

Development of an integrated risk management measure library

Henk Goede, Remy Franken, Eugene van Someren, Wouter Fransman, Rianda Gerritsen-Ebben

TNO, Zeist, The Netherlands



BACKGROUND

REACH and other European legislation require that companies demonstrate the safe use and control of hazardous substances. For this purpose, the quantitative efficiency of Risk Management Measures (RMM) is required to evaluate the operational conditions (OCs) that are part of exposure scenarios in order to predict the resulting exposures or environmental concentrations. Companies can obtain information on the quantitative efficiency of RMM from only a limited number of sources. Important sources are the CEFIC (B15) RMM Library¹, the TNO Exposure Control Efficacy Library (ECEL²) and the OECD emission scenario documents. An integration of these databases into a user-friendly searchable tool will be helpful to bring occupational and environmental RMM data together for Health, Safety & Environment (HSE) professionals in industry. CEFIC initiated this endeavor with the CEFIC LRI B15-2 project, a 8-month project that was completed end of May 2018.

OBJECTIVES

1. To develop a suitable database structure for a web-based integrated risk management measure library (ECEL v2.0) to extract relevant RMM effectiveness values and other RMM related information required in REACH
2. To converge (selected) content of the CEFIC/B15 and ECEL v1.0 databases to evaluate and test the suitability of the database structure
3. To develop a method to pool relevant records and studies in order to derive suitable RMM effectiveness values

DATABASE STRUCTURE

The database consists of two parts: an occupational and environmental module (Figure 1), each focusing on relevant search parameters and underlying data. Each module contains a (i) search screen, (ii) e-cards and (iii) output screen. The database consists of records, each representing a specific evaluation from which a quantitative effectiveness was derived.

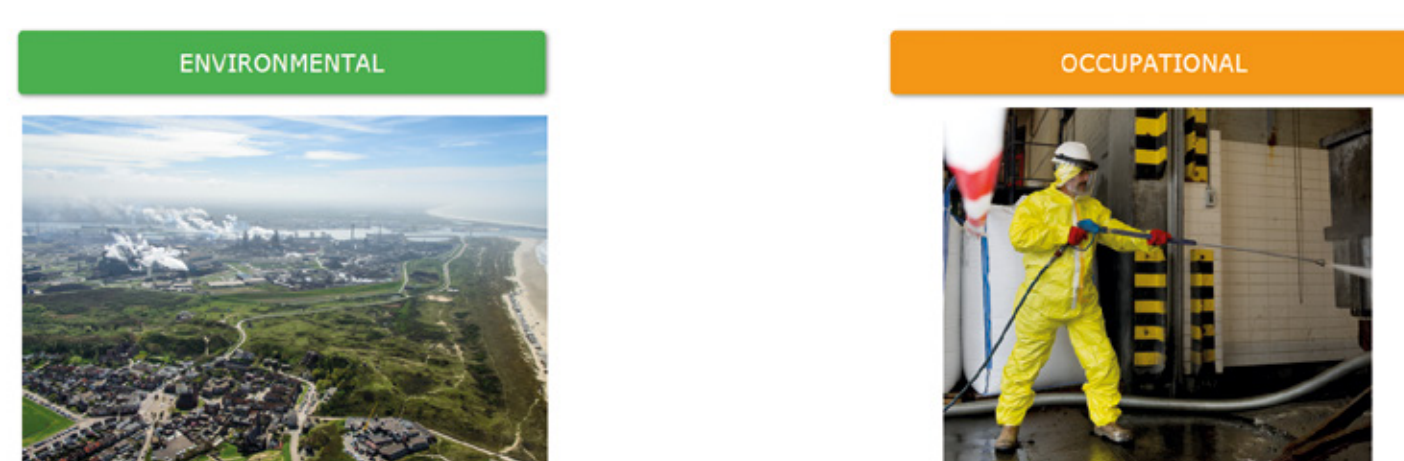


Figure 1: Introduction screen

SEARCH SCREEN

The search screen provides the user with various parameters to search for relevant information, e.g.:

- RMM (sub) group,
- Substance class,
- PROC or ERC

E-card	RMM-group	RMM-subgroup	Route	Substance-Class	Proc-Nr	PROC	Activity-class	Activity-subclass	Sector	Agent
Suppression techniques	Wetting at point of release	Inhalation	search ...	24	High (mech)	Fracturing and energy workup of substances bound in materials and/or articles	Fracturing and abrasion of solid objects	Fracturing and abrasion of stone	Construction	Silica crystalline - quartz (in respirable particulate)
Suppression techniques	Wetting at point of release	Inhalation	search ...	24	High (mech)	Fracturing and energy workup of substances bound in materials and/or articles	Fracturing and abrasion of solid objects	Fracturing and abrasion of stone	Construction	Silica crystalline - quartz (in respirable particulate)
Suppression techniques	Wetting at point of release	Inhalation	search ...	24	High (mech)	Fracturing and energy workup of substances bound in materials and/or articles	Fracturing and abrasion of solid objects	Fracturing and abrasion of stone	Construction	Total particulate

Figure 2: Search screen

A search can be narrowed down by selecting multiple records (Figure 2) relevant for a specific search or scenario. The database user is guided with a frequency plot (Figure 3) and user prompts to ensure that a sufficient number of records and studies are selected.

