Unclassified **NEA/CSNI/R(2012)16**

Organisation de Coopération et de Développement Économiques
Organisation for Economic Co-operation and Development **26-Nov-2012**

English text only

NUCLEAR ENERGY AGENCY
COMMITTEE ON THE SAFETY OF NUCLEAR INSTALLATIONS

NEA/CSNI/R(2012)16
Unclassified

OECD-NEA Piping Failure Data Exchange Project (OECD-NEA OPDE) Final Report

JT03331584

Complete document available on OLIS in its original format

English text only

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

The OECD is a unique forum where the governments of 34 democracies work together to address the economic, social and environmental challenges of globalisation. The OECD is also at the forefront of efforts to understand and to help governments respond to new developments and concerns, such as corporate governance, the information economy and the challenges of an ageing population. The Organisation provides a setting where governments can compare policy experiences, seek answers to common problems, identify good practice and work to co-ordinate domestic and international policies.

The OECD member countries are: Australia, Austria, Belgium, Canada, Chile, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, the Republic of Korea, the Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States. The European Commission takes part in the work of the OECD.

OECD Publishing disseminates widely the results of the Organisation's statistics gathering and research on economic, social and environmental issues, as well as the conventions, guidelines and standards agreed by its members.

NUCLEAR ENERGY AGENCY

The OECD Nuclear Energy Agency (NEA) was established on 1 February 1958. Current NEA membership consists of 30 OECD member countries: Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Luxembourg, Mexico, the Netherlands, Norway, Poland, Portugal, the Republic of Korea, the Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States. The European Commission also takes part in the work of the Agency.

The mission of the NEA is:

– to assist its member countries in maintaining and further developing, through international co-operation, the scientific, technological and legal bases required for a safe, environmentally friendly and economical use of nuclear energy for peaceful purposes, as well as

– to provide authoritative assessments and to forge common understandings on key issues, as input to government decisions on nuclear energy policy and to broader OECD policy analyses in areas such as energy and sustainable development.

Specific areas of competence of the NEA include the safety and regulation of nuclear activities, radioactive waste management, radiological protection, nuclear science, economic and technical analyses of the nuclear fuel cycle, nuclear law and liability, and public information.

The NEA Data Bank provides nuclear data and computer program services for participating countries. In these and related tasks, the NEA works in close collaboration with the International Atomic Energy Agency in Vienna, with which it has a Co-operation Agreement, as well as with other international organisations in the nuclear field.

THE COMMITTEE ON THE SAFETY OF NUCLEAR INSTALLATIONS

"The Committee on the Safety of Nuclear Installations (CSNI) shall be responsible for the activities of the Agency that support maintaining and advancing the scientific and technical knowledge base of the safety of nuclear installations, with the aim of implementing the NEA Strategic Plan for 2011-2016 and the Joint CSNI/CNRA Strategic Plan and Mandates for 2011-2016 in its field of competence.

The Committee shall constitute a forum for the exchange of technical information and for collaboration between organisations, which can contribute, from their respective backgrounds in research, development and engineering, to its activities. It shall have regard to the exchange of information between member countries and safety R&D programmes of various sizes in order to keep all member countries involved in and abreast of developments in technical safety matters.

The Committee shall review the state of knowledge on important topics of nuclear safety science and techniques and of safety assessments, and ensure that operating experience is appropriately accounted for in its activities. It shall initiate and conduct programmes identified by these reviews and assessments in order to overcome discrepancies, develop improvements and reach consensus on technical issues of common interest. It shall promote the co-ordination of work in different member countries that serve to maintain and enhance competence in nuclear safety matters, including the establishment of joint undertakings, and shall assist in the feedback of the results to participating organisations. The Committee shall ensure that valuable end-products of the technical reviews and analyses are produced and available to members in a timely manner.

The Committee shall focus primarily on the safety aspects of existing power reactors, other nuclear installations and the construction of new power reactors; it shall also consider the safety implications of scientific and technical developments of future reactor designs.

The Committee shall organise its own activities. Furthermore, it shall examine any other matters referred to it by the Steering Committee. It may sponsor specialist meetings and technical working groups to further its objectives. In implementing its programme the Committee shall establish co-operative mechanisms with the Committee on Nuclear Regulatory Activities in order to work with that Committee on matters of common interest, avoiding unnecessary duplications.

The Committee shall also co-operate with the Committee on Radiation Protection and Public Health, the Radioactive Waste Management Committee, the Committee for Technical and Economic Studies on Nuclear Energy Development and the Fuel Cycle and the Nuclear Science Committee on matters of common interest."

EXECUTIVE SUMMARY

Structural integrity of piping systems is important for plant safety and operability. In recognition of this, information on degradation and failure of piping components and systems is collected and evaluated by regulatory agencies, international organisations (e.g., OECD/NEA and IAEA) and industry organisations worldwide to provide systematic feedback for example to reactor regulation and research and development programmes associated with ageing phenomena, non-destructive examination (NDE) technology, in-service inspection (ISI) programmes, leak-before-break evaluations, risk-informed ISI, and probabilistic safety assessment (PSA) applications involving passive component reliability.

Several OECD Member countries agreed to establish the OECD-NEA Piping Failure Data Exchange Project (OECD-NEA OPDE) to encourage multilateral co-operation in the collection and analysis of data relating to degradation and failure of piping in nuclear power plants. The scope of the data collection includes service-induced wall thinning, part through-wall cracks, through-wall cracks with and without active leakage, and instances of significant degradation of piping pressure boundary integrity.

