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Sent by email: tom.klopper@angloamerican.com

Air Quality Statement for a Proposed Diamond Cleaning Research Laboratory

Dear Mr Klopper,

Thank you for your instruction to prepare this Air Quality Statement, which is presented below.

1. Introduction

RSK Environment Ltd (RSK) was commissioned to prepare an Air Quality Statement on potential air quality impacts of the fume cupboard discharges from the proposed diamond cleaning laboratory at 17 Charterhouse Street, London, EC1N 6RA, for submission with the application for planning consent.

The proposed development site is within the administrative area of London Borough of Camden (LBC). The whole of Camden is declared as an Air Quality Management Area (AQMA) for exceedance of the annual mean Objective for nitrogen dioxide NO2 and the 24-hour mean Objective for particulate matter (PM_{10}).

2. The Proposed Development

The proposed development is a diamond cleaning research laboratory on the 3rd floor of the existing Anglo American De Beers (AADB) building. The laboratory will be fitted with a fume cupboard extract system which will be ducted via 315mm ducting to discharge 3m above the roof of the building via a high velocity discharge cone (250mm diameter at exit). The extract system will be fitted with scrubbers to abate emissions. Figure 1 shows the proposed fume hood location within the laboratory.

The fume cupboard and extract unit will be designed and installed by competent persons, with reference to good practice guidance including but not limited to BS EN 14175-2:2003 *Fume cupboards – Part 2: Safety and performance requirements*. The fume cupboard and extract duct will be constructed of high-density poly propylene (HDPE) and the discharge will be 3m above roof level, at a velocity of 8m/s to 10m/s. A rooftop plan showing the discharge point is presented in Figure 2, below.

