Comprehensive Decontamination Method Datadase

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ABSTRACT

The DB is a versatile decision support information system. It permits making the best choice of decontamination technologies, procedures and agents. It is meant for educated and skilled experts in radiochemistry and for specialists in physics, chemistry, physical chemistry and other fields. The DB data must meet typical demands of users specialising in decontamination:

- decontamination technologies for a specific contaminant;
- decontamination technologies for a specific surface being decontaminated;
- decontamination technologies for cleaning a specific surface of a specific contaminant;
- decontamination parameters;
- corrosion effects in different conditions;
- etc.;

In this connection the major data entity of the database is a unit record describing a decontamination technology for a specific contaminated surface. The unit record contains information on the surface material, contamination, decontamination effectiveness, corrosion impacts and a literature source. The data presentation makes possible the realization of a record selection algorithm for a “lay” user to support the decontamination decision approaching the best one.

The analysis of the unit record subject and structure served as the basis for developing an infological model “Tables –Relationships” and a tentative alternative of a user interface. Experimental records were entered to optimize users’ inquiries on the composition and corrosion effects of detergents under various conditions.

The full-scale DMDb will include the following features:

- liquid decontamination technologies for metal surface,
- non-chemical decontamination techniques (laser, mechanical, biological, remelting);
- high-temperature water-free methods (using melts, thermal reduction, gas phases);
- decontamination facilities (designs, features);
- decontamination of soils, buildings, hydrogeological structures;
- facilities and methods for decontaminating liquid radwaste; etc.

STATEMENT OF WORK

The database is aimed at making technical examination and an optimum choice of techniques for cleaning industrial and civil surfaces contaminated with radionuclides. The DB system keeps information concerning the properties of material to be decontaminated, contamination composition and conditions, decontamination techniques and results. Also, pictures taken at various treatment stages (and relevant references) can be available. The access is provided by a password, specifically a reading password, to select data scanned to fit any optional set of parameters.

DMDb is a file-structured rational database which is a customised DBMS Microsoft Access application for Windows.

DMDb gives a comprehensive account of material to be decontaminated, decontamination process and its results. The amount of records to be stored is assumed to be more 15 000. A necessary space is 2Gb. Pictures and references are stored in external files.

As new data sets are acquired these are added to the central database using a back-up routine. The database may be distributed to read-only users in CD-ROM format.

Development of DMDb has involved the following stages:

Conceptual stage covers information necessary to meet the demands of potential users: description of surfaces to be decontaminated; operational aspects of decontamination; probable DB application scenarios; requirements placed upon programs and approaches.

Logic stage covers surfaces proposed for potential application scenarios; the logic structure underlying the DB formal model used for examination of approach options; the contents and structure of data on materials to be decontaminated; the logic DB model where each information piece is represented by tables interconnected in accordance with connections between information pieces. The model conforms to normalization demands.

Physical stage covers data tabulation; development of input sheets; analytical treatment of users' reports; testing, adjustment, amendments; users' training; data input; DB operation.
Prospects: candidate application scenarios to extend the DB potentialities in the future.

FLOW SHEET CARD

To facilitate data entry and retrieval a series of forms or "flow sheet cards" have been created covering the following data on a specific technology :

MATERIAL properties of materials being decontaminated;

ASSOCIATED PARAMETRES contamination parameters; characteristics, shape and size of a contaminated surface;
CONTAMINATION TYPE AND APPLICATION contaminant type and application; exposure time, initial radioactive level;
ISOTOPE isotopic composition of contaminants;
SOLVENT composition and concentration of detergents and their components;
REAGENT properties of reagents used as detergents;
DECONTAMINATION PARAMETERS decontamination variables: V/S, time, temperature, stress mode, capacity (for a radionuclide); a number of treatments, etc.;
EFFECTIVENESS decontamination factor;
CORROSION ATTACK corrosion effects; an average corrosion rate;
LOCAL CORROSION DEFECTS pitting, ulcers, intergranular defects, corrosion cracking;
PICTURES, DOCUMENTS pictures and documents demonstrating initial state, process course, final results.

There are established relationships established within the database linking tables MATERIALS, ASSOCIATED PARAMETERS, CONTAMINATION TYPE AND APPLICATION, ISOTOPES, SOLVENTS, REAGENTS, STRESSES.

A DB interface was developed which comprises a form (FLOW CARD) to facilitate data entry. Using preliminary data, several forms have customized for:

1. detergent compositions to be used for specific contaminants;
2. detergent compositions to be used for specific materials being cleaned;
3. corrosion effects of detergents on specific materials under various conditions.

INFORMATION–REFERENCE SYSTEM AND SELECTION ALGORITHM

In accordance with the adopted DB configuration concept, a major data entity (unit record) provides a description of a decontamination technique for a specific contaminated surface. The unit record includes information on contaminating conditions, decontamination efficiency, corrosion effects and a literature source. The unit record structure is given below.

This data presentation makes it possible for a lay user to make the best decision on a specific decontamination technique. The final decision algorithm is shown below in Figure 1.