The project was formally launched in May 2002 under the auspices of the OECD/NEA. Organisations producing or regulating more than 80 % of nuclear energy generation worldwide contributed data to the OECD-NEA OPDE data project. In February 2009, eleven countries[1] signed the OECD OPDE 3rd Term agreement (Canada, Czech Republic, Finland, France, Germany, Korea (Republic of), Japan, Spain, Sweden, Switzerland and United States of America). Upon completion of the 3rd Term (May 2011), the OPDE data project was officially closed to be succeeded by the OECD-NEA "Component Operational Experience, Degradation & Ageing Programme" (CODAP).

A key accomplishment of the OPDE project is the establishment of a framework for the systematic collection and evaluation of service-induced piping degradation and failure. Numerous database application projects have been pursued by the project members. These applications have been essential in improving database structure and database field definitions. Looking forward, CODAP will serve as an important resource for nuclear engineering professionals actively involved in plant ageing management research as well as in the validation of degradation mechanism mitigation strategies.

This final project report describes the status of the OECD-NEA OPDE database after 9 years of operation from May 2002 to May 2011, and gives some insights based on ca. 3800 piping failure events in the database.

[1] Belgium participated in the project during the 1st and 2nd terms but decided not to participate in the 3rd term (2008-2011) of the project.

TABLE OF CONTENTS

FIGURES

TABLES

1. INTRODUCTION

Structural integrity of piping systems is important for plant safety and operability. In recognition of this, information on degradation and failure of piping components and systems is collected and evaluated by regulatory agencies, international organisations (e.g., OECD/NEA and IAEA) and industry organisations worldwide to provide systematic feedback for example to reactor regulation and research and development programmes associated with ageing phenomena, non-destructive examination (NDE) technology, in-service inspection (ISI) programmes, leak-before-break evaluations, risk-informed ISI, and probabilistic safety assessment (PSA) applications involving passive component reliability.

Reviews of service experience with safety-related and non safety-related piping systems have been ongoing ever since the first commercial nuclear power plants came on line in the 1960's. In 1975 the U.S. Nuclear Regulatory Commission established a Pipe Crack Study Group (PCSG) charged with the task of evaluating the significance of stress corrosion cracking in boiling water reactors (BWRs) and pressurised water reactors (PWRs). Service experience review was a key aspect of the work by the PCSG. Major condensate and feedwater piping failures (e.g., Trojan and Surry-2 in the U.S.) due to flow accelerated corrosion (FAC) resulted in similar national and international initiatives to learn from service experience and to develop mitigation strategies to prevent recurrence of pipe failures. Early indications of the significance of thermal fatigue phenomena evolved in the 1970s, and, again, systematic reviews of the service experience enabled the introduction of improved piping design solutions, NDE methods, and operating practices.

In parallel with these focused efforts to evaluate service experience data and to correlate the occurrence of material degradation with piping design and operational parameters, initiatives have been presented to establish an international forum for the systematic collection and exchange of service experience data on piping. An obstacle to the use of the database by other countries of national qualitative and quantitative pipe failure information is that criteria and interpretations applied in the collection and analysis of events and data differ among the various countries. A further impediment is that the descriptions of reported events and their root causes and underlying contributing factors, which are important to the assessment of the events, are usually written in the native language of the countries where the events were observed.

To overcome these obstacles, the preparation for the OECD Pipe Failure Data Exchange (OPDE) Project was initiated in 1994 by the Swedish Nuclear Power Inspectorate (SKI)[2]. In 1994 SKI launched a 5-year R&D project to explore the viability of creating an international pipe failure database. During this period SKI hosted meetings to present results of the R&D and to discuss the principles of database development and maintenance.[3] Since May 2002, the OECD/NEA has formally operated the project under the coordination of the Committee on the Safety of Nuclear Installations (CSNI). The first term of the Project covered the years 2002-2005, the second term covered the period 2005-2008, and the final term covered the period 2008-2011. This report summarises the final project results of the OPDE Project after nine years of operation from May 2002 to May 2011.

[2] Swedish Radiation Safety Authority (SSM) as of July 1, 2008

[3] In September 1996 SKI organised the "Initial Meeting of the International Cooperative Group on Piping Performance" with participants from thirteen countries. Again, in September 1997 SKI organized the "Seminar on Piping Reliability" (SKI Report 97:32); this time with participants from eleven countries.

In May 2011 the Project Review Group (PRG) approved the transition of OPDE to a new, expanded OECD-NEA Component Operational Experience, Degradation & Ageing Programme (CODAP). A first CODAP National Coordinators Meeting was held at NEA Headquarters in November 2011. The CODAP PRG Membership corresponds to that of the OPDE, with two additional member countries (Slovak Republic and Chinese Taipei). The CODAP project builds on the success of OPDE and a related OECD-NEA data project, the SCAP-SCC Working Group.

In 2006 the SCC and Cable Ageing Project (SCAP) was established under the auspices of the OECD/NEA to assess, due to their implication on nuclear safety and their relevance for plant ageing management, two subjects: stress corrosion cracking (SCC) and degradation of cable insulation. The project ran successfully from June 2006 to June 2010 [1].

Fourteen NEA member countries joined the SCAP project in 2006 to share knowledge and by 2010, seventeen countries had joined the project. The International Atomic Energy Agency (IAEA) and the European Commission also participated as observers.

