wed**	**Thu**	**Fri**	**Sat**	**Sun**
Kitchen Canopy (external)								
		Weekly Clean 1				**Weekly Clean 2**		
Kitchen Canopy (internal)								

5.4 The infrequent maintenance tasks should be recorded on a separate log, in a format similar to the example log shown in Table 6. In order to assist with the long-term system maintenance, a diary/calendar should be kept to remind kitchen staff of key dates for component cleaning and replacement, or a date for next inspection.

5.5 The maintenance log should be kept either electronically, in hard copy, or both. Once a task is completed a date for the next completion will be determined and recorded on the log, as well as in the diary/calendar for completion.

Table 6: Example Service and Maintenance Log

Task	Date Conducted	Maintenance Conducted by	Follow-up Maintenance Required	Date task next due
Change bag filters	01/07/16	J. Smith	None	01/10/16
Change carbon filters	01/07/16	J. Smith	None	01/09/16
Check abatement unit and seals	04/07/16	D. Jones	None	04/11/16
Check fans	15/07/16	J. Smith	None	15/10/16
Clean ductwork	04/07/16	D. Jones	None	July 2017

Appendix 1. Professional Experience

Stephen Moorcroft, BSc (Hons) MSc DIC MIEnvSc MIAQM CEnv

Mr Moorcroft is a Director of Air Quality Consultants, and has worked for the company since 2004. He has over thirty-five years' postgraduate experience in environmental sciences. Prior to joining Air Quality Consultants, he was the Managing Director of Casella Stanger, with responsibility for a business employing over 100 staff and a turnover of £12 million. He also acted as the Business Director for Air Quality services, with direct responsibility for a number of major Government projects. He has considerable project management experience associated with Environmental Assessments in relation to a variety of development projects, including power stations, incinerators, road developments and airports, with particular experience related to air quality assessment, monitoring and analysis. He has contributed to the development of air quality management in the UK, and has been closely involved with the LAQM process since its inception. He has given expert evidence to numerous public inquiries, and is frequently invited to present to conferences and seminars. He is a Member of the Institute of Air Quality Management.

Laurence Caird, MEarthSci CSci MIEnvSc MIAQM

Mr Caird is a Principal Consultant with AQC, with ten years' experience in the field of air quality including the detailed assessment of emissions from road traffic, airports, heating and energy plant, and a wide range of industrial sources including the thermal treatment of waste. He has experience in ambient air quality monitoring for numerous pollutants using a wide range of techniques and is also competent in the monitoring and assessment of nuisance odours and dust. Mr Caird has worked with a variety of clients to provide expert air quality services and advice, including local authorities, planners, developers and process operators. He is a Member of the Institute of Air Quality Management and is a Chartered Scientist.

Paul Outen, BSc (Hons)

Mr Outen is a Consultant with AQC, having joined in 2014. He holds a degree in Environmental Geoscience, having specialised in the study of landfill-related particulate matter for his final year thesis. Prior to joining AQC he worked as an Air Quality Consultant at Odournet UK Ltd for 6 years, undertaking a range of air quality and odour assessments across a number of different industries, as well as managing the sampling/technical department for the company. He now undertakes air quality assessments at AQC, utilising the ADMS dispersion models to assess the impacts of a variety of sources on concentrations of nitrogen dioxide, PM_{10} and $PM_{2.5}$.

Full CVs are available at www.aqconsultants.co.uk.