compressed air was used to dilute the aerosol to the intended mass concentration. The test aerosol was passed through a flow splitter and sampled concurrently by an APS 3321 and a PDM 1108. Our results will help industrial hygienists in interpreting data from the PDM 1108 instrument.

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A COMPARATIVE STUDY OF COMMONLY USED INSTRUMENTS FOR ASSESSMENT OF INDOOR ENVIRONMENTAL QUALITY.

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Direct-reading instruments are used to characterize the indoor air environment. During field surveys these instruments can provide different results, even when placed side-by-side. A pilot study was developed to assess and evaluate the performance of direct-reading instruments to the manufacturers' specifications under varying environmental factors. This study consisted of three each of the most commonly used direct-reading instruments: TSI P-Traks, DustTraks, and Q-Traks, and GRIMMs with temperature and humidity probes. Testing was done for 18 days in two different environments, regulated air circulation (RAC) and minimal air circulation (MAC). Instruments were calibrated per the manufacturers' instructions and placed one foot apart in random order inside each environment. In the RAC environment, the location of the instruments was changed daily to offset any bias. Rotation of instruments was not required in the MAC environment. For each instrument type, the difference or percent difference was calculated between the instruments and compared to the manufacturers' specifications. For the MAC scenario, the Q-Traks provided CO_2 (70.8%) and humidity (8.1%) values which were much greater than the manufacturer's specifications (± 10.1% and ± 3%, respectively). The temperature difference (0.8%) was within TSI's specification (± 1.0°F). The total count difference from the GRIMMS (11.6%) was over five times higher than the manufacturer's specification (± 2%). Since the P-Traks, DustTraks, and GRIMMS (humidity and temperature) do not have published accuracy ranges, the National Institute for Occupational Safety and Health (NIOSH) method comparison accuracy criterion (± 25%) was used. Only the DustTrak results were greater than the NIOSH criterion, at 69.5%. Similar results were seen in the RAC environment. This study indicates that direct-reading instruments may not perform according to published specifications. This would greatly impact the characterization of indoor environmental air quality. NIOSH is currently conducting further research to determine the extent of this potential problem.

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EVALUATION OF GAS MONITORS.

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There are no nationally or internationally accepted performance standards for gas monitors. Determining which instrument is best to use for evaluating a workplace can be just as important to industrial hygienists and safety professionals as is the actual gathering of the data. With so many makes and models of instruments available with many features and options, the decision to select the proper equipment which best fits the user's requirements can be overwhelming. Even when the desired instrument has all the features needed for the survey, do we really know that the selected instrument will do what it needs to do, in the environment being surveyed?

Industrial hygiene and safety professionals should periodically evaluate the instruments available to them, whether it is their own equipment or potential items to purchase or rent. Many factors need to be considered. OSHA is continually evaluating instruments considered for purchase and use by the OSHA compliance officers in the field. Factors of concern involve accuracy, safety approvals, functionality, desirable optional features, environmental effects on the instrument, and serviceability.

Applied to a simple item as a gas monitor, this evaluation translates into examining whether there is an intrinsic safety rating, ease of operation, environmental effects, possible radio-interference on the gas monitor reading, and serviceability.

Without consensus standards, it behooves the user to evaluate instruments which they intend to purchase. It is not sufficient to rely solely on the instrument manufacturers to provide the needed information.

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AN AUTOMATED AIR SAMPLER FOR ANALYSIS OF VOLATILE AND SEMI-VOLATILE CHEMICALS IN INDOOR AIR.

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The use of fused silica lined and SUMMA passivated stainless steel canisters for air analysis has been previously limited to the more volatile constituents, such as solvents and other chemicals with high vapor pressures. This has precluded their use for detection of compounds with greater polarity and those compounds classified as "semivolatiles" with boiling points over 200°C. The introduction of heated GC autosamplers in the past two years has allowed these less volatile compounds to be recovered from fused silica-lined canisters, but losses were occurring in the flow regulating inlets used to perform time-weighted canister sampling in the field. An automated system for integrated sampling of air into canisters has been developed which allows recovery of both volatile and semivolatile compounds. Flow is controlled into the canisters using a novel "pulsed sampling" approach which minimizes inlet surface area to allow compounds up to C25 to be introduced quantitatively into the canister. The system allows up to eight canisters to be sampled under a user-specified schedule, or can wait for sampling to commence after receiving an external start signal. The canister pressure is monitored during the filling process in order to validate proper sampling fill rates during time-weighted averaging. A small critical orifice inlet can be easily exchanged to completely eliminate any chance of cross contamination, making cleanliness validation of the main sampler unnecessary. This is significant in that sampling professionals will not have to utilize GCMS equipment to validate the cleanliness of this sampler before use. Data will be presented showing the improved recovery of a wide range of chemicals, including microbial VOCs for mold detection, chemical warfare agent simulants, and heavier polar organics such as glutaraldehyde.

