I. INTRODUCTION

The purpose of this chapter is to provide guidance to OSHA Compliance Safety and Health Officers (CSHOs) and to the industrial hygiene community on the potential for skin exposure to chemicals in the workplace and the available means of assessing the extent of skin exposure. This chapter provides guidance for the use and interpretation of surface wipe sampling for assessing potential contamination which may lead to biological uptake through inhalation, ingestion, or dermal exposure. This chapter discusses methods for assessing skin contamination, such as dermal dosimeters (e.g., sorbent pads) and dermal wipe sampling, and provides guidance for monitoring of biological uptake. Finally, this chapter provides guidance for certain specialized analyses unrelated to dermal exposure, such as soil analysis, materials failure analysis, explosibility determinations, and identification of unknowns.

Skin exposure to chemicals in the workplace is a significant problem in the United States. Both the number of cases and the rate of skin disorders exceed recordable respiratory conditions. In 2010, 34,400 recordable skin diseases or disorders were reported by the Bureau of Labor Statistics (BLS) at a rate of 3.4 illnesses per 10,000 full-time employees, compared to 19,300 respiratory conditions with a rate of 1.9 illnesses per 10,000 full-time employees (BLS, 2011).

In addition to causing skin diseases, many chemicals that are readily absorbed through the skin can cause other health effects and contribute to the dose absorbed by inhalation of the chemical from the air. Skin absorption can occur without being noticed by the worker. This is particularly true for non-volatile chemicals that are hazardous and which remain on work surfaces for long periods of time. The number of occupational illnesses caused by skin absorption of chemicals is not known. However, of the estimated 60,000 deaths and 860,000 occupational illnesses per year in the United States attributed to occupational exposures, even a relatively small percentage caused by skin absorption would represent a significant health risk (Boeniger, 2003).

Biological monitoring refers to testing which is conducted to determine whether uptake of a chemical into the body has occurred. Biological monitoring tests assess a sample of a worker's urine, blood, exhaled breath, or other biological media to evaluate the presence of a chemical or its metabolite, or a biochemical change characteristic of exposure to a particular chemical. Biological exposure guidelines such as the American Conference of Governmental Industrial Hygienists (ACGIH) Biological Exposure Indices (BEIs) are numerical values below which it is believed nearly all workers will not experience adverse health effects. The BEI values correspond to the biological uptake that would occur in workers exposed to airborne concentrations at the ACGIH Threshold Limit Value (TLV). When biological monitoring indicates that workers have been exposed to a chemical, but the airborne concentrations are below any exposure limits, it suggests that exposures are occurring by another route, such as dermal absorption and/or ingestion.

Where other exposure routes are suspected, surface wipe sampling may be useful. Surface wipe sampling in areas where food and beverages are consumed and stored (including water bubblers, coolers, and drinking fountains) can be used to assess the potential for ingestion or dermal exposure. Such wipe sampling results can be used to support citations for violations of the Sanitation standard, 29 CFR 1910.141, or the applicable housekeeping provisions of the expanded health standards, such as Chromium (VI), 29 CFR 1910.1026. To assess the potential for skin absorption, surface wipe sampling in work areas may be used to show the potential for contact with contaminated surfaces. Such results could be used to support violations of the Personal Protective Equipment (PPE) standard, 29 CFR 1910.132(a), or applicable provisions of the expanded health standards, such as the Methylenedianiline standard, 29 CFR 1910.1050. For direct assessment of skin contamination, skin wipe sampling or dermal dosimetry may be used.

In addition, Section V of this chapter, Other Analyses, provides guidance for submitting samples to the Salt Lake Technical Center (SLTC) for specialized analyses including:

- Soil analysis in support of the Excavation standard (29 CFR 1926 - Subpart P - Excavations).
- Materials failure analysis.
- Explosibility determinations including:
    - Combustible dust analysis
    - Flash points
    - Energetic reactivity of chemicals
    - Autoignition temperatures
- Biological sampling for organisms (or chemicals associated with their presence) such as:
    - Fungi
    - Bacteria (such as Legionella)
    - Endotoxin (component of the outer membrane of certain gram-negative bacteria)
- Mass spectrometry analysis for identification of unknown materials in:
    - Industrial processes
    - Indoor air samples
    - Contaminated water samples

Many of these tests are labor intensive and custom in nature. Always discuss the need for specialized analysis with the SLTC prior to collecting or sending samples.

Appendix D discusses techniques for combustible dust sampling. Such sampling is conducted where the potential for rapid combustion/burning (deflagration) or violent burning with rapid release of pressure (explosion) is suspected due to the presence of accumulations of settled dust. Bulk samples of settled dust are collected and sent to the SLTC. Lab analysis is used to determine whether the composition of the dust poses an explosion hazard.