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TO: BOARD OF DIRECTORS

THROUGH: PHILLIP A. WASHINGTON 
CHIEF EXECUTIVE OFFICER

FROM: GREGORY G. KILDARE 
CHIEF RISK, SAFETY & ASSET MANAGEMENT OFFICER

**SUBJECT: UNIVERSITY OF SOUTHERN CALIFORNIA (USC) STUDY OF
PARTICULATE MATTER IN THE UNDERGROUND PORTIONS
OF THE METRO RED AND GOLD LINES**

ISSUE

This Board Box informs the Board of a recent study authored by PhD students at the USC Viterbi School of Engineering and co-authored by a Professor of Civil and Environmental Engineering regarding the types and levels of airborne particulate matter (PM) measured in the Red Line and underground portions of the Gold Line.

DISCUSSION

Last week, Metro's Media Relations department was informed of the publication of the subject study in the *Aerosol and Air Quality Research* Journal. Prior to the release of this publication, Metro staff was not informed nor was staff involved in the research undertaken in this study. Subsequent to being made aware, Staff obtained a copy of the study and has completed reviewing it. A brief summary of the study follows. The results of the study are based on air samples collected by the researchers during the summer of 2010 on the Gold and Red Line platforms and on-board trains. The specific stations where the samples were collected are not disclosed in the report. For comparative purposes, air samples were also collected along the I-110 and I-710 freeways, along Sunset and Wilshire Boulevards, and at a site adjacent to the main USC campus.

Laboratory analyses of the air samples were then conducted to identify the type and concentration levels of PM and to quantify the cancer risk and chronic health hazards associated with exposure to the chemical species detected. The authors note a

particular concern related to the concentration levels of a particular element, Chromium (VI) or Cr^{6+} , found primarily in the air samples taken on the Red Line platforms. Cr^{6+} , also known as hexavalent chromium, is a known carcinogen, and according to the report, has been shown to dominate airborne PM emissions resulting from high temperature processes such as welding and combustion.

It is also important to note that the study assumes that all detected chromium is hexavalent chromium, which is the oxidation state of chromium. While Metro does not perform any activities that would result in high temperatures during normal revenue service hours, Cr^{6+} can also be generated from the friction-induced wear of steel rails. The authors acknowledge that other recent studies of airborne PM in subway systems in New York, Naples, Mexico City, London, Milan, Barcelona, and Shanghai have also detected higher concentrations of metals, including Chromium. For example, a previous study of the PM levels in New York's subway system found Cr levels to be 84 ng m^{-3} , compared with $23.1 \pm 4.7 \text{ ng m}^{-3}$ found in samples collected in 2010 in the Red Line.

The report goes on to calculate the risk of cancer using various formulae and assumptions regarding exposures which may not be reflective of a typical Red Line passenger. The authors conclude that while the concentration of chromium measured in the Red Line air samples is significantly lower than the permissible exposure levels set by the Occupational Safety and Health Administration, a calculated lifetime exposure could result in a cancer risk that is greater than recommended by the World Health Organization, and others. The study authors were clear that these risks are present during a 70-year lifetime of daily exposures and do not represent an imminent threat to either our passengers or our employees.

Despite this slightly higher calculated cancer risk, the authors conclude that transportation on the Red Line could still be preferable to single occupancy vehicle travel because other risks using this latter approach could be far worse. Such risk exposures of single occupancy vehicle commuting include carbon monoxide, nitrogen oxides, volatile organic compounds, as well as the significant risk of a collision and carbon contributions to global warming.

Given that staff was not privy to the study results prior to release, we were unable to comment to the study authors on changes in operating practices that could well result in a lower health risk than that presented. For example, the air sampling done in 2010 was prior to any tunnel cleaning of dust and particulates since the Red Line began operation in 1993. In 2013, Metro began tunnel cleaning and a new contract for tunnel cleaning was recently awarded. Therefore, the particulate concentrations in the Red Line could be significantly lower than were measured in 2010.

Further, the study authors did not determine specifically that the chromium particles they identified in the Red Line were of the cancer causing type. Staff would like a more definitive determination that the Chromium found in the Red Line is in fact, Chromium (VI).

NEXT STEPS

Staff has reached out to the authors to schedule a meeting to further discuss the report, the assumptions, and to clarify other questions staff has on the report's findings. Staff will also hire a Consultant to conduct its own independent assessment of the PM in the Red Line by taking more recent air samples to verify the findings of the USC study and the assumptions made. We will also ask the consultant to evaluate alternative tunnel cleaning methods to determine if a more effective cleaning method can be devised. Until then, to mitigate the buildup of PM in the Red Line, staff will continue its efforts of cleaning the tunnel according to its existing protocol which Metro initiated in 2013.