

Analysis of Environmental Impacts
Proposed development
4 St. Mary's Place Stamford
by
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1.0 Introduction and outline.

1.1 I have particular expertise not just in Environmental Health related matters and acoustics but also commercial kitchen design. I have designed a significant number of large and small commercial catering kitchens and have particular expertise in ventilation requirements and odour control. As a consequence I am able to provide expert advice on the interrelationship between kitchen design requirements and odour and noise control. I have also been directly involved in odour nuisance cases where carbon filters have failed due to incorrect ventilation design. I consider I have expertise in relation to the competing issues in this case.

1.2 **1) Odour and kitchen extract requirements.** There is legitimate concern over the adequacy of the kitchen ventilation system as proposed which may ultimately require changes to the external layout in order to achieve the ductwork and airflow required.

1.3 There are limitations to the airflow speed through ductwork and fans and ventilation related equipment is designed with these tolerances taken into account. For example the noise emissions from a fan or terminus are based on the normal pressure drop values caused by ductwork limitations and a range of airflow speeds. High airflow leads specifically to internal duct turbulence which in turn generates increased noise. In the circumstances of this case this leads to unpredictable levels of noise and a number of other problems. This is entirely different to increasing the final terminal velocity (efflux velocity) in an attempt to improve dispersal of pollutants.

- 1.4 Where plant operates outside of its tolerances noise generation can increase substantially and there is no manufacturer's guarantee. Warranty is also lost. Similarly odour control systems are based on the same tolerances and cannot be expected to adequately perform when operated outside of their normal tolerances for airflow. Odour control systems are particularly sensitive to airflow rates and their success generally requires lower than normal airflow speeds. In this case the chimney flue limitations leads to substantially higher airflow rates than is usually designed for. This may in part be addressed by siting the odour control close to the kitchen canopy but that introduces further problems of its own.
- 1.5 Where the limitations prevent adequate air extract and make-up supply air, fugitive emissions become a serious concern leading to unacceptable risks of localised odour issues. In view of the enclosure by buildings, entrapment of these odours is a high risk. It follows therefore for an odour control system to be acceptable there needs to be appropriate airflow rates, sufficient contact time between the odour counteracting medium and the gaseous stream and suitable temperatures.
- 1.6 In summary, ventilation requirements, odour and noise control are all inter-related.
- 1.7 The airflow rate required for the chimney flue space is excessive and it is unlikely the various plant will be able to meet both general health and safety requirements as well as the requirements to adequately mitigate the impact that the planning conditions are designed to address.
- 1.8 A low odour form of cooking was apparently proposed but this is not reflected in the kitchen equipment design. On the contrary the kitchen design includes deep fat frying, griddle use and grilling. This causes additional problems as you could not easily apply a condition preventing frying as there are so many forms of frying and varying definitions. It should be possible to use a scheme type condition where the main cooking appliances are prior approved or approved on a temporary / trial basis. These would be limited by the ventilation and odour control requirements but it could result in a significant reduction in equipment limiting the extent of cooking achievable.
- 1.9 Prima facie the information suggests it may not be practicable to control the operations to a point that does not defeat the enterprise.
- 1.10 In the Planning Inquiry in 2010 the Inspector was satisfied odour could be controlled by an odour management plan and "over capacity

in the design". This is based on adopting a specific style of cooking which would reduce odour emissions. The equipment proposed indicates a highly odorous style of cooking and a high ventilation demand. Thus the principles on which the Inspector concluded are not met. Further there does not appear to have been appropriate technical evidence presented on the problems with the odour control systems proposed and the limitations on tolerances.

1.11 It is feasible to reduce odours and ventilation demand by the style of cooking and appliances used but this development proposal does not incorporate them. In my direct experience of odour control systems the problems in this case warrant consideration of an alternative approach. There are alternative odour abatement systems and it may be feasible to achieve the desired level of odour control through modifications both to the cooking equipment and the odour arrestment system used. The current proposals are inadequate in that regard.

1.12 It is unfortunate as I had agreed to meet with the developer's consultant's to try to address these issues but they declined.

1.13 Detailed points on kitchen extraction and odour control.

1.14 **Style and demand of cooking.** The Inspector's decision refers at paragraph 33 to the use of a specific style of cooking. The canopy and kitchen layout reveals a high proportion of what is termed "flame" cooking. This effectively refers to cooking equipment requiring greater than normal airflow rates due to the nature of gaseous and harmful emissions. It does not mean it involves open flames. They also emit highly odorous and grease laden emissions. The grease serves to inhibit the odour arrestment. Examples in this case include deep fat fryers, mirror griddle, ribbed griddle, salamander (grill) and solid top oven / range. Thus the style of cooking is based on equipment that has high airflow requirements and is highly odorous, contrary to the scenario analysed by the Inspector.

