

QA-Perspective of Knowledge Producer: Examples of Implementation In the Laboratory Studies

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1

General QA Requirement and Responsibilities

- QA Requirements ⇒ **To be Practical**
 - Traceability
 - Reproducibility
 - Scientific Defendability

- Responsibility ⇒ **To be Practical**
 - Management – Resource Allocation
 - Execution - Check

2

QA Requirement : Key Concepts by SNL

- Traceability
 - understanding the source and justification of data and other inputs that generate conclusions
- Transparency
 - being able to follow the decision points, logic, calculations, and operations that produced results
- Reviews
 - ensuring that technical, quality, and managerial reviews are performed and comments and resolved
- Reproducibility
 - being able to reconstruct the results
- Retrievability
 - being able to retrieve associated documentation

3

QA Procedure and Important Component in Laboratory Studies

- Planning & Review → Execution → Results & Discussion & Review → Reflection to Design and PA
- Important Components for Stakeholders

Examples;

- Documentation (TR, Literatures, Manuals) – Review System in Directorate Exists.
- Manuals
- Databases
- Standardization of Experimental Methodologies
- Others

4

An Example – Documentation

We can search and browse of JAEA's research results by JOPSS.

The screenshot shows the JOPSS web interface. At the top, there are logos for JAEA and JAEA Abstracts. The main heading is 'JOPSS JAEA Originated Papers Searching System'. Below this, there is a language selector for '[JAPANESE / ENGLISH]'. A paragraph of text explains that users can search and browse information of research results brought by JAEA staff and download full-text data (PDF Format) of JAEA Reports, JAEA-Research, JAEA-Technology, JAEA-Data/Code, JAEA-Testing, JAEA-Evaluation, JAEA-Review and JAEA-Conf. A 'News' section contains a message: '31 December 2008 : Trial version has been terminated.' Below the news is a 'Search Target' section with checkboxes for 'JAEA Reports (JAEA-Research etc)' and 'Pages Published in Journals'. The search form includes fields for 'AND Report No.', 'AND Publication Year' (with 'from' and 'to' sub-fields), and search criteria dropdowns for 'AND All', 'AND Title', and 'AND Author'. There are also some example report numbers listed on the right side of the form.

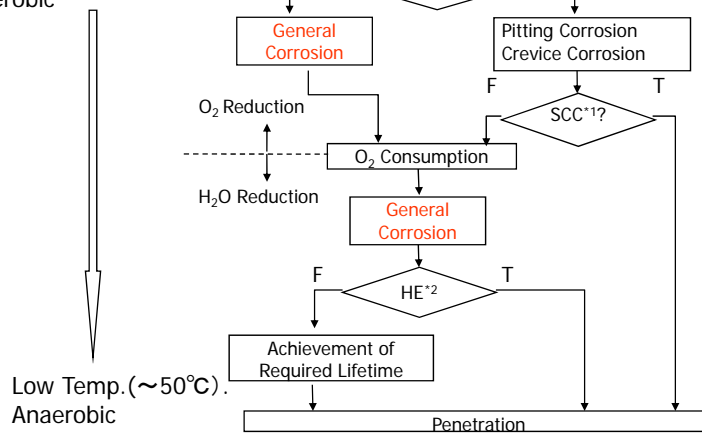
5

An Example - Manuals

Assessment of Lifetime of Carbon-Steel Overpack

Corrosion Scenario

High Temp. (~100°C)
Aerobic



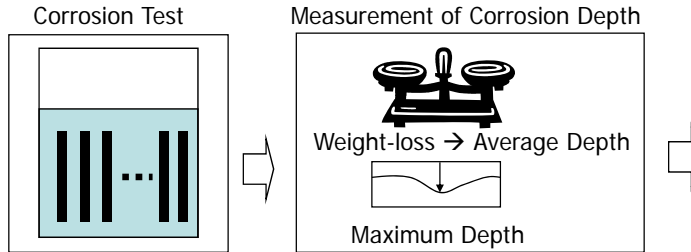
*1 SCC: Stress Corrosion Cracking
*2 HE: Hydrogen Embrittlement