The objective of the SCAP coordinated project was to share the corporate knowledge and operating experience, to understand the failure mechanisms, and to identify effective techniques and technologies to effectively manage and mitigate active degradation in nuclear power plants. The specific objectives of the project were to:

- Establish a complete database with regard to major ageing phenomena for SCC and degradation of cable insulation through collective efforts by OECD/NEA members;
- Establish a knowledge base in these areas by compiling and evaluating the collected data and information systematically;
- Perform an assessment of the data and identify the basis for commendable practices which will help regulators and operators to enhance ageing management.

The scope of the SCAP SCC Working Group covers class 1 and 2 pressure boundary components, reactor pressure vessel internals and other components with significant operational impact, excluding steam generator tubing. The entire SCC database consists of an event database and general information. The general information consists of regulations/ codes and standards, inspection/ monitoring/ qualification, preventive maintenance/ mitigation, repair/ replacement, safety assessment, and R&D. Together these comprise the knowledge base.

Following the completion of the SCAP project, SCC Working Group participants were interested in some form of continuation and discussions were initiated to explore possible alternatives. It was recognised that there are many aspects very similar to those existing in OPDE and the concept of a new project was envisaged to combine the two projects into the “Component Operational Experience, Degradation & Ageing Programme” (CODAP). The objective of CODAP is to collect information on passive metallic component degradation and failures of the primary system, reactor pressure vessel internals, main process and standby safety systems, and support systems (i.e., ASME Code Class 1, 2 and 3, or equivalent). It also covers non safety-related (non-Code) components with significant operational impact. It is intended that CODAP will also include information on age-related degradation of buried tanks and plastic piping.

2. OPDE OBJECTIVE AND SCOPE

OPDE has established an international database on pipe degradation and failures in commercial nuclear power plants in 11 OECD Member Countries. The database supports the following activities:

- Trend analysis, including ageing analysis
- Statistical analyses to determine pipe failure rates and rupture frequencies for use in risk-informed activities (e.g., loss-of-coolant-accident frequency assessment, internal flooding initiating frequency assessment, high-energy-line-break frequency assessment, RI-ISI Δ-risk assessment, etc.)
- Source of data parameters for input to probabilistic fracture mechanics codes. The database is also a source of information on degradation susceptibilities and degradation rates for use in the verification and validation of probabilistic fracture mechanics (PFM) codes.
- Degradation mechanism analysis (DMA) in risk-informed ISI (RI-ISI) applications
- Development of defences against recurring (e.g., systematic) pipe failures
- Exchange of service data in order to pinpoint potential generic implications of a specific, significant pipe failure.

The OPDE Project addresses typical metallic piping components of the primary system, main process and standby safety systems, and support systems (i.e., ASME Code Class 1, 2 and 3, or equivalent, piping). It also covers non safety-related (non-Code) piping, which if leaking could lead to common-cause initiating events such as flooding of vital plant areas. As an example, raw water systems such as non-essential service water, circulating water or fire protection could be significant flood sources given a pipe break. In other words, the OPDE database covers degradation and failure of high-energy and moderate-energy piping as well as safety-related and non safety-related piping.

Included in the database are events that result in remedial action (e.g., replacement, repair) with or without reactor shutdown to cold shutdown condition. The types of degradation or failure include service induced inside diameter pipe wall thinning and non through-wall cracking as well as pressure boundary breaches, such as pinhole leaks, leaks, severance and major structural failures (pipe "breaks" or "ruptures"). For pipe flaws that do not penetrate the pipe wall or weld/weld heat affected zone the OPDE work scope encompasses degradation exceeding design code allowable for wall thickness or crack depth as well as such degradation that could have generic implications regarding the reliability of NDE/ISI techniques. In summary, the following types of degradation and failures are considered:

- Non through-wall defects (e.g., cracks, wall thinning) interpreted as structurally significant and/or exceeding design code allowable
- Through-wall defects without active leakage; leakage may be detected following a plant operational mode change involving for example depressurization and cool-down, or as part of preparations for NDE
- Small leaks (e.g., pinhole leaks, drop leakage) resulting in temporary or permanent repair

- Leaks (e.g., leak rate within Technical Specification limits)
- Large leaks (e.g., through-wall flow rates in excess of Technical Specification limits)
- Severance (pressure boundary failure attributed to external impact or vibration fatigue)
- Rupture (major structural failure).

In May 2002 the starting point for the Project was an in-kind contribution by SKI in the form of an international pipe failure database in Microsoft® Access. This database included pipe failure data for the period 1970 to 1998, and it contained approximately 2,300 records. During the first term of the project the emphasis was on validating the content of the SKI in-kind contribution, improving and streamlining the database structure and data input format, and populating the database with new failure data for the period 1999 to 2003, as well as with pre-1998 records.

During the second term (2005-2008) an Online-version of the database was implemented to facilitate data submission. Authorised users can access the Online-version via a secure server operated by the NEA Information Technology (IT) Group. An effort was initiated to encourage plant operators to directly input failure records via the Online-version. Database user IDs and passwords were provided by NEA-IT to respective National Coordinator for distribution within the country.

During the third term (2008-2011), online data submissions were made by plant operators in Canada and Switzerland. Insights and lessons learned from implementing and using the OPDE Online Database were transferred to the SCAP-SCC project [1].

Signatory countries can use the database content to generate their own qualitative and quantitative piping reliability insights. An international co-operation for quantification of piping reliability parameters may be established separately in the future should the participating organisations wish to do so.

