SCAP

OECD-NEA SCC and Cable Ageing Project

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Swedish Radiation Safety Authority
**SCAP Objectives**

1. Establish a complete *database* with regard to major ageing phenomena for SCC and degradation of cable insulation through collective efforts by OECD/NEA members,

2. Establish a *knowledge-base* by compiling and evaluating collected data and information systematically, with regard to major ageing phenomena for SCC and degradation of cable insulation, and

3. Perform an *assessment* of the data and identify the basis for *commendable practices* which will help regulators and operators to enhance ageing management.
<table>
<thead>
<tr>
<th>Country</th>
<th>MB</th>
<th>SCC</th>
<th>Cable</th>
</tr>
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<tbody>
<tr>
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<td>EC</td>
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</table>

- 17 countries are members of the project.
- The IAEA and the EC are participating as observers.
## SCAP (Project) Schedule

<table>
<thead>
<tr>
<th>MB</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
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<tr>
<td>1st MB (June)</td>
<td>▲</td>
<td>2nd MB (May)</td>
<td>▲</td>
<td>3rd MB (June)</td>
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<table>
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<tr>
<th>SCC WG</th>
<th>1st WG (Oct)</th>
<th>2nd WG (Jan)</th>
<th>3rd WG (May)</th>
<th>4th WG (Nov)</th>
<th>5th WG (Mar)</th>
<th>6th WG (Nov)</th>
<th>7th WG (Mar)</th>
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<th>Cable WG</th>
<th>1st WG (Sep)</th>
<th>2nd WG (Mar)</th>
<th>3rd WG (Sep)</th>
<th>4th WG (Feb)</th>
<th>5th WG (Sep)</th>
<th>6th WG (Feb)</th>
<th>△</th>
<th>△</th>
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### Database, Knowledge base definition and collection of data

### Populating data

### Assessment of data

### Development of commendable practices
SCC Working Group

Scope of the SCC Event Database

- The SCC event database addresses passive component degradation or failure attributed to stress corrosion cracking (SCC) occurring at NPP in participating countries.
- The scope of the database includes ASME class 1 & 2 pressure boundary components, reactor pressure vessel internals and other components with significant operational impact, excluding steam generator tubing.
- The following mechanisms are considered in the database:
  - Inter-granular SCC in austenitic stainless steel and nickel-based material
  - Primary water SCC
  - External chloride SCC
  - Irradiated assisted SCC
  - and trans-granular SCC
SCC Working Group

SCC Event Database structure – Finalized in Nov 2007

- SCAP SCC is a relational database in Microsoft® Access.
- The data entry is managed via input forms, tables, roll down menus and database relationships.
- Database searches and applications are performed through user-defined queries that utilize the tables and built-in data relationships.
- The data entry forms are organized to capture essential passive component failure information together with supporting information.
SCC Working Group

SCC Event Database structure (The four data entry forms) [1/2]

1. Failure Data Input
   • Type of event (e.g. through-wall crack with active leakage) and corrective actions taken at the plant.
   • A detailed description of plant conditions prior to the event and the plant response and method of detection is recorded.

2. Flaw Characterization
   • Description in free-format of the flaw. For through-wall flaws information about size, for part through-wall flaws information on flaw depth, length and orientation is included.
3. ISI History

- Information about ISI of the affected component or ISI history such as time of most recent inspection is recorded including ISI programme weaknesses

4. Root Cause Information

- This form consists of fields to describe the age of the component (in-service life time), location of failure, the method of detection and the apparent cause in terms of the different SCC mechanism along with fields describing contributing factors.

  (e.g. Alloying elements, Mechanical properties, Surface finish, Chemical history, Repair weld, Crack morphology, SCC mechanism, Specific regulatory actions)
**SCC event database (example of input format)**

### SCAP-SCC 2007:1 - Form 1

<table>
<thead>
<tr>
<th>EID</th>
<th>Last Update</th>
<th>Multiple Event Report</th>
<th>Completeness Index</th>
<th>Event Data</th>
<th>Plant Name and Type</th>
<th>Plant Operational State</th>
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<td>0</td>
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<td>1</td>
<td>3</td>
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</table>

**Event Narrative**

The Electric Power Company has been undergoing periodic inspection since ______. When tests prior to the visual inspection of piping nozzle stubs (locations 1-5) attached to the reactor vessel upper head were conducted, a leaking nozzle stub (No. _____) was identified as the source of the leak.

The leak was located on _______ and was confirmed to be leakage from the piping nozzle stub. The leak was observed only on the piping nozzle stub (No. _____) during installation of the pipe for measurement temperature.

### Diameter Class | Diameter [mm] | Diameter [inch] | Wall Thickness [mm] | Pipe Schedule
<table>
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<th></th>
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<th></th>
<th></th>
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<tr>
<td>4</td>
<td>102</td>
<td>4</td>
<td></td>
<td></td>
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</tbody>
</table>

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The system was under _______ when the leak was discovered.
SCC event database (*Web based interface and data access policy*)

- The database is located on a secure server at the NEA with username and password to input and retrieve data.
- There are 3 levels of access (Clearing house, National representative, Operator)
- The web interface was launched in October in 2007.