Figure 1. Proposed Diamond Cleaning Laboratory

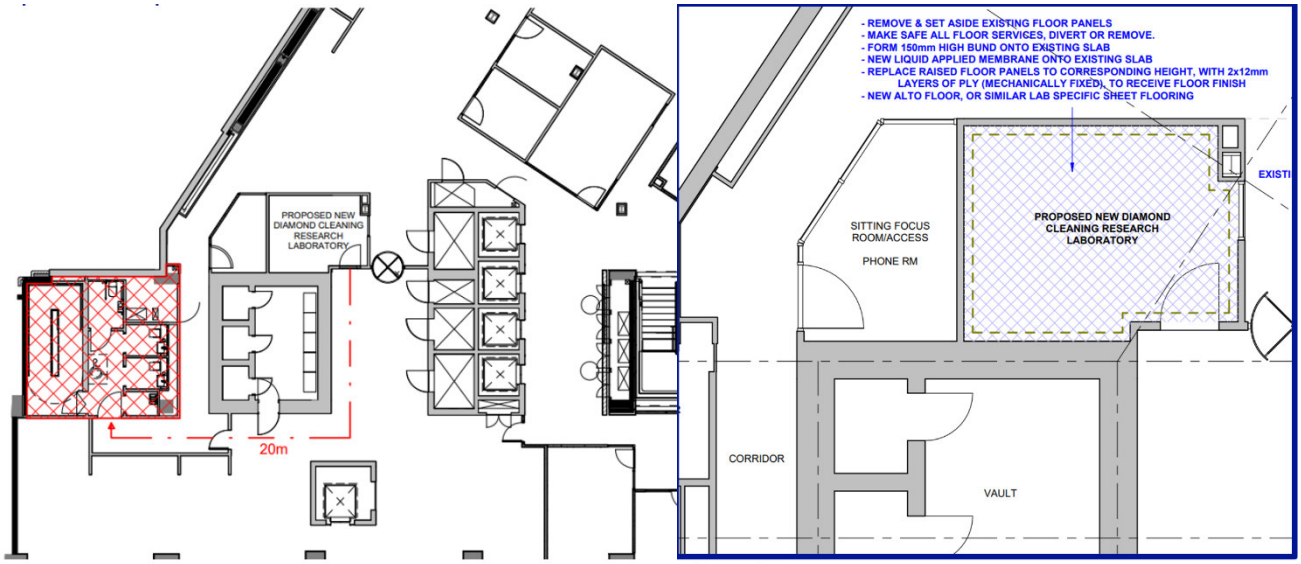
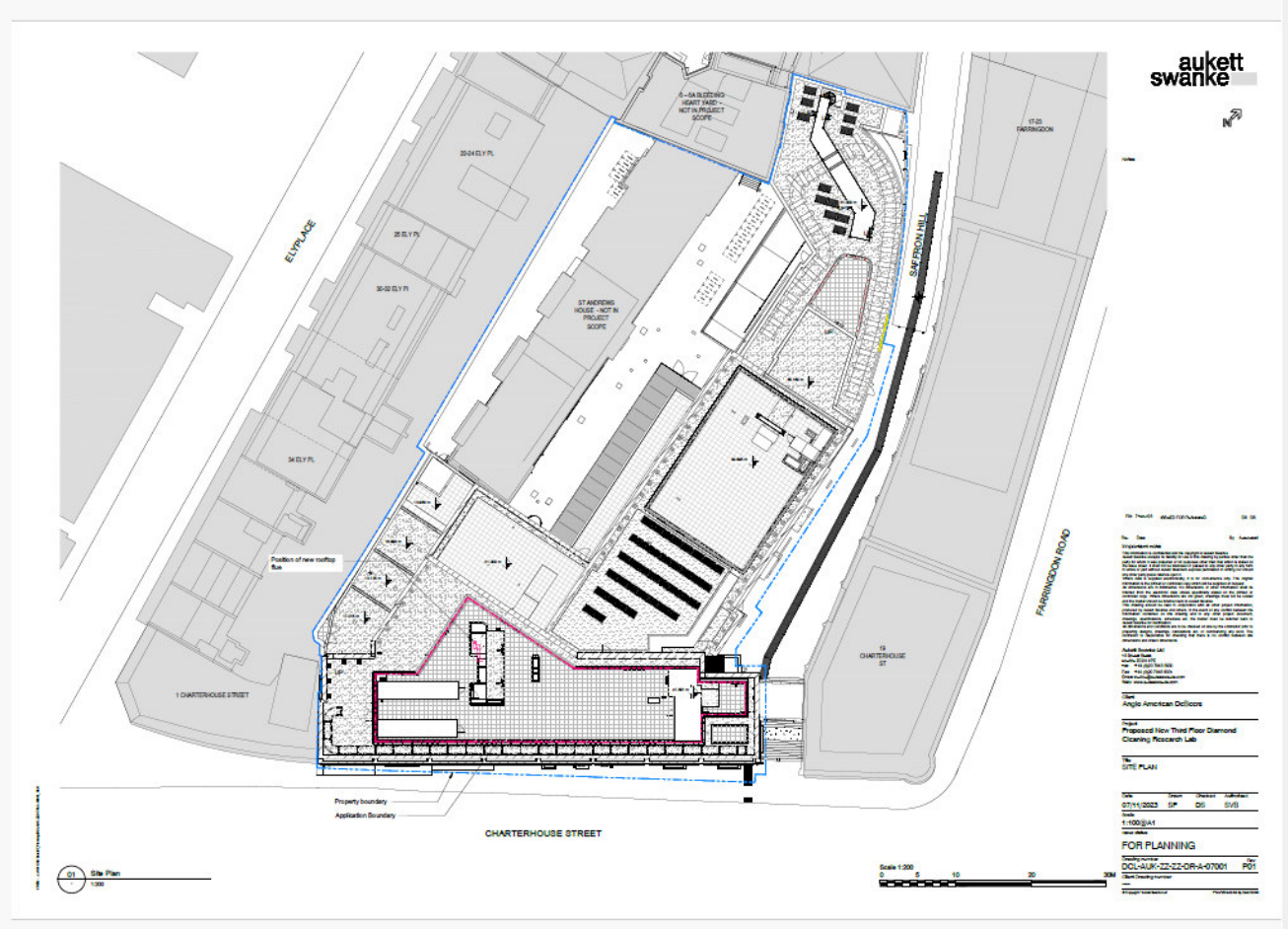


Figure 2. Roof Plan Showing Discharge Location



3. Emissions Inventory

A number of common laboratory chemicals/reagents will be used within the hood, including nitric acid (HNO_3), perchloric acid ($HClO_4$), hydrofluoric acid (HF) and hydrochloric acid (HCl). Their use will be intermittent, and in small quantities, for short periods of soaking or moderate heating/boiling.

