safety of workers encountering these high tech hazards. Simple strategies to improve the present state include: 1) Recognizing healthcare as a high hazard employment sector; 2) Fortifying voluntary safety guidelines to the level of enforceable regulation; 3) "Potent" inspections; 4) Treating hazardous pharmaceuticals like the chemical toxicants they are. Adoption of these strategies will allow us to protect health care workers at least as well as workers in other high hazard sectors.

48 Roberta Turci

rturci@fsm.it

Roberta Turci received a degree in Industrial Chemistry from the University of Milan in 1995. Since 1996, she has been working at the Laboratory for Environmental and Toxicological Testing at the Salvatore Maugeri Foundation in Pavia, Italy. Her work focuses on the assessment of occupational and general population exposure to toxic chemicals such as antineoplastic agents, pesticides, PAHs, VOCs, and PCBs. Within the past seven years, her research activities have concentrated particularly on the development of cost-effective methods and measurement tools in an effort to provide accurate data for controlling and ultimately preventing occupational exposure to anticancer drugs. Current research activities also include: assessment of human exposure to endocrine disruptors through diet and establishment of reference values of PCBs, PBDEs and dichloroanilines in non-occupationally exposed subjects.

Residual hazard assessment related to handling of antineoplastic drugs (ADs): safety system evolution and quality assurance of analytical measurement

Despite improvement of operating procedures and publication of safety guidelines, contamination is still observed in healthcare settings where antineoplastic drugs are handled. Even after cleaning work areas, some residual contamination may still be present. Zero percent contamination, it is true, is not a realistic goal. Nevertheless, the scientific community should set zero contamination as its main goal. The strategies to reach this objective may be traced on the basis of the following: 1) a wider and wider number of drugs should be monitored; 2) safety equipment and devices must be available to the workers; 3) the likely source of the widespread contamination in workplaces is the safety cabinet; 4) in contrast to biological endpoints, direct determination of the parent drug or its metabolite in urine is the recommended approach, since provides higher sensitivity and specificity; 5) reliable analytical methods are necessary to measure the extent of the contamination; and 6) analytical methods which are intended to be applied for routine testing must be assessed through method validation studies. These studies rely on the determination of overall method performance parameters, including uncertainty measurement. Over the last years, our laboratory has developed and validated a number of analytical methods for the determination of several drugs in environmental and biological samples. Many surveys were carried out in several hospitals and there has been a progressive, significant decrease in the number of positive samples, mostly due to the improvement of working procedures and safety measures.

49 Tom Connor

[illegible]

Dr. Connor is a Research Biologist at the National Institute for Occupational Safety and Health (NIOSH) in Cincinnati, OH and is the Project Officer for a study that is examining the potential effects of hazardous drugs on healthcare workers and is also conducting an evaluation of personal protective clothing used in the healthcare industry. He was a primary contributor to the NIOSH Alert on Hazardous Drugs published in September 2004. Dr. Connor received his BS and MS degrees in microbiology/chemistry from the University of Rhode Island and his doctorate in environmental toxicology from the

University of Texas Medical Branch. Dr. Connor's research area has focused on occupational exposure to hazardous drugs.

Hazardous anticancer drugs in healthcare: environmental exposure assessment

Exposure of health care workers to anticancer drugs became problematic in the 1970s. Shortly thereafter, studies began documenting exposure of health care workers to these drugs. Investigations employing biological markers such as urine mutagenicity, chromosomal aberrations, sister chromatid exchanges and micronuclei demonstrated associations between occupational exposures and elevated marker levels. Other analytical methods emerged to monitor workplaces where drugs were handled. These contemporary studies uncovered widespread contamination of drugs on work surfaces, trace amounts in air samples, and their presence in worker urines. Vials containing these drugs are often contaminated with the drug when they are shipped. Most workplace surfaces are contaminated with the drugs being prepared and used in that area. Other anticancer/hazardous drugs would most likely be used in these areas. The interior surfaces of biological safety cabinets and isolators, floors, countertops, carts, storage bins, waste containers, treatment areas, tabletops, chairs, linen and other items are all potential sources of exposure to anticancer drugs. Patient body fluids contain the drugs and/or metabolites, often more biologically active than the parent compounds. An exposure assessment of areas where anticancer/hazardous drugs are handled must consider every potential source and route of exposure. Data from surface contamination and inhalation studies suggest that dermal exposure is the primary route of exposure. Assessment of exposure is the first step in providing a safe work environment for these workers. However, because of the many drugs to which they are exposed, any assessment can only be an estimation of the overall exposure. The findings and conclusions in this abstract have not been formally disseminated by the National Institute for Occupational Safety and Health and should not be construed to represent any agency determination or policy.

50 Anna Tompa

[illegible]

Professor Anna Tompa, MD, is Director of the Department of Public Health at Semmelweis Unversity Medical Faculty since 2004. She received her PhD from the Hungarian Academy of Sciences in Budapest, Hungary in 1981 and completed her residency in Pathology at Semmelweis University Medical School, also in Budapest, in 1996. Dr. Tompa was the main contributor to the Hungarian Chemical Safety Program, establishing the National Chemical Safety Department in 1998. She was named Doctor of the Hungarian Academy of Sciences (D.Sc.) in 1999 for her work on the theoretical basis and practical use of human genotoxicological monitors in Hungary. Her primary research interests have focused on cancer prevention, using biomarkers to detect early signs of disease.

Chemical safety and health conditions among Hungarian hospital nurses

In our study the follow-up genotoxicological and immunotoxicological investigations were carried out on 500 nurses (700 investigations) with various working conditions from different hospitals. They were exposed to different chemicals: cytostatic drugs, ethylene oxide (ETO), anesthetics and sterilizing materials. The following biomarkers were used: clinical laboratory routine tests, completed with genotoxicological monitoring (chromosome aberrations (CA), sister-chromatid exchange (SCE), HPRT gene mutations (VF), UV-induced unscheduled DNA synthesis (UDS)), immune toxicological monitoring (rate of lymphocyte subpopulations, lymphocyte activation markers) and leukocyte oxidative burst (ROS). The highest rate of genotoxicologically affected donors (25.40%) was found in the group of cytostatic

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