In May 2011 the Project Review Group (PRG) approved the transition of OPDE to a new, expanded OECD-NEA Component Operational Experience, Degradation & Ageing Programme (CODAP). A first CODAP National Coordinators Meeting was held at NEA Headquarters in November 2011. The CODAP PRG Membership corresponds to that of the OPDE, with two additional member countries (Slovak Republic and Chinese Taipei). The CODAP project builds on the success of OPDE and a related OECD-NEA data project, the SCAP-SCC Working Group.

In 2006 the SCC and Cable Ageing Project (SCAP) was established under the auspices of the OECD/NEA to assess, due to their implication on nuclear safety and their relevance for plant ageing management, two subjects: stress corrosion cracking (SCC) and degradation of cable insulation. The project ran successfully from June 2006 to June 2010 [1].

Fourteen NEA member countries joined the SCAP project in 2006 to share knowledge and by 2010, seventeen countries had joined the project. The International Atomic Energy Agency (IAEA) and the European Commission also participated as observers.

The objective of the SCAP coordinated project was to share the corporate knowledge and operating experience, to understand the failure mechanisms, and to identify effective techniques and technologies to effectively manage and mitigate active degradation in nuclear power plants. The specific objectives of the project were to:

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

Establish a knowledge base in these areas by compiling and evaluating the collected data and information systematically;
Perform an assessment of the data and identify the basis for commendable practices which will help regulators and operators to enhance ageing management.

The scope of the SCAP SCC Working Group covers class 1 and 2 pressure boundary components, reactor pressure vessel internals and other components with significant operational impact, excluding steam generator tubing. The entire SCC database consists of an event database and general information. The general information consists of regulations/ codes and standards, inspection/ monitoring/ qualification, preventive maintenance/ mitigation, repair/ replacement, safety assessment, and R&D. Together these comprise the knowledge base.

Following the completion of the SCAP project, SCC Working Group participants were interested in some form of continuation and discussions were initiated to explore possible alternatives. It was recognised that there are many aspects very similar to those existing in OPDE and the concept of a new project was envisaged to combine the two projects into the "Component Operational Experience, Degradation & Ageing Programme" (CODAP). The objective of CODAP is to collect information on passive metallic component degradation and failures of the primary system, reactor pressure vessel internals, main process and standby safety systems, and support systems (i.e., ASME Code Class 1, 2 and 3, or equivalent). It also covers non safety-related (non-Code) components with significant operational impact. It is intended that CODAP will also include information on age-related degradation of buried tanks and plastic piping.

3. OPDE ORGANISATION

Each participating country was represented by a National Coordinator. The OECD/NEA is responsible for administering the project according to OECD rules. To assure consistency of the data contributed by the National Coordinators the Project operated through the Clearinghouse. The Clearinghouse verifies whether the information provided by the National Coordinators complied with the OPDE Coding Guidelines (OPDE-CG). The OPDE Project Review Group (PRG) controlled the project with support from the OECD/NEA project secretary and a Clearinghouse.

The PRG ran the Project and meets at least once perannum. The PRG responsibilities included but were not limited to the following types of decisions:

- Secure the financial and technical resources necessary to carry out the Project
- Nominate the OPDE Project chairperson
- Define the information flow (public information and confidential information)
- Approve the admittance of new members
- Nominate project task leaders (lead countries) and key persons for the PRG tasks
- Define the priority of the task activities
- Monitor the progress of the Project and task activities
- Monitor the work of the Clearinghouse and quality assurance

The third term OPDE participating countries and organisations are listed below:

- Canada (Canadian Nuclear Safety Commission)
- Czech Republic (Nuclear Research Institute, REZ)
- Finland (Radiation and Nuclear Safety Authority)
- France (Institut de Radioprotection et de Sûreté Nucléaire)
- Germany (Gesellschaft für Anlagen- und Reaktorsicherheit)
- Japan (Japan Nuclear Energy Safety Organisation)
- Korea (Republic of) (Korea Institute of Nuclear Safety and Korea Atomic Energy Research Institute)
- Spain (Consejo de Seguridad Nuclear)
- Sweden (Swedish Radiation Safety Authority)
- Switzerland (Swiss Federal Nuclear Safety Inspectorate)
- United States of America (Nuclear Regulatory Commission)

Belgium (Electrabel and Tractebel) participated in the first and second terms, but decided not to join the third term of the project.

4. QUALITY ASSURANCE & DATA QUALITY

The OPDE Quality Assurance Program (OPDE-QAP) establishes the organisational and technical principles and measures for quality assurance and monitoring of the work during operation of the OPDE Project to ensure high quality of the end product (the database with companion reports and publications). The OPDE-QAP applies to all activities in the project and wasto be followed by all project participants.

To achieve the objectives established for the OPDE database, a Coding Format was developed. This Coding Format is reflected in the Coding Guidelines. The Coding Guidelines are built on established pipe failure data analysis practices and routines that acknowledge the unique aspects of passive component reliability in heavy water reactor and light water reactor operating environments (e.g., influences by material and water chemistry).

For an event to be considered for inclusion in the OPDE database it must undergo an initial screening for eligibility. An objective of this initial screening is to go beyond the abstracts of event reports to ensure that only pipe degradation and failures according to the work scope definition are included in the database.

Data quality is affected from the moment the service data is recorded at a nuclear power plant, interpreted, and finally entered into a database system. The service data is recorded in different types of information systems ranging from work order systems, via ISI databases and outage summary reports, to licensee event reports or reportable occurrence reports. Consequently the details of a degradation event or failure tend to be documented to various levels of technical detail in these different information systems. Building an OPDE database event record containing the full event history often entails extracting information from multiple sources.

