1 Executive Summary

This report describes the outcome of the CTP's trial of a direct spray evaporative cooling system at Charing Cross Station Jubilee line platform 4. A non-passenger service platform was chosen due to stakeholder concerns related to the system. Given the lack of train movement, and the associated heat and piston effect, the trial was unable to evaluate all of the relevant factors, but it was judged that sufficient parameters could be evaluated to remove many of the associated concerns before trialling or implementing at a live platform. The evaporative cooling trial at Charing Cross was challenging but managed to fulfil most of its objectives.

Positive factors from the trial included:

- There was no measurable increase in the risk of slips trips and falls.
- There were no issues with smells.
- There appeared to be a local cooling benefit.
- The system was controlled as expected.
- There were few drips from the system.
- There were no legionella issues.
- The power and energy usage of the system was low.

Negative issues from the trial included:

- The noise from the installation was perceived as a problem.
- There was haziness in the platform environment.
- The system suffered from leaks.
- The materials used could not be sourced to be compliant with LUL materials standards.
- There were numerous issues of high bacterial count when the system was not continually operated.

Some of the negative issues were as a consequence of the trial location and circumstances. In particular, it appears that the cooling density should be limited to close to 50 kW per platform and that the train heat and piston effect are important in reducing fogging. Some of the negative issues could be overcome with further engineering development.

The extent to which the negative issues could and should be overcome, and therefore whether direct spray evaporative cooling should be adopted, is subjective. It is perhaps useful to compare the direct spray evaporative cooling with the duct mounted evaporative cooling trial that has given the CTP confidence to adopt future duct mounted systems.

The key difference between the systems are summarised as:

- Direct spray evaporative cooling has more components and therefore a higher potential for component failure.
- Failure or faults of the direct spray evaporative cooling are likely to have a direct and immediate effect on the public or staff. The duct mounted systems are contained away from public areas.
- The distributed nature of the components requires maintenance in public areas during engineering hours only.
- The potentially convoluted pipework routes and the inability to place the ultra violet light filtration units close to the direct spray increase the likelihood of bacterial growth in the direct spray system unless operation is more or less constant.
- The maximum installed cooling capacity of the direct spray system potentially needs to be limited to around 50 kW per platform. The duct mounted systems can potentially deliver a higher cooling capacity. At reduced cooling capacity, but similar, if not more, maintenance, the whole-life costs of the direct spray evaporative system is potentially higher and the benefits lower.
- Direct spray evaporative cooling systems require water and power supply while duct mounted systems require in addition to water and power supply, an existing ventilation system. If a new ventilation system is required, cost benefit ratio for a duct mounted system could be significantly higher.

Given the above points, it is recommended that direct spray evaporative cooling systems are **not** presently accepted for general adoption on London Underground. Should interest in these systems remain, further trials are required but at a live station with high frequency of trains. The recommendation to not use direct spray evaporative cooling does not preclude the use of duct mounted systems which, designed well, may be less susceptible to the issues generated by the direct spray method.