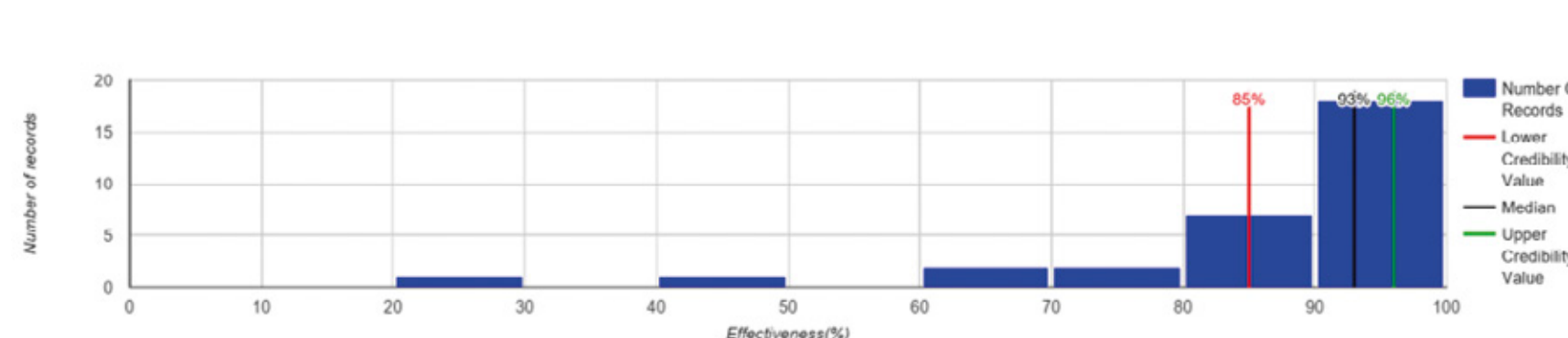


Figure 3: Frequency plot for user search guidance

E-CARDS

E-cards (Figure 4) are provided for each record and provides more specific information of each study, e.g. RMM conditions of use, technical information, type of studies (e.g. intervention) and information of the measurement data (e.g. pre-post test).

Reference	Industry	Construction	Substance	Silica crystalline - quartz (in respirable particulate)
Abbas-Monabbadi F., Hsu S., Ames A., et al. Crystalline silica dust and respirable particulate matter during indoor concrete grinding - wet grinding and unassisted grinding compared with unassisted diamond grinding. J Occup Environ Hyg. 2003;10(10):576-584.	Construction	Handheld method	Handheld method	Handheld method
Risk management strategy	Unassisted conventional grinding in a room with no general ventilation	RMM assigned	Wet grinding in a room with no general ventilation	Wet grinding in a room with no general ventilation
Measurement technique	Unassisted conventional grinding in a room with no general ventilation	RMM assigned	Wet grinding in a room with no general ventilation	Wet grinding in a room with no general ventilation
Situation before	Unassisted conventional grinding in a room with no general ventilation	RMM assigned	Wet grinding in a room with no general ventilation	Wet grinding in a room with no general ventilation
Situation after	Unassisted conventional grinding in a room with no general ventilation	RMM assigned	Wet grinding in a room with no general ventilation	Wet grinding in a room with no general ventilation
N = 1	Exposure 1 (30 mg/m ³)	N = 3	Exposure 2 (30 mg/m ³)	N = 3
N = 6	Exposure 3 (30 mg/m ³)	N = 3	Exposure 4 (30 mg/m ³)	N = 3
Effectiveness	98			

Figure 4: Example of an e-card

OUTPUT SCREEN

After selecting relevant records from the search screen, the database calculates the following outputs:

Effectiveness: 90%
 Credibility interval: 85%-96%
 Records: 35
 Studies: 14

EFFECTIVENESS VALUE (%)

An indication of the effectiveness (or efficiency) of a Risk Management Measure (RMM), or the expected reduction in exposure or emission is provided, expressed as a percentage (%).

The effectiveness (%) is derived from the 50th percentile (median) of the selected data.

CREDIBLE INTERVAL

The reported credibility interval can be interpreted as the range of 95% most credible effectiveness values based on the selected studies and their accompanying records. This interval is obtained by running a Bayesian bootstrap estimation of the posterior distribution.

HISTOGRAM PLOTS

A histogram frequency plot indicates on the x-axis the % effectiveness presented in various bins (e.g. 0-10%; 90-100%), and the y-axis representing the number of records available for each bin. An indication of the 95% credible interval with the median value (50th percentile) is presented on the plot.

CONCLUSION AND FUTURE INITIATIVES

The database was reviewed by a test panel of industrial HSE professionals. Some of the issues encountered during the testing were resolved, however, a follow-up project will be required to introduce further refinements. With the database structure and functionalities completed, the next step will be to obtain and convert relevant data sources into the ECEL v2.0 database.

ACCESS TO ECEL V2.0

<https://prod-diamonds.tno.nl>

REFERENCES

- 1 www.cefic.org
- 2 Fransman W., Schinkel J., Meijster T., et al (2008) Development and Evaluation of an Exposure Control Efficacy Library (ECEL). Ann Occ Hygiene 52 (7):567-575.

ACKNOWLEDGEMENTS

Funding is provided by CEFIC LRI under grant agreement LRI-B15.2-TNO