The term “data quality” is an attribute of the processes that have been implemented to ensure that any given database record (including all of its constituent elements, or database fields) can be traced to the source information. The term also encompasses “fitness-for-use”, that is, the database records should contain sufficient technical detail to support database applications.

In OPDE, a “Completeness Index” (CI) is used for database management purposes. It distinguishes between records for which more information must be sought and those considered to be complete (Table 1). Each record in the database is assigned a CI, which relates to the completeness of the information in the database relative to the requirements of the Coding Guidelines.

The “Completeness Index” is also intended as a database filter for determination of the ‘fitness-for-application’. The range of possible database applications covers advanced applications (e.g., the study of effect of different water chemistries on specific degradation susceptibilities), risk-informed applications (e.g., technical basis for degradation mechanism assessment in risk-informed ISI programme development, or statistical parameter estimation in support of internal flooding PSA), and high-level summaries of service experience trends and patterns. Advanced database applications would normally rely on queries that are based and the subset of the overall database content consisting of those records for which CI = 1. By contrast, high-level database applications would draw on information from the entire database content.

Completeness Index	Description
1	Validated – all source data have been reviewed – no further action is expected
2	Validated – source data may be missing some non-essential information – no further action anticipated. The term "non-essential" implies that information about piping layout (including location of a flaw) may not be known exactly but can be inferred based on other, similar events (at the same or similar plants)
3	Not validated – validation pending

Table 1: OPDE Completeness Index (CI) Definitions

5. OPDE DATABASE STRUCTURE

OPDE is a relational database in Microsoft® Access. It includes information on pipe degradation and failure in light water reactors and heavy water reactors for the period 1970 to 2011. The opening screen of the Access version (Figure 1) includes the user terms and conditions.

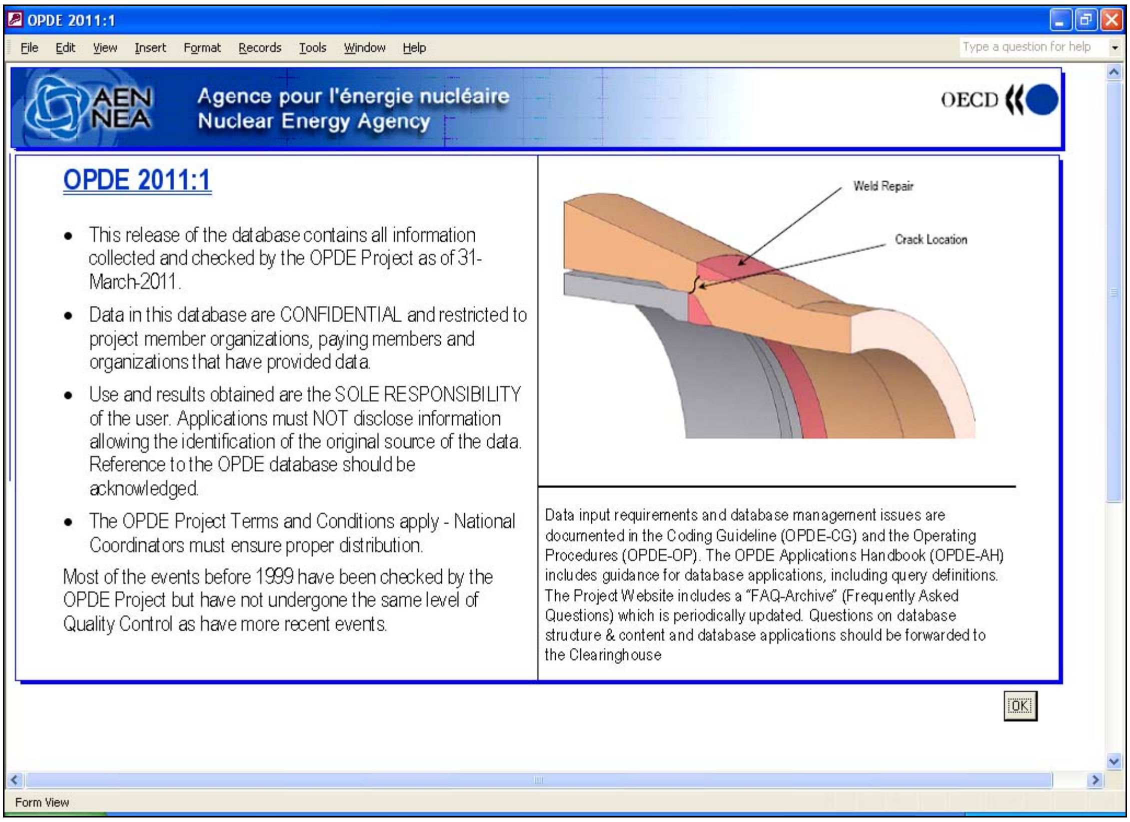


Figure 1: OPDE 2011:1 Database Opening Screen

OPDE data entry is managed via input forms, tables, roll-down menus and database relationships. Database searches and applications are performed through queries that utilise the tables and data relationships. The database structure is presented in Figures 2 through 6.

