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Development of a database for radionuclide sorption on clay and cement systems in support to radioactive waste management

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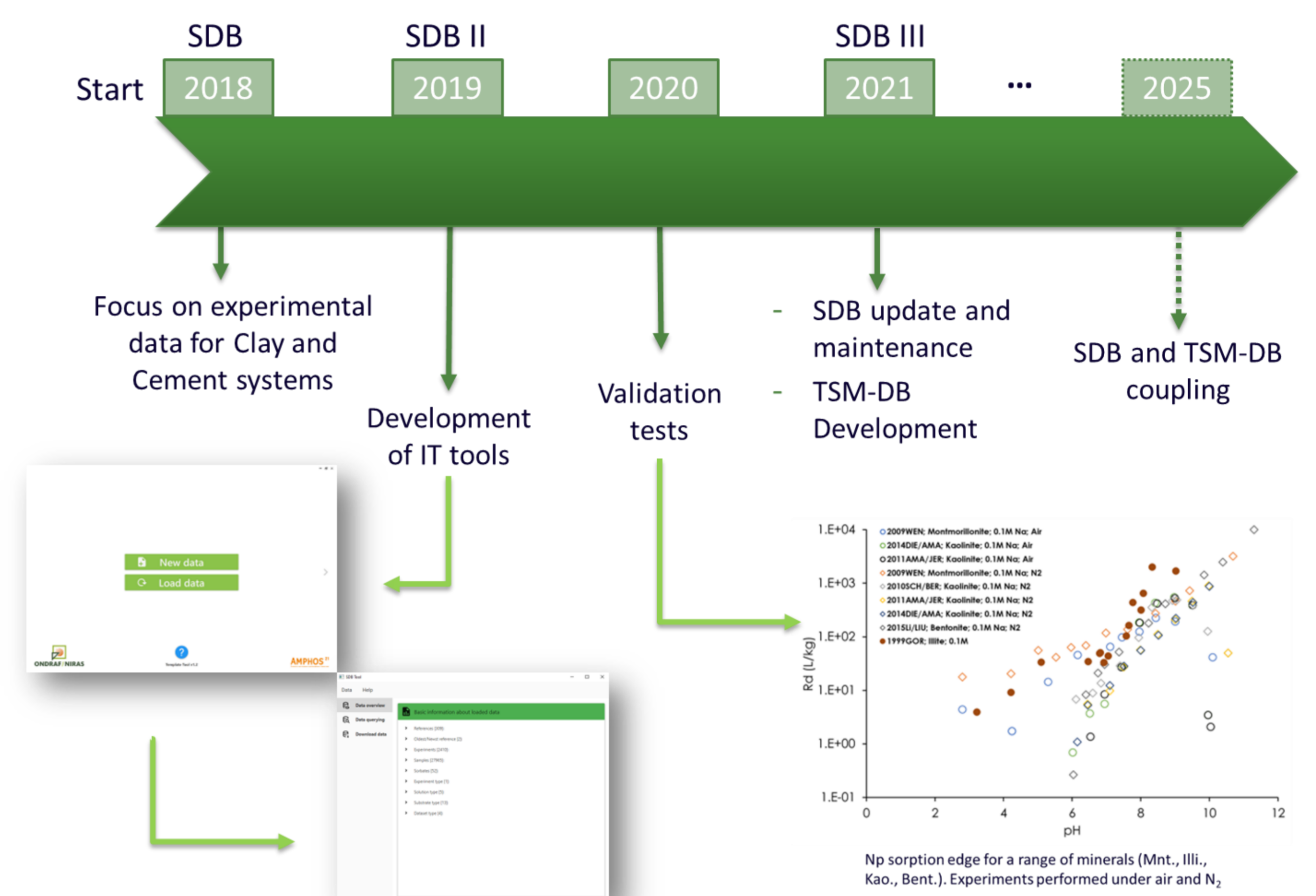[2] **Belgian Agency for Radioactive Waste and Enriched Fissile materials (ONDRAF/NIRAS)**, Belgium
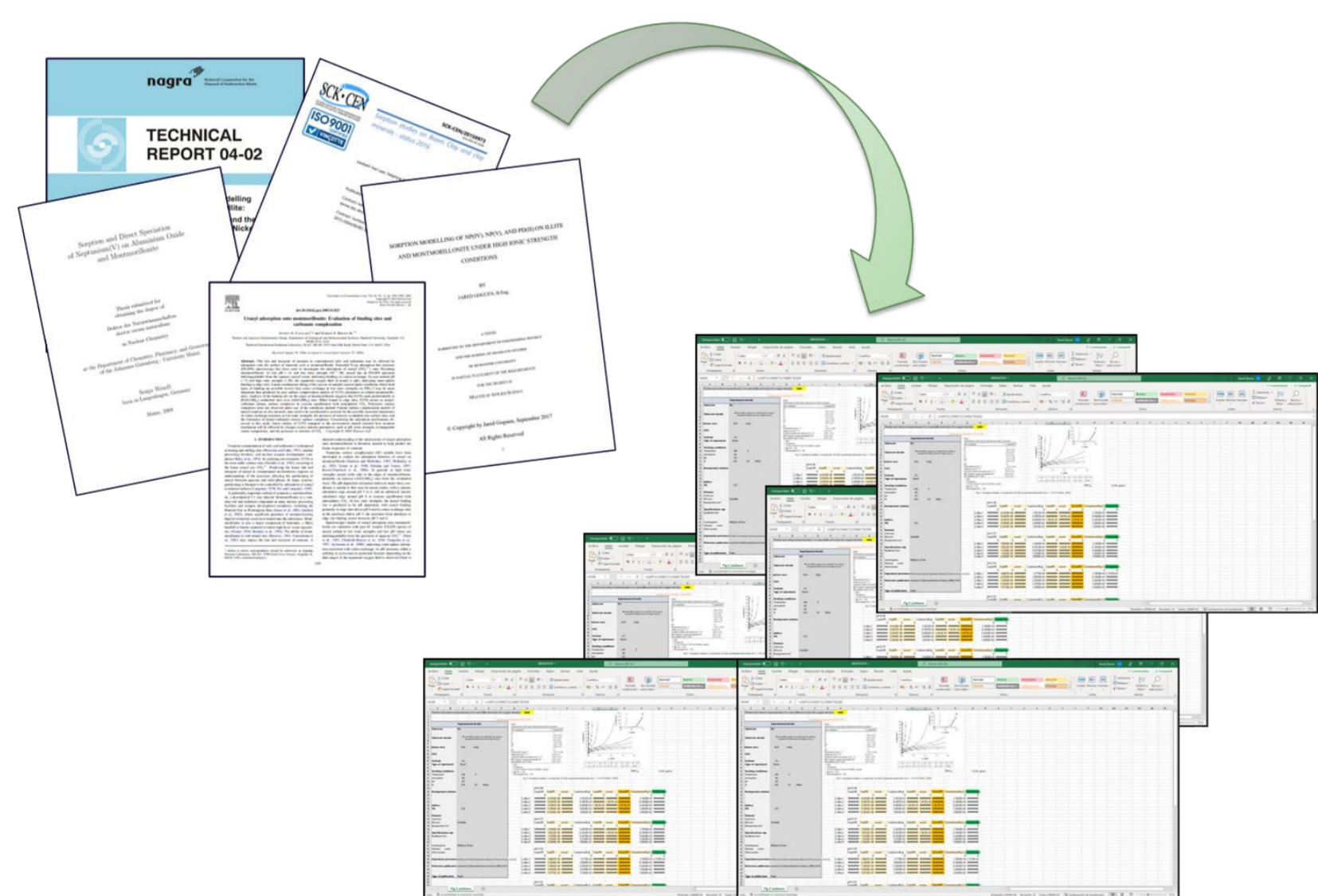
ABSTRACT