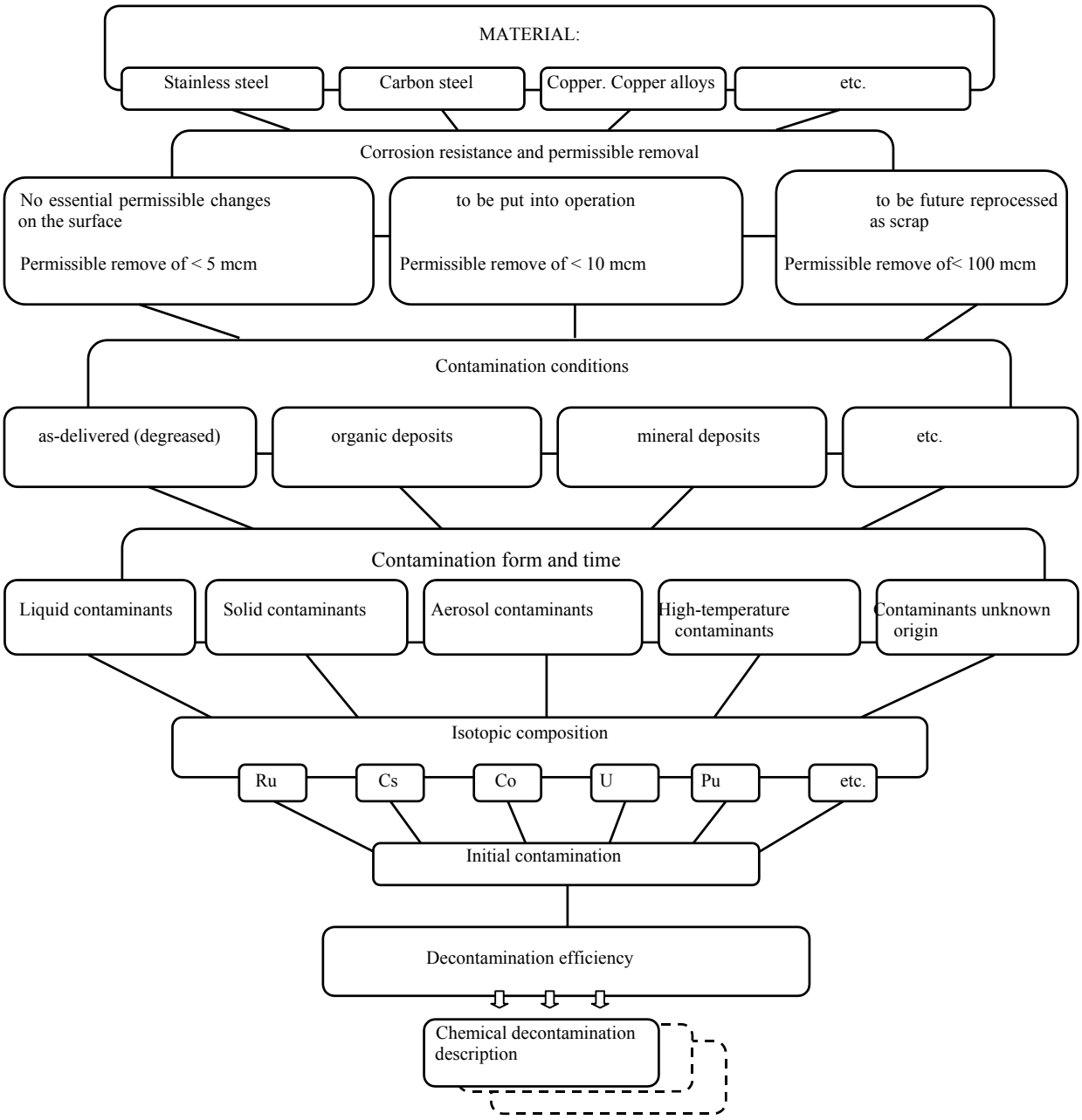

Fig.1. Decision algorithm.

The decision (record sorting/filtering) on a particular decontamination technique should follow a strict scheme. The principal criterion is a material to be decontaminated: stainless steel, carbon steel, etc.. Then one of the following items is indicated:

I - “No essential permissible changes on the surface” ;
II – “To be put into operation”;
III - “To be further reprocessed as scrap”.

This uniquely specifies maximum permissible corrosion attack and hence the range of technologies. In similar fashion, a technology is selected depending on the surface

contaminating conditions: “Surface state…”, “Contaminant form…”, “Isotopic composition…”, etc.

The algorithm must be adequate to provide the best choice of a decontamination technique. Also, the DMDb records serve special needs for decontamination information:

- decontamination technology for a specific contaminant;
- decontamination technology for a specific surface being decontaminated;
- decontamination technology for cleaning a specific surface of a specific contaminant;
- decontamination parameters;
- corrosion effects in different conditions;
- etc.

Thus, the approach to the DMDb configuration and unit record structure provides an information-reference system capable of serving both highly specialized needs and lay user requirements.

The full-scale DMDb will include the following additional features:

- liquid decontamination technologies for metal surface;
- non-chemical decontamination techniques (laser, mechanical, biological, remelting);
- high-temperature water-free methods (using melts, thermal reduction, gas phases);
- decontamination facilities (designs, features);
- decontamination of soils, buildings, hydrogeological structures;
- facilities and methods for decontaminating liquid radwaste;
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