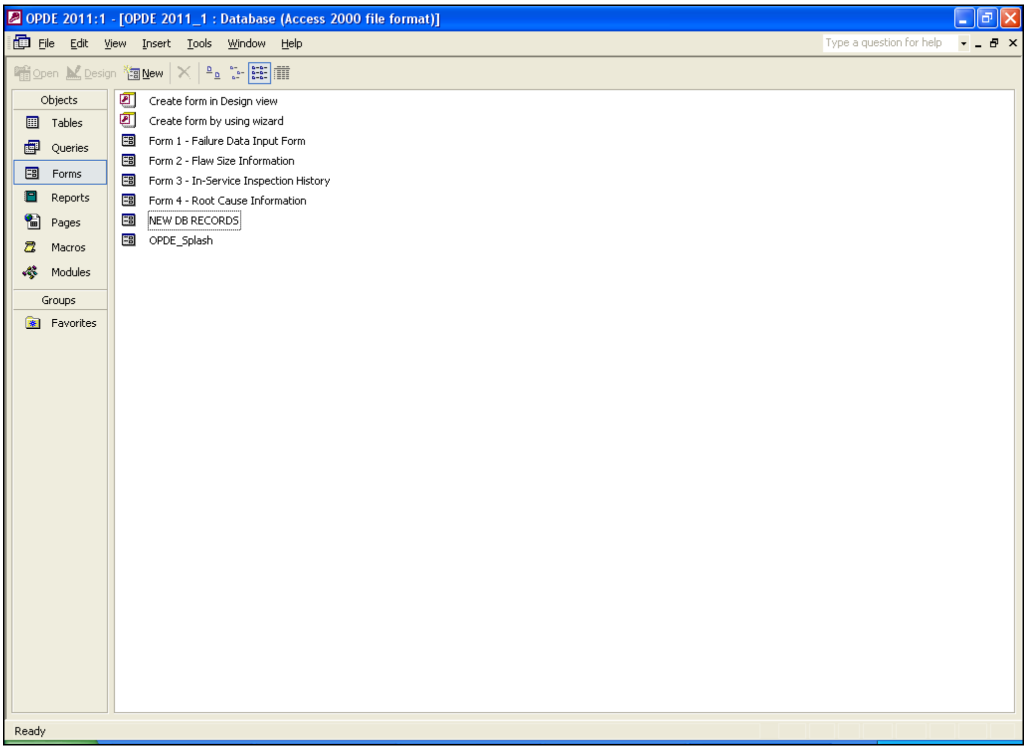


Figure 2: Database Input Forms

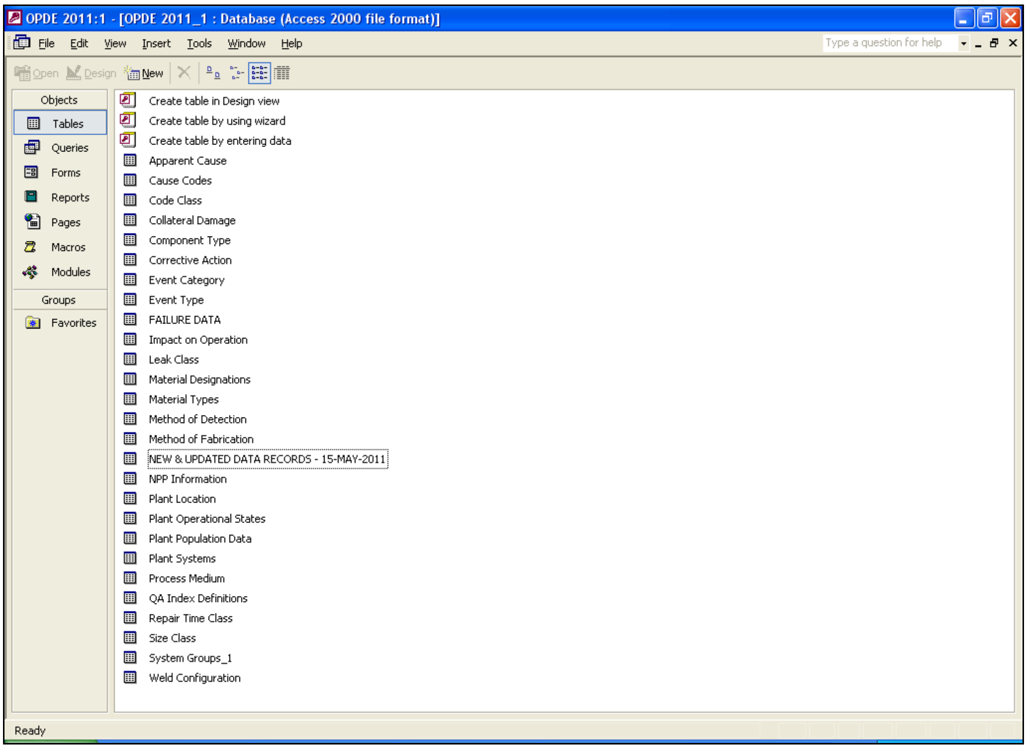


Figure 3: Database Tables & Roll-Down Menus