6

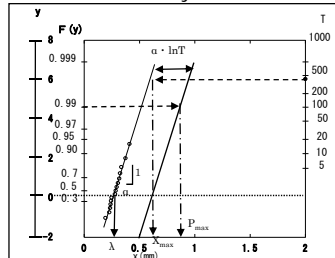
An Example - Manuals

Assessment of Lifetime of Carbon-Steel Overpack

➤ Data Production : Experimental Procedure and Analysis



Extreme Value Statistical Analysis of Measured Maximum Depth



Estimation of Maximum Depth of Overpack

7

An Example - Manuals

Assessment of Lifetime of Carbon-Steel Overpack

➤ Procedure of Estimation for General Corrosion Depth due to Oxygen

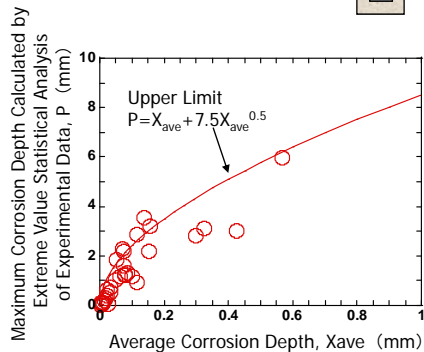
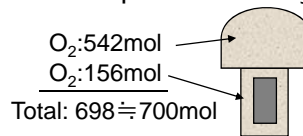
Example: Soft Rock System,
Vertical Emplacement

Total Amount of O_2 in Buffer and
Backfill : **700mol**

Total Amount of Corrosion of
Overpack : **1400mol**
 $2Fe + O_2 + 2H_2O = 2Fe(OH)_2$