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EXPRESS ANALYSIS OF SIX ELEMENTS BY ICP-MS.

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A significant amount of time is saved by digesting air samples in plastic centrifuge tubes using microwave energy at atmospheric pressure, hence the term "express." The method currently permits analysis of six elements: arsenic, cadmium, cobalt, copper, lead, and nickel. Detection limits for these elements show improvements ranging from three-fold for arsenic (as compared to its analysis by GFAAS) to 1000-fold for lead (as compared to its analysis by FAAS or ICP-AES).

Air samples are collected on mixed cellulose ester (MCE) membrane filters with accompanying cellulose backup pads (BUP). When sampling for volatile arsenic compounds, the BUP must be impregnated with a sodium carbonate solution. The MCE filters are oxidized and digested with the aid of concentrated nitric acid, hydrogen peroxide, and microwave heating to 106°C. After cooling, concentrated hydrochloric acid is added to the sample and it is reheated in the microwave to 86°C. Internal standards are added to correct for ICP-MS drift. The disadvantage of this technique is not being able to use the high pressure which occurs in a closed-vessel microwave oven, which has been shown to aid in the digestion of certain refractory elements and compounds.

Microwave digestion was compared with hot plate digestion in the analysis of SRM 1648 (Urban Particulate Material). SRM 1648 was used in this test because it is the nearest characterized material that could be found to simulate an urban, industrialized particulate. SRM 1648 contains certifiable values for five out of the six elements in this analysis (cobalt lacks a certifiable value). The analytical recoveries of the five elements were quite comparable, indicating that the two digestion techniques are similar with regard to the elements and compounds found in this material.

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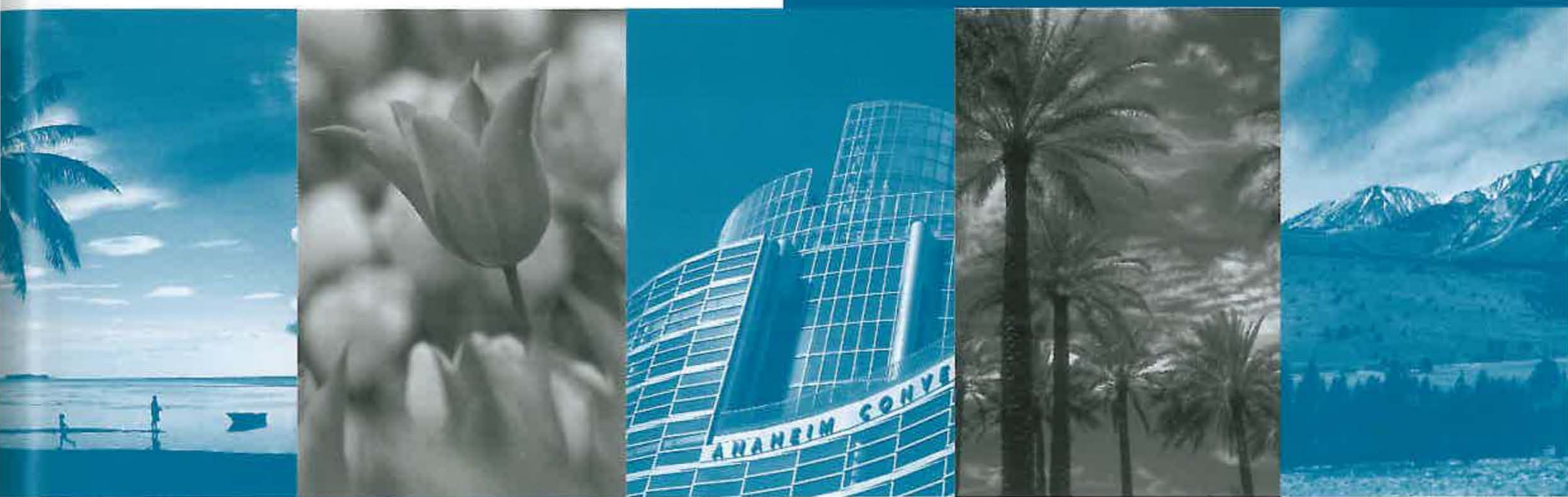

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