An inventory of chemicals likely to be used and estimated quantities and frequencies is presented in Table 1, below.

Table 1: Emissions Inventory

Chemicals	Maximum Quantity Stored	Nature of Use and Duration of Emissions	Total Volume of Acid used Per month (ml)	Duration of Use Per month
Nitric acid (HNO_3) 68%	1L	Light boil on hotplate using a covered beaker. 15mins of emissions	800	60 minutes
Hydrofluoric acid (HF) 70%	1L	Ambient overnight soaking in sealed container. Transfer from one container to another. 30 secs of emissions	60	1 minute
Hydrochloric acid (HCl) 32%	1L	Ambient overnight soaking in sealed container. Transfer from one container to another. 20 secs of emissions	60	40 seconds
Perchloric acid ($HClO_4$) 70%	1L	Light boil in conical flasks, covered with watchglass. 2.5hr of emissions.	200	150 minutes

4. Impact Assessment

The quantities expected to be used are very small and their use infrequent, nevertheless a conservative impact assessment was carried out and is presented below.

The site is within an urban area characterised by commercial uses. An aerial view of the site and receptors is presented in Figure 3, below. The closest receptors to the discharge are ventilation inlets for the 17 Charterhouse Street building air handling units. The fume extract discharge will be located in accordance with good practice at least 10m away from intakes. The closest nearby buildings are neighbouring buildings on Charterhouse Street, buildings to the south if Charterhouse Street.

The Lakes Environmental ScreenView screening model tool was used with highly conservative assumptions based on continuous use of the substances and chemicals presented in Table 2, to screen impacts with the following input parameters:

- Stack Height – 28.5m (building height +3m)
- Stack Diameter (at exit)- 250mm

- Stack Exit Velocity - 10m/s
- Stack Gas Exit Temperature - 293k
- Receptor Height - 20m

'Worst case' unabated emissions rates were estimated assuming that the entire quantity of each acid used was volatilised and discharged during the use period, for example 800ml of 68% nitric acid per hour, and that these emissions are continuous, throughout a whole month. In reality, this represents a substantial overestimate.

5. Assessment Criteria

There are no statutory ambient air quality standards for the substances listed in the Emissions Inventory (Table 1) however Environment Agency guidance Air emissions Risk Assessment For Your Environmental Permit lists 'environment assessment levels' (EALs) to judge the acceptability of emissions to air from industrial processes, and their relative contribution to the environment. The guidance states that EALs represent a pollutant concentration in ambient air at which no significant risks to human health are expected. The laboratory extract will not be regulated by the Environment Agency therefore EAL are not strictly applicable, however they nevertheless represent appropriate benchmarks for the assessment of these impacts.

Table 2: Environmental Assessment Level (EAL) Standards

Substance	Annual mean EAL µg/m^3	Hourly EAL µg/m^3
HNO_3	52	1,000
HF*	16	160
HCl	NA	750
$HClO_4$	NA	NA

*Monthly.

6. Results

The results are presented in Table 3, below, expressed as predicted hourly means and projected annual means at the receptor predicted to experience the maximum impact.

The maximum hourly and projected annual mean concentrations are well within the EALs.

These results were predicted on the basis on continuous operation, whereas in reality operation is likely to be of the order of one to three hours per month.

7. Mitigation

The emissions are small and infrequent and the screening model predicted that impacts will be well within EALs nevertheless, best practice mitigations measures will be adopted to minimise emissions, as follows:

- Limited operation, estimated at approximately one to three hours per month;
- Acid heating/boiling will be covered (Round Bottom Flasks or Beakers) by watch glasses to promote refluxing;
- Additional reflux condenser to be considered for acid heating process;
- The extracted air will be passed through a scrubber with a nominal abatement efficiency of 95% of acid gases;
- High velocity discharge cone to discharge point;
- Continuous gas monitoring in the pre-stack section prior to release;
- The extract system will be designed and installed by competent persons in accordance with relevant good practice and guidance;
- The system will be subject to regular inspection and maintenance.