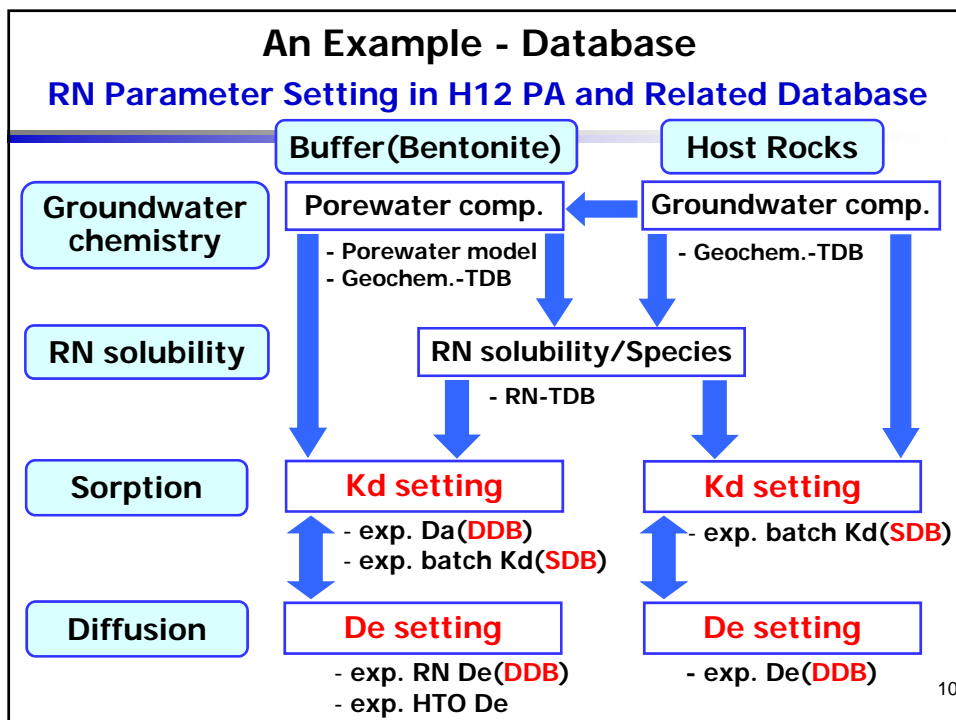
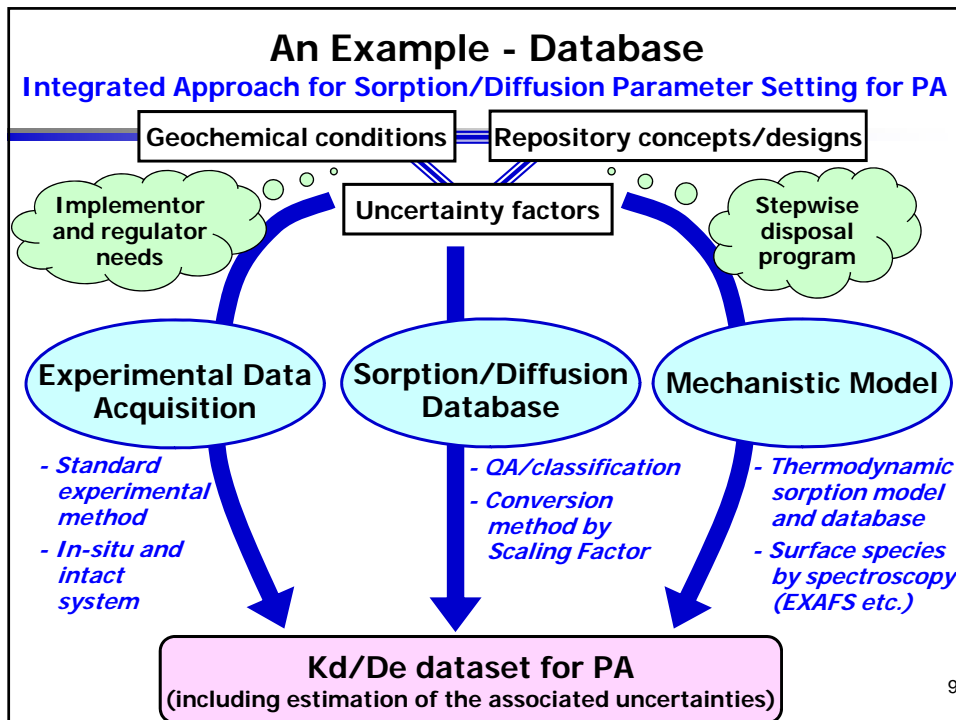
Average Corrosion Depth : **1.8mm**
(Overpack Surface Area: $55129cm^2$)

Maximum Corrosion Depth : **11.8mm**
 $P = X_{ave} + 7.5X_{ave}^{0.5}$
 $X_{ave} = 1.8mm$



Relationship between Average Corrosion
Depth and Maximum Corrosion Depth

8



An Example - Database RN Migration Database on Web



RN migration database has been provided on Web since Aug. 2003.
<http://migrationdb.jaea.go.jp/>

Thermodynamic Database(TDB) includes RN TDB to calculate solubility and species, which is available for geochemical codes such as PHREEQC, EQ3/6 etc.

Sorption Database(SDB) compiles RN distribution coefficient(Kd) measured by batch method for EBS material and various types of rocks.