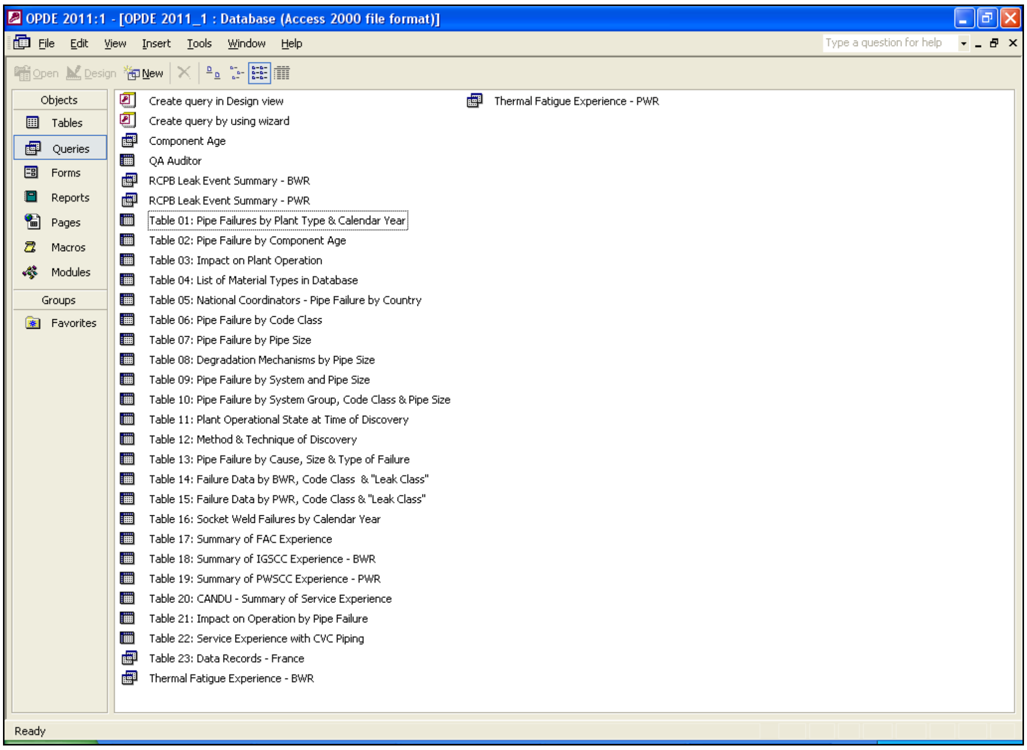


Figure 4: Database Sample Queries

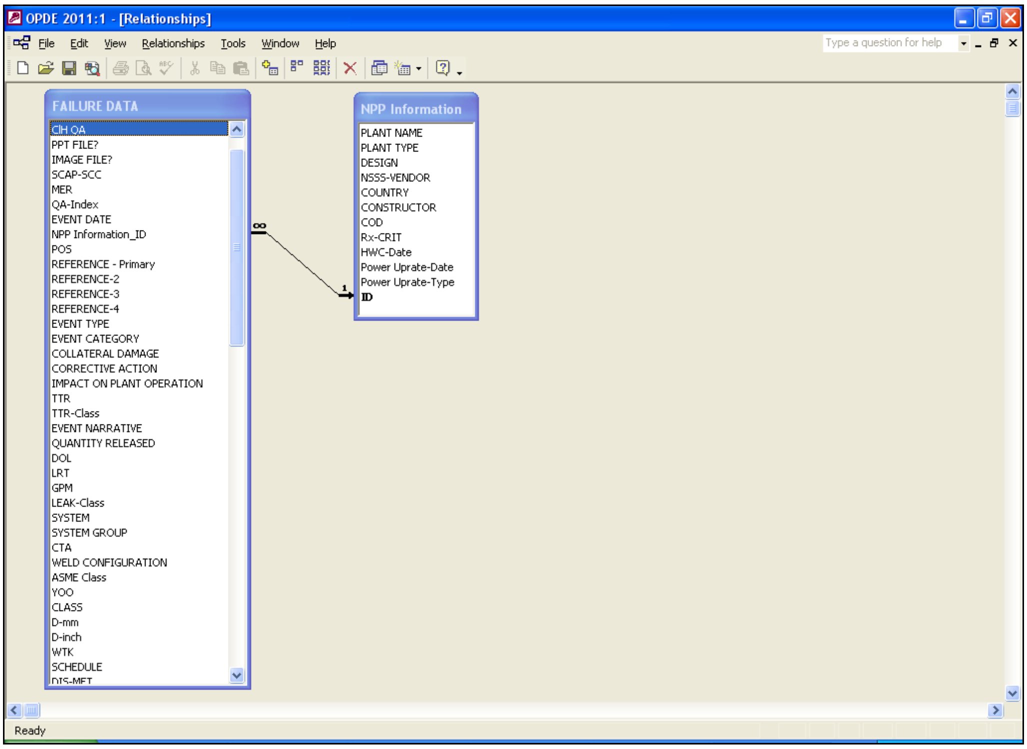
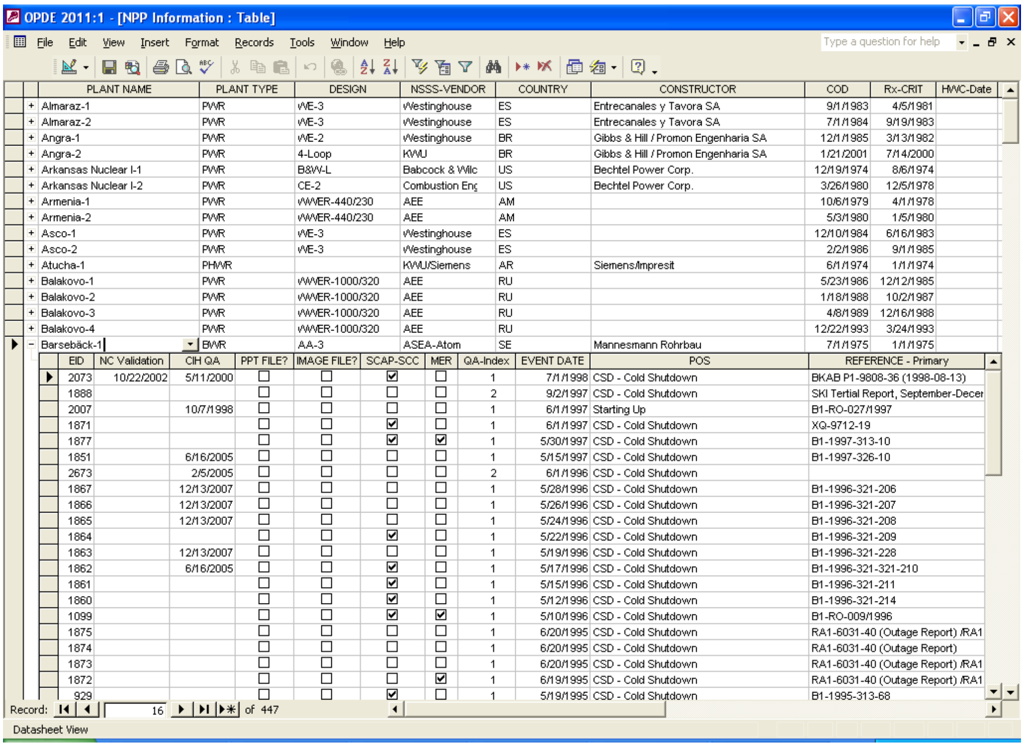