Figure 3. Aerial View of Site And Receptors

Table 3: Estimation of Emissions Rates

Chemicals	Maximum Quantity Stored	Nature of Use and Duration of Emissions	Total Volume of Acid used Per month (ml)	Duration of Emissions Per month	Density (g/cm^3)	Mass (g)	Emission Factor (g/s)
Nitric acid (HNO_3) 68%	1L	Light boil on hotplate using a covered beaker. 15mins of emissions	800	60 minutes	1.4048	562	0.312
Hydrofluoric acid (HF) 70%	1L	Ambient overnight soaking in sealed container. Transfer from one container to another. 30 secs of emissions	60	Assume 15 minutes	1.23	74	0.082
Hydrochloric acid (HCl) 32%	1L	Ambient overnight soaking in sealed container. Transfer from one container to another. 20 secs of emissions	60	Assume 15 minutes	1.1493	70	0.115
Perchloric acid ($HClO_4$) 70%	1L	Light boil in conical flasks, covered with watchglass. 2.5hr of emissions.	200	150 minutes	1.66	332	0.0369

Table 4: Maximum Predicted Hourly and Annual Mean Impacts of Acid Emissions, Based On Continuous Operation

Chemical	Stack Height (m)	Diameter (m)	Temper-ature (°C)	Exit velocity (m/s)	Emission Factor (g/s)	Max. Hourly Impact (distance adjusted for HF) * µg/ m^3	Max. Projected Annual Impact (monthly for HF)** (distance adjusted for HF)* µg/ m^3	% of Hourly EAL	Percentage of exposure Limits Annual (monthly for HF)
Nitric acid (HNO_3)	28.5	0.25	Ambient	10	0.312	128	10.3	13	20
Hydrofluoric acid (HF)					0.082	30	0.20	19	1
Hydrochloric acid (HCl)					0.115	47	3.7	6	-
Perchloric acid ($HClO_4$)					0.037	15.2	1.2	-	-

* as per the United States Environmental Protection Agency's (U.S. EPA) Industrial Source Complex-Short Term (ISCST) dispersion model, the Pasquill-Gifford Stability Classification, and research conducted by Dr.Mark Eltroth of URS Corporation, June 23, 2009, to justify a conservative reduction factor equation for HF plume reactivity.

** Hourly impacts are calculated to specific averaging times as per US EPA (1995). SCREEN3 Model User's Guide, EPA-454/B-95-004, US Environmental Protection Agency and EA (2023) Air emissions risk assessment for your environmental permit - Calculating averaging periods

8. Conclusions

A diamond cleaning research laboratory is proposed on the 3rd floor of the existing Anglo American De Beers (AADB) building. The laboratory will be fitted with a fume cupboard extract system.

The fume cupboard and extract unit will be designed and installed by competent persons, with reference to good practice guidance including but not limited to BS EN 14175-2:2003 Fume cupboards – Part 2: Safety and performance requirements. The fume cupboard and extract dust will be constructed of high density poly propylene (HDPE) and the discharge will be 3m above roof level, at a velocity of 10m/s. The extracted air will be passed through a scrubber with a nominal abatement efficiency of 95% of acid gases.

Potential air quality impacts of the fume cupboard discharges were estimated on a highly conservative basis assuming 'worst case' emissions on a continuous basis and without abatement, whereas in reality, this represents a substantial overestimate and the substances will be used in small quantities and infrequently resulting in substantially lower emissions to air that those assessed, and will be abated with a nominal abatement efficiency of 95% of acid gases.

The predicted maximum and average concentrations were well within the assessment criteria and a significant adverse impact on air quality is highly unlikely.

We hope you will find our letter helpful and of interest. However, should you have any queries or wish to discuss any matters, please do not hesitate to contact us.

Yours sincerely,

For RSK Environment Limited

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