1.15 A different style of cooking and reduced cooking facilities are necessary to reduce odour production and airflow requirements. Requirements cannot be met using for the current proposal and prima facie a substantial reduction is required.

1.16 **Make up air requirements.** This was discussed in written evidence at the Inquiry but the evidence did not address the actual make up air requirements of the proposal, merely whether they could be natural or mechanical. It is suggested by the Inquiry evidence that

make up air can be natural. However, this needs to be of the order of 85% of extracted air.

- 1.17 Guidance is provided in DW172¹ and in guidance from the HSE. At the quoted flow rate of 21m/s using two flues of diameter 200mm there is an extract rate of approximately 1.3m³/s. This leads to a make up air requirement of over 1m³/s. This is substantial and it cannot be met via natural means without large openings. A natural ducted inlet would be large and could not be accommodated in the space provided without major changes to the external design. This would compromise the acoustic performance of any wall it passed through and increase the risk of fugitive odour emissions.
- 1.18 Guidance is given in section 6 of DW172. It states "*Where a natural ducted inlet for relief air is selected it should be as short as possible, at high level and with filtration*". Filtration typically halves airflow leading to an opening requirement into the kitchen of the order of 2m² direct to the external air. This is not practical without compromising the other requirements for this development.
- 1.19 Mechanically supplied make up air is required from somewhere and / or cooking facilities radically reduced and alternative types of cooking (induction and pressure / combination cooking) is used. This is still unlikely to reduce airflow requirements low enough unless there is a reduction in the cooking appliances. Additional underground ducted supply air could be provided as long as there are locations to draw from. This is not included in the design and as proposed the development cannot meet requirements without compromising the planning objectives in relation to odour and noise etc.
- 1.20 If the extract rate of 2m³/s as identified below is applied, this increases supply air levels to 1.7m³/s and a natural opening in the order of 3.4m² in the kitchen wall.
- 1.21 **Air handling unit capability.** I am personally unaware of an air handling unit that can operate satisfactorily with its filters at 21m/s flow rate, providing 2m³/s and perform within its tolerances. DW172 gives a maximum design flow rate of 6-9m/s for the main ducts which is substantially below the flow rates proposed in this case. The developer needs to demonstrate there is a ventilation system that can achieve what is stated and at the same time function in relation to odour arrestment.

¹ Heating and Ventilating Contractors' Association Specification For Kitchen Ventilation Systems. This document is referred to by the HSE and is considered the industry standard to which all systems should be designed. Departure warrants detailed explanation and demonstration it achieves the health and safety requirements.

- 1.22 There is a fundamental difference between a high efflux velocity at the terminus and a high flow rate in a duct. The former can be achieved without compromising the latter. High efflux velocity is desirable. High duct airflow rates are not.
- 1.23 It is highly unlikely ventilation demands can be met without changes to the building envelope. Highly specialised and bespoke kit is warranted in any event. In view of its operation outside of standard performance criterion it would require prior and post approval with the alternative being limitations on cooking appliances.
- 1.24 The appliances under the canopy alone indicate an air flow rate of about 1.3m³/s depending how it is calculated. In addition there is a bake off oven, convection oven, microwave, hot pass, dishwasher, under-counter refrigerators and freezer, stills area with water boiler, hot cupboard and sinks, all which create ventilation demand in addition to the equipment directly under the canopy.
- 1.25 This additional demand is conservatively about another 0.7m³/s. This gives a typical minimum extract requirement of about 2m³/s. This is similar to that for other comparable projects with which I have been involved. In turn this indicates the ventilation system at a maximum capacity of 1.3m³/s cannot meet the requirements of the kitchen. Health and safety and food safety requirements would then demand additional extraction and supply air.
- 1.26 Reduced ventilation demand through reduced cooking equipment is needed or additional extract and supply air ability provided.
- 1.27 **Proposed odour arrestment system.** Carbon filters (activated charcoal) are proposed. These have a number of inherent problems and in any event would require planning control as there would be no means to prevent post development removal of the filters and loss of odour control. Removing the filters substantially reduces costs and reduces the pressure drop in the system. Thus it is advantageous to operators to dispense with the system. Thus the filter use needs to be controlled by condition.
- 1.28 Various other issues arise.
- 1.29 The filters increase air resistance pushing a system that is already beyond any normal design limits to work in parameters it is simply not designed or tested for. Fans will require increased sizing to address the pressure drop.
- 1.30 Carbon filters require a contact time to absorb odour molecules. The airflow rate therefore needs to be low for this to happen. This is not

achieved and the system would be operating outside of acceptable operating parameters.

