ENVIRONMENTAL AND BIOLOGICAL MONITORING OF FORMALDEHYDE INSIDE A HOSPITAL SETTING: A COMBINED APPROACH FOR RISK ASSESSMENT EVALUATION AND MANAGEMENT

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Introduction: Different sources of chemical risk for health operators are present in hospital settings; among different potentially harmful compounds, formaldehyde (FA) currently represents one of the most serious concern. Specific attention should be devoted to operators working for example in histopathology laboratories, which are daily potentially significant exposure to this compound. New International Agency for Research on Cancer (IARC) classification of FA as a "carcinogenic substance for human" has urged the need for a monitoring system to assess the chemical risk associated to this substance in hospital settings. Formaldehyde can be adsorbed both by the high respiratory ways, as a gas, and by the skin when in an aqueous solution. Here we show data related to biological (BM) and environmental monitoring (EM) of FA in the histopathology laboratory of the University Hospital "San Giovanni di Dio e Ruggi d'Aragona" of Salerno (Italy). Aim of this work was to provide a tool to support the hospital risk assessment and management and reduce working risk associated with the use of FA.

Materials and methods: For EM, continuous environmental measurement system (CEMS) was performed using an electrochemical PPM Formaldemeter htV sensor, while active samplings using silica gel vials coated with DNPH (2,4Dinitrophenyl-hydrazine) were made. The threshold limit value (TLV) used was that suggested by the National Institute for Occupational Safety and Health, NIOSH, at 0.016ppm. For BM, urinary FA of laboratory staff was evaluated using a CE-IVD kit in combination with a High Performance Liquid Chromatography coupled with UV-Visible detector (HPLC-UV) system. The BM TLV is 5.6mg/L according to the guidelines of the Italian Association of Industrial Hygienists (AIDII).

Results: An average FA concentration was found higher than accepted cut-offs in three out of 20 monitored environments including the processing room for histological samples and the processor box used for sample treatment. This trend was observed throughout the monitoring time, in different working days and at different sampling times. For MB, three withdrawal points were scheduled (working shift start, daily shift end, weekly shift end). Samples were collected in a three-year period (2016-2018). Within this period urinary values were all far below the established regulatory limits.

Discussion and conclusions: Because of the criticisms underlined by our EM results, the Pathology Unit has decided to purchase a new set of instrumentation that allows the automation of some procedures and pre-packaged containers in order to reduce FA dispersion in the environment. For what it concerns our BM campaign, we suggest that current methods and limits are not suitable for assessing the effective FA exposure at concentrations used in hospital settings, which are lower than levels currently found in industrial plants and for which these limits have initially been set. More appropriate limits for hospital settings along with the search of new biomarkers assessing chronic FA exposure are currently under study. Improving prevention by constantly monitoring the presence and level of potentially toxic substances both in exposed workers and in workplaces is mandatory for an effective assessment of chemical risk by hospital management.