Diffusion Database(DDB) compiles RN diffusion coefficient(D_e/D_a) for EBS material and various types of rocks. (available on Web since March, 2007)

Number of registration member: 570 (331;Japanese) (in Nov., 2008)
*charge free registration

11

An Example - Database Sorption Kd Database (JAEA-SDB)

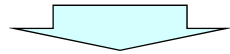
The screenshot displays the JAEA-SDB interface. On the left, there are search filters for 'Elements' (listing various nuclides like Ac, Am, Bk, Cm, etc.), 'Solid Phase Group' (listing materials like Bentonite, Clay minerals, etc.), and 'Detailed Search Condition' (listing parameters like pH, Eh, Ionic Strength, etc.). On the right, there is a 'Data Display' section with a search condition of 'Element: No' and 'Solid Phase Group: Bentonite (Clay minerals)'. Below this is a table of search results with columns for 'Nuclide', 'Rock', and 'Solid Phase Group'. A 'pH-Kd' plot is shown on the right side of the interface, displaying Kd values on a logarithmic scale (from 10⁻⁴ to 10⁴) versus pH values (from 1 to 13). The plot shows a dense collection of data points for various nuclides across different pH levels.

- RNs; HLW PA-related 22(+15) RNs
- Solid; major rocks, bentonite
- 24,000 Kd data

An Example - Database Evaluation of Reliability of Kd data in the SDB

SDB is extensive compilations of Kd data

- ✓ more than 24,000 Kd data from open literatures
- ✓ a great variety of Kd values under various conditions
- ✓ quality assurance(QA) in experimental methodology



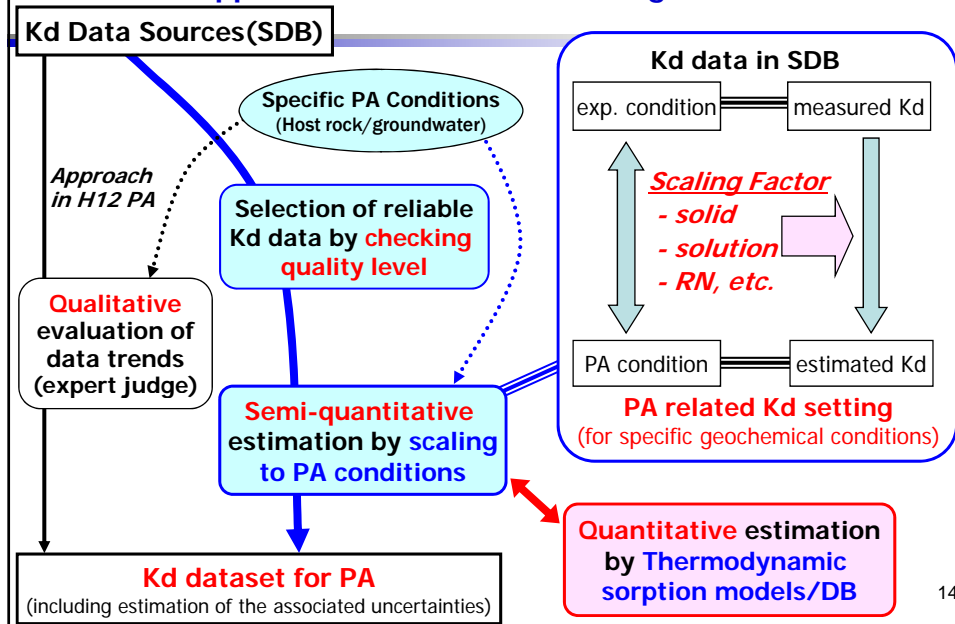
QA/classification criteria

- I) Completeness of documentation
- II) Quality of reported data (exp. methodology, etc.)
- III) Consistency of data (comparison with related data)

→ **Strongly related to data production (experimental procedure and documentation)**

	Checkpoint (criteria II)	Weighting factor	
II-a	Solid phase	A~C/D	x 2
II-b	pH	A~D	x 8
II-c	redox conditions	A/B~C/D	x 8
II-d	final solution comp.	A/B~C/D	x 8
II-e	temperature	A/B~C/D	x 1
II-f	solid/liquid ratio	A/B~C/D	x 2
II-g	sorption ratio	A~C/D	x 2
II-h	Initial RN conc.	A~C/D	x 8
II-i	phase separation	A~C/D	x 8
II-j	reaction time	A/B~C/D	x 2
II-k	agitation	A/B~C/D	x 1
II-l	RN loading	A~C/D	x 2
II-m	reaction vessel	A~C/D	x 1
II-n	Uncertainty estimates	A~D	x 2
II-o	Parameter variation	A~D	x 8