**Figure. Interactions (3 levels of the access)**
The bar chart illustrates the distribution of SCC (Stress Corrosion Cracking) database content across different categories:

- **TGSCC**
- **PWS CC**
- **IGSCC - RPV Internals**
- **IGSCC - Ex-RPV Piping**
- **IASCC**

The table below provides the count of occurrences for each category:

<table>
<thead>
<tr>
<th></th>
<th>IASCC</th>
<th>IGSCC - Ex-RPV Piping</th>
<th>IGSCC - RPV Internals</th>
<th>PWSCC</th>
<th>TGSCC</th>
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<td>2</td>
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<td><strong>BWR</strong></td>
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<td>103</td>
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</table>
SCC Knowledge base structure

SCC Knowledgebase

Basic information

Regulation/ codes and standards

Information flow chart for reportable events

Inspection/ Monitoring / Qualification

Damage mechanisms overview (SOAR)

Example

PWSCC

Preventive maintenance/ Mitigation

Repair/ Replacement

Evaluation (Crack Growth/ Fracture)

Research and Development

IGSCC
SCC working group approach to identify commendable practices

1. Basic information
   - Information flow chart for reportable events
   - Damage mechanisms (PWSCC, IGSCC - Austenitic Stainless Steel)
     - Definition
     - History of selected important events
     - Affected materials, systems, components, NEA report table

2. Regulation/ codes and standards
3. Inspection/ Monitoring / Qualification
4. Preventive maintenance/ Mitigation
5. Repair/ Replacement
6. Evaluation (Crack Growth/ Fracture)
7. Research and Development

- Evaluation of DB and operating experience
- Comparison of general information

Materials from member countries

Knowledgebase

Open to the public

Report from SCC consultants (PWSCC, IGSCC)

Commendable practice report
(Example) PWSCC of SG nozzles

**Inspection (VT or ECT or UT)**

**Indication**
- Yes
- No

**Sizing (UT)**
- Shallow crack
  - Defect removal
    - Polishing
    - EDM removing

- Deep crack
  - Repair (52/52M)
    - Weld Inlay
    - Structural Weld Overlay
  - Replacement (Inconel690)
    - Partial replacement

**Mitigation**

**Stress and material improvement (e.g.)**
- Residual stress improvement
  - WJP (Water Jet Peening)
  - LP (Laser Peening)
  - USP (Shot Peening by Ultrasonic Vibration)
  - MSIP (Mechanical Stress Improvement Process)

- Improvement of material
  - Weld metal and Replacement

**After removing a flaw or while leaving a flaw,**
- Polishing
- EDM removing

**Deep crack**
- Repair (52/52M)
  - Weld Inlay
  - Structural Weld Overlay
- Replacement (Inconel690)
  - Partial replacement

**Commendable Practices**

**1. Improvement of surface stress characteristics.**
   Repair welding (52/52M)
   Replacement (Inconel690)

**2. Improvement of material.**
   Weld ability Ni based alloy is a concern.
   Determination of welding conditions depends on the amount of removed crack.
Future steps and intended outcomes

Current status
- The scope of the database and the database structure and format has been defined.
- The element of the knowledge base has identified and the knowledge base platform tools has been developed.
- The project is currently in the phase of populating data and assessing the data

Next steps
- Assessment of data and development of commendable practices (2009)
- Report on commendable practices (May 2010)
- Workshop (24-25 May 2010, Tokyo, Japan)

Intended outcomes
Project’s outcomes will be used by the NEA member countries to:
- Support regulatory authorities’ reviews of ageing management programmes
- Evaluate how operating experience and state-of-the-art technology are incorporated into plant operating practices
Project Workshop in 2010

Commendable Practices for Safe Long Term Operation of Nuclear Reactors OECD/NEA SCAP

Location and date:

25-26 May 2010, Tokyo, Japan

Detail information will be available in October at the NEA website: http://www.nea.fr/html/jointproj/scap.html

The workshop will be held in conjunction with International Symposium on the Ageing Management and Maintenance of Nuclear Power Plants (ISaG). This symposium will be held on 27-28 May 2010 and is sponsored by NISA.
Main objectives of the workshop

• To discuss available data and Knowledge base to support long term operation of Nuclear plants
• Present the database and knowledge bases from SCC and Cable working group and identify the outcome of their work
• Share knowledge and experience gathered on SCC and degradation of cable insulation.
• Discuss commendable practices developed within SCAP
• Address the needs for utilization of the databases in the future

Sponsorship

The workshop is organized by NEA/CSNI (Committee on the Safety of Nuclear Installations) and:

• Hosted by the Japan Nuclear and Industrial Safety Agency (NISA) and the Japan Nuclear Energy Safety Organization (JNES)
• Conjunction with NISA program on Ageing Management for Safety Long term operation of Light Water Reactors (International Symposium on the Ageing Management and Maintenance of Nuclear Power Plants (ISaG)
• (Cooperation with the IAEA)
Insight into establishing an international database (1/2)

Complicated task to establish a forum for the exchange of international event data
- Different regulatory regimes
- Proprietary nature of much information relating to engineering activities (e.g. structural evaluation of flawed parts, root cause evaluation, and ISI technology)
- Reporting levels: Vary from country to country
- Resources must be allocated by all member countries at own cost

To try and overcome these difficulties, the project has brought together SCC experts from regulatory bodies, industry, research institutions and academia.
Insight into establishing an international database (2/2)

OPDE database

The experience from the OPDE project has been essential for the establishment of the SCAP SCC event database

- Practical approach for the database development and maintenance
- Coding guideline and quality assurance program
- Work done by the Clearing House
- Expert network already existed (all OPDE members in SCAP SCC WG)

- OECD Pipe Failure Data Exchange Project (OPDE) project was formally launched in May 2002 under the auspices of the OECD/NEA but initial discussions started as early as in 1994
- It now includes approximately 3600 records on pipe failures from 321 NPPs and the current term ends 2011