1.31 The flue gas temperature is critical to performance and needs to be below 40 degrees C. This often requires mixing with cold make up air within the extract system and sufficient separation distance from heat producing sources to ensure loss of temperature in the flue gases. Thus this creates a further demand for mechanical make up air. This cannot be achieved in the space available or with the high velocity flue gases proposed. In summary a means of odour control is specified that cannot practically function within the parameters identified and the design as shown in the application.

1.32 Changes to cooking style and equipment will help reduce exhaust gas temperature but not overcome all the problems. An alternative odour control regime is likely to be required such as ozone injection. However, this also requires contact time and brings with it its own problems including the risk of ozone emissions. This may require a two stage system of ozone injection and excess ozone removal at certain times. In any event flow rates need to reduce. The carbon system proposed cannot work effectively under the requirements imposed in this case.

1.33 **Internally generated noise from plant, equipment and activity.**
This issue relates to activity within the kitchen and first floor storage area which could transmit noise either through the structure or via openings in the structure. I have not seen this problem addressed in the Inspectors decision of May 2010.

1.34 Potential issues arise in relation to noise emitted through the door of the kitchen which opens to the outside garden and thus this needs to be kept closed by condition and any future openings in the kitchen facade or roof and alterations to them also prevented by condition.

1.35 The main potential noise sources include impact noise generated internally and airborne noise escaping any opening into the rear garden area. The latter is addressed by control over openings and their use. The former requires further consideration. In my experience potential impact noise transmission problems in commercial kitchens include slamming of walk-in cold room doors, occasional hammering operations such as meat tenderising and occasionally loud metal on metal crashes when items are dropped.

1.36 A segregated raw preparation area is not identified in the layout nor is the stainless steel fabrication design type identified. The cold room doors are shown opening inwards which is unusual. They normally

open outwards. Devices controlling closing could be fitted where they lead to noise transmission.

- 1.37 Additional concern arises over emissions through the large glazed wall of the kitchen. This wall needs to ensure an adequate attenuation of noises such as metal pots and pans clashing, shouting and call orders etc. It is important therefore that its acoustic performance is also specified and is subject to prior approval.
- 1.38 Internally transmitted noise or airborne noise emissions from the kitchen have not been addressed. These issues can be dealt with by a scheme type condition where the walk-in cold room doors and worktop / bench design are prior approved. Thus for example mobile benches are mounted on rubberised wheels and incorporate a sound deadened marine ply core in the underside of the worktop to reduce noise.
- 1.39 **Noise from plant transmitted externally such as from the condenser units.** The levels currently proposed in the draft condition permit excessive noise from plant that is liable to cause unacceptable intrusion.
- 1.40 This appears to have arisen on an incorrect understanding that the lower limits in BS4142 1997 are set because adverse impact does not arise at lower levels. This is incorrect. Previous studies on BS4142 suggest the relationship of source noise to background noise continues below the BS4142 limits and that they were originally set because of instrument limitations that no longer apply. It is common in many urban areas to apply much stricter limits on plant noise.
- 1.41 Stricter limits are warranted in this case because of the low background noise levels which arise and also the likelihood attenuation through windows facing the plant will be less than 10 decibels. Not only are stricter limits warranted in this case but they are achievable.
- 1.42 I am satisfied the condenser plant room design can be made to work and indeed there are low cost measures which can improve the efficiency of the present design without any increased noise. Plant noise is therefore controllable by condition but with revised limits recommended necessary to protect amenity.
- 1.43 Paragraph 38 of the appeal decision indicates there was a noise condition accepted by all to control the noise. It is not clear if this was the same as the condition now proposed. It is apparent the objector's acoustician did not accept this condition but this does not appear to have been dealt with by the Inspector.

- 1.44 The level in the condition is erroneously argued to be influenced by the World Health Organisation value for "critical health effects" from steady continuous noise which was argued at the appeal should apply during the day. This is an incorrect application of that guidance and a line of argument rejected by the courts in nuisance cases (when considered at precedent level). It is also contrary to national guidance / research, both in relation to ventilation plant noise and noise policies.
- 1.45 It was stated at the Inquiry that BS4142 1997 is "not applicable when the background and rating level are very low". The standard actually states "The method is **not suitable** ... when the background and rating levels are **both** very low". (my emphasis). It defines "very low" when the background level is below about 30dB **and** the rating level is below about 35dB. (My emphasis). The meaning is subtly different.
- 1.46 In cases where the source of noise is irregular enough to attract attention a 5dB penalty is added. Thus the rating level is 5dB higher than the measured or determined source value.
- 1.47 The standard does not provide a reason why there is a cut-off and it runs contrary to its foreword which relates the effect to the difference between the source noise and the background noise level as well as other factors such as the absolute level. It was incorrectly stated at the Inquiry that the cut off is because "at these low levels there would be no material impact irrespective of the difference between the noise level of the plant and the background level."
- 1.48 It can be seen with a "rating" level of 35dB which can equal a measured source noise of 30dB the standard still applies even if the background noise was 15dB. This is because both are not low. Further, research indicates the principle of comparing background to source noise emergence would apply in any event at lower levels. The condition proposed by the Council equates to a rating level of 35-40dB which is well within BS4142 and indicative of unacceptable impact. For example at night the background level drops as low as 24dB LA90. This leads to an indication of complaints at a rated source level of 34dB. This is 1dB below the proposed limit and it equates to an actual source level of 29dB. Thus the proposed condition limit is at a level where complaints are predicted to arise.
- 1.49 In my experience it is normal and reasonable to design or control to a rating level equal to the background noise level or within 3dB of it. In some cases this will still allow excessive noise but generally provides a good compromise level of control. This indicates the night