An Example - Database Application of SDB to Kd setting for PA



14

An Example - Standardization

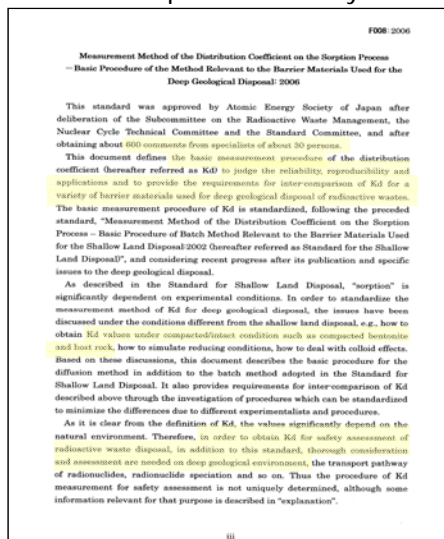
Standardized Measurement Method of the Distribution Coefficient on the Sorption Process by AESJ



15

An Example - Standardization

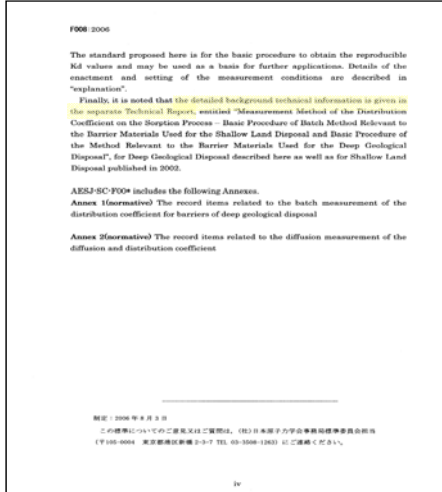
Standardized Measurement Method of the Distribution Coefficient on the Sorption Process by AESJ



16

An Example - Standardization

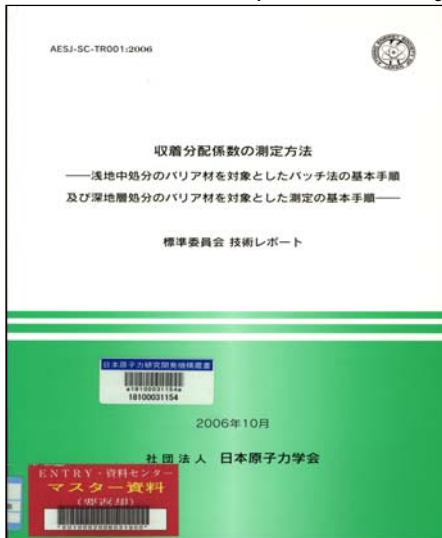
Standardized Measurement Method of the Distribution Coefficient on the Sorption Process by AESJ



17

An Example - Standardization

Background TR for Standardized Measurement Method of the Distribution Coefficient on the Sorption Process by AESJ

