External validation of tiered-approach models under REACH

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European Chemicals Agency guidance introduced various tiered-approach models to estimate an occupational exposure in the iterative process of developing the exposure situations. Those are Targeted Risk Assessment (TRA), Metal Estimation and Assessment of Substance Exposure (MEASE), EMKG-Expo-Tool (Easy-to-use workplace control scheme for hazardous substances), and Stoffenmanager. If those first tier tools suggest that the exposure may be too high, then either the exposure situation can be amended or a higher tier model such as the Advanced REACH (Registration, Evaluation, Authorization, and restriction of Chemicals) Tool (ART) can be applied. However, a comprehensive study to compare the performance of tiered-approach models has not been carried out with independent data sets that were not used in the calibration of the models. Many researchers including model developers and practitioners are of the opinion that a comprehensive validation for these models is crucial. In addition, it is not clear if these models, which were developed based on European exposure data, are also applicable to US exposure situations. Therefore, the purpose of this study is to perform a comprehensive external validation of tiered-approach models used for REACH based on exposure measurements collected from the US. The personal exposure data from previous NIOSH internal projects and  Health Hazard Evaluation reports  were collated (~ 5000 measurements from 880 tasks).  However, since these pre-existing data were collected for other purposes, some information necessary to complete the model input parameters were not available. Thus, additional data collection including contextual information related to exposure determinants was performed at various workplaces including at a paint manufacturing plant, metal company, wind-mill manufacturing company, dry-cleaning shop, aviation plant, histology lab, and dental service area (~ 200 measurements from 16 tasks). This is an on-going project and expected to be complete by September, 2015. Field surveys to obtain exposure measurements and workplace descriptions is planned to continue until September, 2014. Once

we finish sample collection, exposure situation scenarios will be generated and circulated to the collaborators in UK, Germany, and Switzerland for entering the model input parameters independently based on the given information and estimating the exposures using the tiered models. Then the output of each model will be compared with measured personal exposures. The evaluation results will be discussed with collaborators to determine the most suitable model for each of the identified exposure situations. Recommendations will be made for each model to improve their practical value based on the strengths and limitations.