

TECH NOTES

Full Disclosure Kit for Lead Performance Report

Introduction

The Full Disclosure® Lead Kit Cat. No. 550-001 uses color chemistry for the detection of lead on both dermal and non-dermal surfaces. This technology was developed by researchers at the National Institute for Occupational Safety and Health (NIOSH) as a simple, qualitative, and direct-reading tool to detect elemental lead and lead compounds on workers' skin, specifically hands, primarily in lead-acid battery plants and firing ranges. Full Disclosure is suitable for detecting elemental lead, lead nitrate, lead sulfate, lead acetate, lead oxides, and other easily solubilized lead compounds. Full Disclosure was not designed for nor intended to detect lead chromates, alkyl lead (i.e., tetraethyllead [TEL] or tetramethyllead [TML]), or other more refractory or less easily solubilized compounds of lead. It can be used as a quantitative kit Cat. No. 550-002 by sending the disclosed wipes to a qualified laboratory for analysis by atomic spectrometry (ICP or AA).

The operating instructions provide step-by-step instruction on how to prepare the solutions and conduct the wipe sampling. The purpose of this report is to present technical information regarding the testing and performance of the kit.

Results and Discussion

Stability of Solutions

The Developing Solution (#3) must be chilled to a very cold temperature of 35 F (2 C) when the Disclosing Powder (#1) is added. This is in order to keep the solution viable for the longest possible time. During testing, the solution was chilled for approximately one hour, and then used intermittently throughout an eight-hour period. The solution maintained its viability in detecting lead. If the solution is kept chilled, it will remain active for at least 10 days. It is recommended that the solution be used as soon as possible.

The Extraction Solution (#2) can be stored indefinitely at ambient temperatures.



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Response to Various Levels of Lead

An AccuTrace Lead Reference Standard (ICP-29N-1) at 1000 µg/ml was used to spike Ghost Wipes with lead. This was used to determine the lower limit of visual identification. Lead was spiked at 10, 20, 100, and 1000 µg of lead. No response was detected at 10 µg, but there was a pink/red color detected at all other levels. A spike was then prepared at 15 µg and a very light pink was observed. It was felt that this was still too low as some observers might not notice this small color change. After preparation of a few more spikes, it was determined that 18 µg was a consistent and reliable lower limit of visual identification of lead.

Response to Lead and Lead Salts

Full Disclosure was designed to respond to elemental lead, lead oxides, and some lead salts commonly found in lead-acid battery plants. Lead salts that are disclosed include lead nitrate, lead sulfate, and lead acetate. Full Disclosure will not respond to lead chromates, which are insoluble in weak acids. Full Disclosure will not respond to alkyl lead. Full Disclosure is not suitable for detecting lead in paint or paint chips, on painted surfaces, or embedded in material such as plastic. The lead, if present, may be encapsulated in a resin matrix and, therefore, would not be solubilized in the extraction solution.

Blank Determinations

Blanks were determined in two ways: with and without reagents. Three wipes were taken out of their pouches and immediately placed into glass vials and sealed. Another three wipes were taken out of their pouches and sprayed with both the Extraction Solution (#2) and the Developing Solution (#3) as outlined in the Full Disclosure Operating Instructions. They were also placed in vials and sealed. These six wipes were sent to an AIHA-accredited laboratory for analysis by NIOSH Method 7300 using ICP-AES. The reporting limit for this method and laboratory was 0.5 microgram per wipe. Blanks were prepared on March 17, 2003, and analyzed two days later on March 19, 2003.

The results for all six wipes were less than the reporting limit of 0.5 microgram per wipe. This indicates that the reagents do not contribute to the background of the wipe.

Stability of Color Stain

The color change (pink to reddish) is not stable and does begin to fade. Therefore, once the reagents are sprayed on the Ghost Wipe, it should be checked immediately for a color change.

Interferences

Silver, cadmium, barium, mercury, and titanium also form colored complexes with the chemistry contained in the Full Disclosure Kit but with much less sensitivity than that of lead. The color complexes formed from silver, titanium, and mercury are a different hue, being reddish-purple to hot pink. Tin is a negative interference, quenching the color reaction at high concentrations. Whether these elements are also present should be determined prior to use.

Summary

The Full Disclosure Kits for lead can provide both a qualitative and quantitative determination of lead on surfaces and on skin. The instantaneous color reaction will give the user an immediate indication of the presence of lead on the surface or skin, and help determine if more appropriate action needs to be taken. The lower limit of visual identification is 18 micrograms of lead per wipe. If lower levels are suspected, the wipes can then be sent to a qualified laboratory for analysis by atomic absorption spectrometry (AAS) or anodic stripping voltammetry.