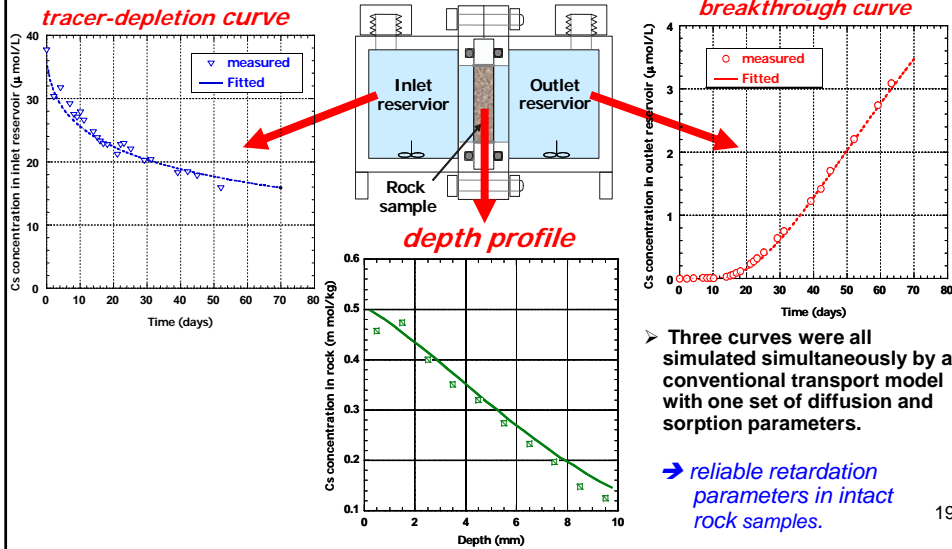


18

An Example - Standardization

Proposal to Revise the Present Standardized Measurement
Method of the Distribution Coefficient on the Sorption Process in Compacted / Intact System

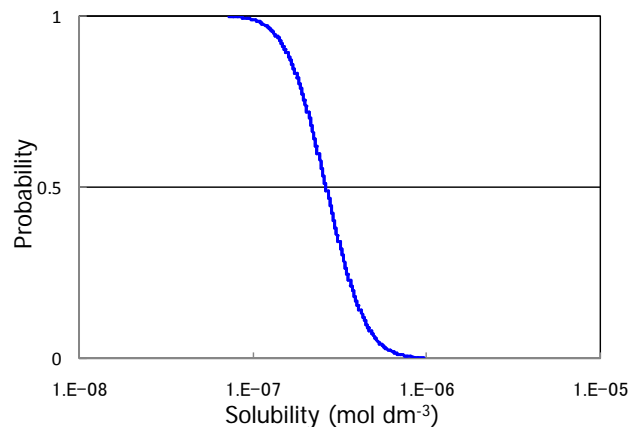
Cs Retention in Intact Rock; Multi-curve analysis



19

Uncertainties in TDB Development

Application to Probabilistic Assessment



An Example : Probability of Se Solubility Based on Data Obtained in NUCEF-JAEA and Other Uncertainty Information (NUCEF REVIEW, No. 13(2008), in Japanese)

20

How to Treat Uncertainties in Data for PA

- Uncertainties can be Derived at Various Stages, However it's not Clear How to Reflect to PA, Deterministic or Probabilistic ?
- What's the Priority in Data Uncertainties?

for Example;

TDB low priority ?

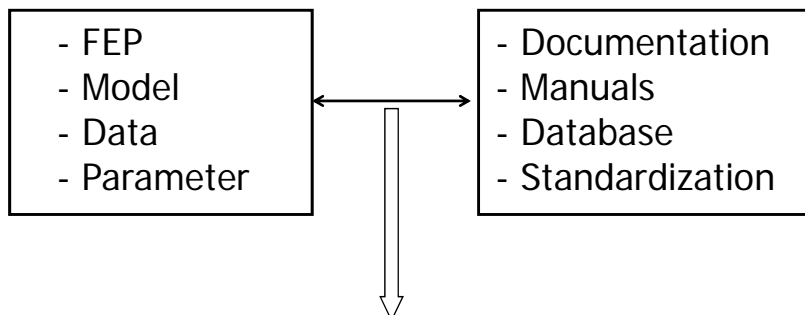
SDB high priority ?

DDB low priority ?

•
•
•

21

What's Relation between Laboratory Studies and Uncertainties in PA?



How to Prioritize the Task / Work
for Uncertainty Analyses?

22

What Do We Do for QA **Practically** ?

- It's Very Hard and Time Consuming Only to Maintain QA Requirements and Responsibilities.
- Practical and Simple Solutions Exist ?
- What's the Practical Objectives of This Workshop ?

23