time limit should not exceed a rating level (actual sound energy level of 19-22dB) not exceeding 24-27dB LAeq(5min).

- 1.50 The analysis above is based on the lowest recorded background noise level and it is to be recognised that most of the time levels are higher than this. Further, a difference of 5dB between the background and rating noise level is considered of marginal significance in terms of likelihood of complaint. This suggests rating levels up to 5dB above the lowest background are possibly acceptable where it is occasional situation and thus a condition level of 25dB LAeq(5min) is appropriate. This does not need to differentiate between day and night as the plant operates day and night and so needs to be designed to meet the night time requirements.
- 1.51 A revised planning condition setting a lower level is therefore required. It is also necessary to revise how the limit applies as measurements become increasingly difficult at low levels. As a consequence a determined level is needed which allows the use of other techniques as well as direct measurement at the receiver location. This requires a new form of words.
- 1.52 **Noise from use of the garden area which could arise from staff use.** The inspector identified concerns with use of the garden area and in particular human voices. Controls need to address staff use of this area and activities such as the tipping of waste etc. Tipping crushed glass in the evening or night time can be highly intrusive and disturbing due to the nature and character of the noise.
- 1.53 Staff are likely to want to go outside to relax during breaks, possibly smoke and chatter. This could become a regular intrusive activity and in view of the recognised importance of the quietness of this locality it requires control.
- 1.54 Some conflict may arise as the relevant Food Safety Directives require specifically that food waste shall not accumulate in food preparation rooms (kitchens). Addressing waste is normally dealt with by taking out the waste at the end when the kitchen closes. This is probably not an option in this case and sealed bags are required. This can be managed. A scheme type condition controlling the use of the garden and yard is required.
- 1.55 **Waste management.** De-watering of waste was proposed at the Inquiry to address waste problems with chilled storage to prevent odour. This is not identified in the plans and submitted application information. Further the de-watering unit was to be located in the kitchen but is not shown or listed. These units require adequate

space and commonly cause spillage and contamination problems. Its location needs to be identified on a plan as does the chilled storage.

1.56 Thus a waste management scheme condition is already proposed but the infrastructure requires identification.

1.57 **Summary findings**

1.58 To ensure the residential and commercial uses can appropriately co-exist in this case a high level of control is required over the design and use of the commercial operation. In most cases issues can be addressed with appropriate design but the ventilation system and odour control requirements remain a serious obstacle in this case because of the constraints on extract and supply air. Modification to cooking style as identified in the appeal decision is not reflected in the application details and the design. It will require significant constraints. I am concerned this is to the extent that it could defeat the enterprise and thus it requires further demonstration it can be achieved.

1.59 Controls and measures required include:

A) A noise scheme type condition to address internal design issues that may generate noise and the acoustic performance of the glazed wall.

B) A condition preventing alterations to roofs, facades and openings without prior written approval of the LPA.

C) A condition controlling the opening of the kitchen, restaurant and glazed lobby doors.

D) A revised plant noise condition with a lower decibel limit and different form of words.

E) A scheme type condition controlling garden and yard use by staff to limit activity and prevent noise during unsocial times.

F) A waste management scheme condition is already proposed but the infrastructure requires identification and approval.

G) Redesign of cooking equipment and methods and ventilation design and odour control. Change is required to meet what the Inspector identified in the decision and to address the physical constraints. This cannot currently be dealt with by condition as it is not demonstrated the requirements can be achieved in practice. Approving the development with this matter left unaddressed would

lead to an unsatisfactory situation where additional ventilation plant and ductwork not currently identified is likely to be an inevitable requirement that would conflict with the planning objectives.

Until the ventilation issues in G) above are addressed I am unable to recommend approval. These observations are made in the light of the planning decision of May 2010.

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