

HAZARD RATING OF SUBSTANCES SYSTEMS DEVELOPED BY NIOSH'S RTECS-NOHS AND USEPA

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ABSTRACT

This research study attempts to evaluate the hazard rating of substances systems developed by NIOSH's (National Institute for Occupational Safety and Health) RTECS-NOHS (Registry of Toxic Effects of Chemical Substances – National Occupational Hazards Survey) and USEPA (United States Environmental Protection Agency). Evaluation on rating methodologies and parameters used by both NIOSH and USEPA's systems reviewed that both systems aim at ranking common industrial organic compounds used or released into the atmosphere with special focus on chemical toxicological health effects. The NIOSH's RTECS-NOHS system solely emphasizes on health risks depending on chemical toxicological effects pertaining to eight health effect endpoints, whilst USEPA's system considers toxicological effects, occupational standards, chemical production rate, fraction of production loss and chemical's volatility characteristics. It is also found that NIOSH's system allows users great flexibility in defining toxicological priorities by assigning a multiplier or/and adding in the constants. The scoring system developed by USEPA for the individual parameters considered in the priority ranking range from zero to five without providing flexibility for users in defining toxicological priorities or assigning multipliers. It is also found that certain modifications must be made to account for fundamental differences between worker and population exposures for application purposes.

Keywords : *Exposure Index, Hazard Rating, Health Effect Endpoints, Preliminary Scoring, Priority Ranking, Toxicological Health Effects*

1 INTRODUCTION

The identification of the relative toxicities of chemicals currently used by a facility or for the whole industry within the Commonwealth of Massachusetts was accomplished by reprocessing the computer-based NIOSH's RTECS-NOHS data files (extracting the relative toxicity indices of the chemical compounds that matched with those currently listed in the Massachusetts TRI (Toxic Chemicals Release Inventory) data base) [1]. The NIOSH data were first compiled in 1982 and NIOSH scientists are updating the RTECS-NOHS using the most recent chemicals identified in the industry and the most updated RTECS toxicological data from time to time. All of the toxic chemicals recorded in the USEPA TRI [1] data bases, reported under the Toxic Chemical List defined in Section 313 for the U.S. Emergency Planning and Right-To-Know Act (SARA Title III) were identified [3]. In Massachusetts, a total of 97 different organic and inorganic compounds were identified which were reported as large quantity generators based on 1989 TRI data. The 1983 RTECS-NOHS chemical relative toxicity data were matched to the 97 chemical compounds in the Commonwealth that reported under SARA Title III [3]. Thus, a rank-ordered list of relative Health Risk Index Numbers (*HRINs*) was generated.

Environmental persistency of chemicals in the air is an integral part of the model. The method of estimation of the atmospheric fate of a chemical preferred by USEPA is the use of chemical reactivity data [4]. For most organic chemicals, degradation rate constants are generally derived based upon the reactions with the hydroxyl radical (OH) and ozone (O₃). Howard et al. (1991) on behalf of the USEPA completed compiling the rate constants for chemicals of anthropogenic origin for individual abiotic and biotic

degradation processes. Typical half-lives in the atmosphere are on the order of hours [5].

2 NIOSH'S RTECS-NOHS SYSTEM

One of the primary elements in the development of the toxic chemicals prioritization model is the adoption of the existing "Hazard Rating of Substances System" developed by NIOSH (October, 1983), generally known as "NIOSH's RTECS-NOHS SYSTEM" [6]. This system was developed by NIOSH as an instrument to use the National Occupational Hazards Survey (NOHS) data for surveillance [7]. NOHS was conducted from 1972 to 1974 in approximately 5,000 industrial facilities throughout the United States of America, and the data collected were used to estimate the extent of worker exposures, that is, number of chemicals to which workers are potentially exposed, duration of the potential exposure, and percent of worker in the industry who are potentially exposed. In order to completely reflect the relative impacts of the individual chemicals on the workers, NIOSH used these data to calculate an exposure index for each substance found in a given industry and RTECS. This exposure index is the multiplied by a hazard rating (Hazard Risk Index Number or *HRIN*) calculated from NIOSH's RTECS.

2.1 Specific Test Classes

For each chemical, the RTECS database includes one record of citation for each type of toxicity test in the literature. The RTECS data are input to a computer file, and January 1981 computer tape version of RTECS contains positive effects of 45,156 different chemicals. Each report of toxicity (that is, test record) is characteristically expressed in terms of:

- the daily or single dose of the chemical;