Sorption is one of the most effective mechanisms retarding the migration of radionuclides (RN) through engineering and natural (i.e. host-rock) barriers of geological repositories of radioactive waste [1-5]. This term refers mainly to chemical interactions, although Van der Waals physical interactions are also included.

Since 2018, ONDRAF-NIRAS, the Belgian radioactive waste management organisation has been developing a sorption database (SDB) of radionuclides with a first focus on clays and cement phases that will be eventually extended to other materials. Together with the development of the SDB, ONDRAF/NIRAS is now working on developing a complementary database focused on the modelling of adsorption data. The main aim of the present work is to present to the scientific community the current state of both databases as well as the future development steps.

Timeline

Np sorption edge for a range of minerals (Mnt., Illi., Kao., Bent.). Experiments performed under air and N₂
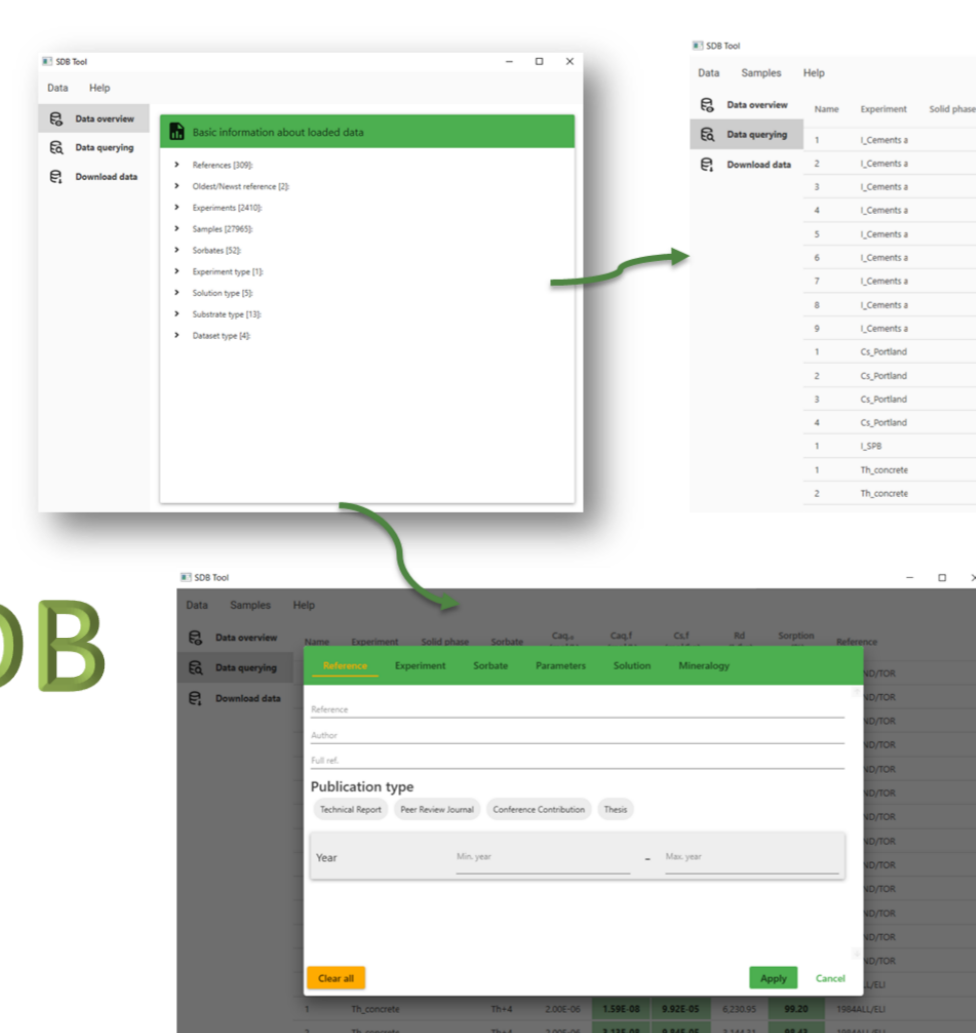
Methodology

1. Raw sorption data or adsorption models taken from literature (Peer-review articles, Technical Reports, PhD. Thesis, Ms.C. Thesis)

