Supplementary Information for Problem Statement B

(B) Odour Monitoring and Source Tracing of Odour Incidents Caused by Industries

1. Will NEA consider using portable gas chromatograph (GC) to analyse the odour and determine the chemicals?

   As the chemicals causing odours are often volatile and disperse rapidly in the atmosphere, the chemical plumes are likely to dissipate before officers arrive at the affected areas. This is a limitation of the use of portable instruments for analysing odours.

   For the purposes of this innovation call, NEA is seeking solutions based on in-situ sensing devices. These devices can be deployed in a network for real-time continuous monitoring of odours, which can be caused by a diverse range of odorous chemicals, existing either singly or as a mixture in the ambient air. Each solution shall also need to be able to identify the chemicals and trace the detected odours to their emission sources.

2. Can NEA prioritise and list the key odour chemicals for this trial?

   This call seeks solutions for the detection of odours, which can be caused by a diverse range of odorous chemicals, existing either singly or as a mixture in the ambient air. The solutions shall be scalable and adaptable to address odours from various types of sources such as industrial facilities.

   The list of key odorous chemicals, for the purposes of this grant call, is provided below for reference; please note that the list is non-exhaustive. Proposers are requested to indicate in their proposals the specific capabilities of their systems and the odorous chemicals detectable by their systems (with the associated detection limits), which shall include but need not be limited to this list provided.

Chemicals of Interest	Detection limit (based on odour threshold)
Benzene	34 ppm
Toluene	0.16 – 6.7 ppm
Xylene	20 ppm
Hydrogen sulphide	0.0011 ppm
Ethyl Mercaptan (odorant in LPG)	0.0002 ppm
Ethylbenzene	0.46 – 0.60 ppm
Sulphur dioxide	0.5 ppm
Nitric Acid	0.27 ppm
Nitric oxide	0.3 – 1 ppm
Phenol	0.06 ppm
Styrene Monomer	0.017 – 1.9 ppm
Chlorine	0.08 ppm
Ammonia	16.7 ppm
n-Butane	2591 ppm
1-Butene	69 ppm
Ethane	899 ppm
Ethylene	270 ppm
iso-Pentane	400 ppm
Propane	12,225 ppm

Propylene	23 ppm
Acetylene	226 ppm
Napthalene	0.084 ppm
1,2,3-trimethyl benzene	6 ppm
1,2,4-trimethyl benzene	
1,3,5-trimethyl benzene	
Diethyl benzene	0.071 ppm
Dodecane	0.531 ppm
Heptane	0.67 ppm
Hexane	1.5 ppm
Nonane	2.2 ppm
Octane	1.7 ppm
Undecane	0.87 ppm
Methyl isobutyl ketone	0.1 ppm
Biphenyl	8.3×10^{-4} ppm
D-limonene	0.2 ppm
m-Diethyl benzene	3.8×10^{-4} – 0.071 ppm
Indane	Not available

The solution shall be tested in the Jurong West area, and NEA will work with the solution provider to identify other trial sites if necessary.

To recap, besides detecting and monitoring odour, the solutions shall be capable of identifying the chemicals contributing to the odours, and tracing the source of the detected odours.

3. Are there fly zones in the Jurong West trial site? Is there any restriction on unmanned aerial vehicles (UAVs)?

   Should there be proposals involving UAVs, NEA will discuss the details of the trials with the Civil Aviation Authority of Singapore (CAAS).

4. What is the maintenance requirement?

   The system should not require maintenance for at least six (6) months.

5. What is the resolution requirement for source identification?

   The solution should preferably trace the source to a particular facility. If this is not possible, it should narrow down to a cluster of buildings, or at least an area reasonably small for NEA officers to conduct further investigation.

6. Does NEA monitor emissions from industries?

   NEA monitors certain air pollutants such as SO_2 and CO directly at certain industrial stacks. However, volatile organic compounds (VOCs) are not monitored at the stacks, but monitored at the ambient level instead.

7. Will solution providers be able to install sensors at existing stacks? If so, who will install it?

   There is no restriction to the specific locations of the sensors. However, as stacks are within the private industrial premises, the solution providers will need to seek

permission from the premises owners to access the stacks and install the sensors. NEA can facilitate discussions with the owners, but solution providers should note that the owners are not obliged to participate in the trial. Solution providers can explore non-private premises for sensor installation.