2. Preparation of excel files with selected data

3. Introduction of datasets in the JSON files (Template Tool)

4. Introduction of JSON files in the database (S-DB and TM-DB Tools)

Template Tool
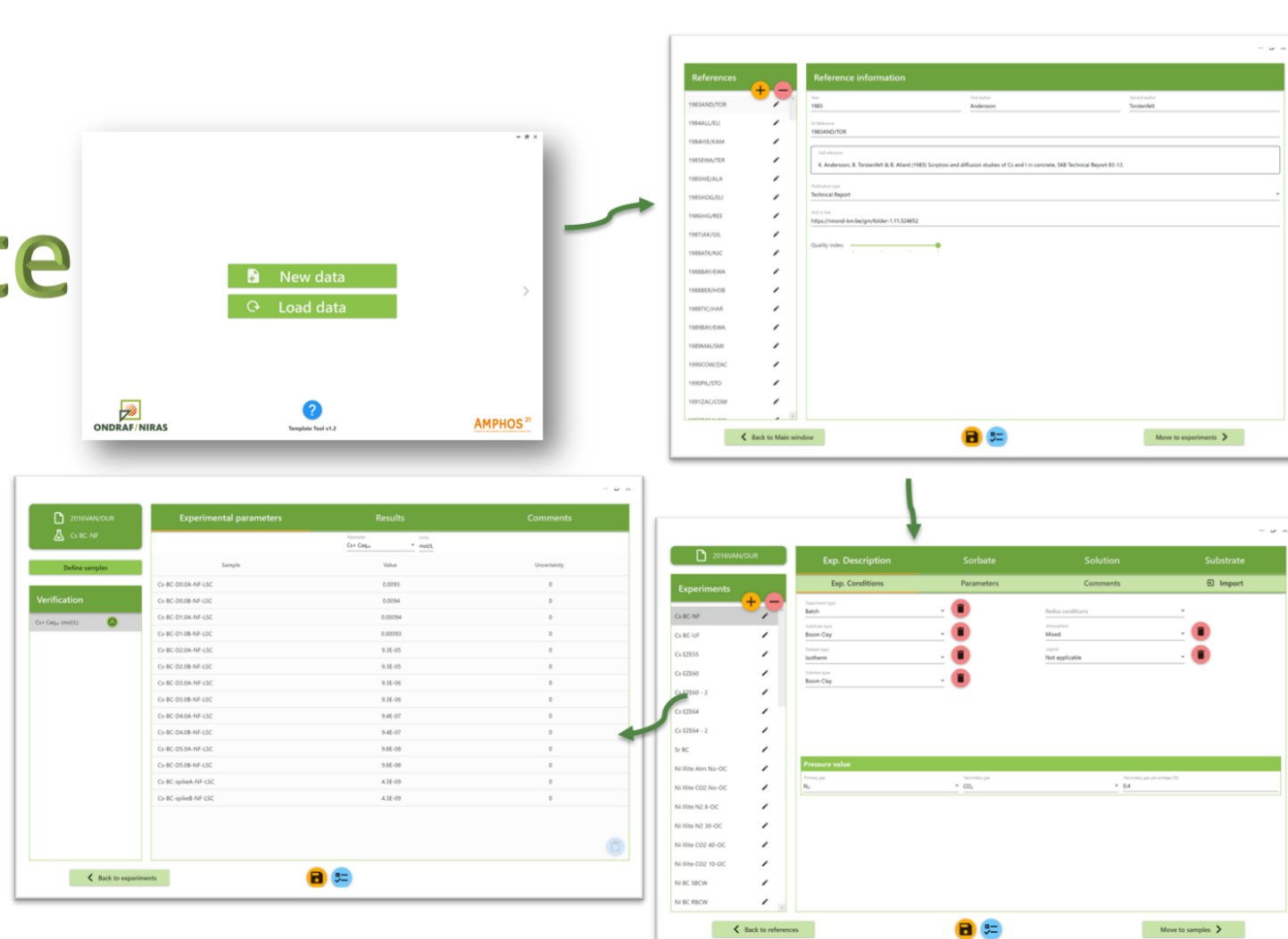
SDB

TSM Template

SDB & TSM Content

➢ More than 300 references, approx. 30.000 datapoints

➢ Sorption data for more than 50 radionuclides

➢ More than 20 solid phases, including:

  ➢ Host rocks (Boom Clay, CallOx, etc.)

  ➢ Clay phases (Bentonite, Montmorillonite, illite, etc.)

  ➢ Cementitious systems (HCP, Mortars, CSH, Ett., etc)

➢ More than 100 Thermodynamic Sorption Models TSM (SCM and IE, with and without electrostatics)

➢ TSM focus on montmorillonite and illite

Conclusions

➢ The two databases (SDB and TSM-DB) themselves and the developed apps are a very useful tool for the forthcoming calculations in support of safety/performance assessments exercises of radioactive waste management agencies.

References

[1] RETROCK, 2005, (C.No.: FIKW-CT-2001-20201); [2] [2] Baeyens, B., et al., 2014, Nagra NTB, 12-04. [3] McKinley, I. G., and Scholtis, A., 1991, Proc. NEA Workshop, Interlaken, Switzerland (pp. 16-18). [4] Ochs, M. and Talerico, C., 2004, SKB TR-04-18. [5] Wersin, P. Et al., 2012, Posiva 2012-39.

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