Figure 5: Database Relationships


OPDE 2011:1 - [NPP Information : Table]

PLANT NAME	PLANT TYPE	DESIGN	NSSS-VENDOR	COUNTRY	CONSTRUCTOR	COD	Rx-CRIT	HWC-Date
Almaraz-1	PWR	WE-3	Westinghouse	ES	Entrecanales y Tavora SA	9/1/1983	4/5/1981	
Almaraz-2	PWR	WE-3	Westinghouse	ES	Entrecanales y Tavora SA	7/1/1984	9/19/1983	
Angra-1	PWR	WE-2	Westinghouse	BR	Gibbs & Hill / Promon Engenharia SA	12/1/1985	3/13/1982	
Angra-2	PWR	4-Loop	KWU	BR	Gibbs & Hill / Promon Engenharia SA	1/21/2001	7/14/2000	
Arkansas Nuclear I-1	PWR	B&W-L	Babcock & Wilc	US	Bechtel Power Corp.	12/19/1974	8/6/1974	
Arkansas Nuclear I-2	PWR	CE-2	Combustion Enç	US	Bechtel Power Corp.	3/26/1980	12/5/1978	
Armenia-1	PWR	VVWER-440/230	AEE	AM		10/6/1979	4/1/1978	
Armenia-2	PWR	VVWER-440/230	AEE	AM		5/3/1980	1/5/1980	
Asco-1	PWR	WE-3	Westinghouse	ES		12/10/1984	6/16/1983	
Asco-2	PWR	WE-3	Westinghouse	ES		2/2/1986	9/1/1985	
Atucha-1	PHWR		KWU/Siemens	AR	Siemens/Impresit	6/1/1974	1/1/1974	
Balakovo-1	PWR	VVWER-1000/320	AEE	RU		5/23/1986	12/12/1985	
Balakovo-2	PWR	VVWER-1000/320	AEE	RU		1/18/1988	10/2/1987	
Balakovo-3	PWR	VVWER-1000/320	AEE	RU		4/8/1989	12/16/1988	
Balakovo-4	PWR	VVWER-1000/320	AEE	RU		12/22/1993	3/24/1993	
Barsebäck-1	BWR	AA-3	ASEA-Atom	SE	Mannesmann Rohrbau	7/1/1975	1/1/1975	

EID	NC Validation	CIH QA	PPT FILE?	IMAGE FILE?	SCAP-SCC	MER	QA-Index	EVENT DATE	POS	REFERENCE - Primary
2073	10/22/2002	5/11/2000	☐	☐	☑	☐	1	7/1/1998	CSD - Cold Shutdown	BKAB P1-9808-36 (1998-08-13)
1888			☐	☐	☐	☐	2	9/2/1997	CSD - Cold Shutdown	SKI Tertial Report, September-Decer
2007		10/7/1998	☐	☐	☐	☐	1	6/1/1997	Starting Up	B1-RO-027/1997
1871			☐	☐	☑	☐	1	6/1/1997	CSD - Cold Shutdown	XQ-9712-19
1877			☐	☐	☑	☑	1	5/30/1997	CSD - Cold Shutdown	B1-1997-313-10
1851		6/16/2005	☐	☐	☐	☐	1	5/15/1997	CSD - Cold Shutdown	B1-1997-326-10
2673		2/5/2005	☐	☐	☐	☐	2	6/1/1996	CSD - Cold Shutdown	
1867		12/13/2007	☐	☐	☐	☐	1	5/28/1996	CSD - Cold Shutdown	B1-1996-321-206
1866		12/13/2007	☐	☐	☐	☐	1	5/26/1996	CSD - Cold Shutdown	B1-1996-321-207
1865		12/13/2007	☐	☐	☐	☐	1	5/24/1996	CSD - Cold Shutdown	B1-1996-321-208
1864			☐	☐	☑	☐	1	5/22/1996	CSD - Cold Shutdown	B1-1996-321-209
1863		12/13/2007	☐	☐	☐	☐	1	5/19/1996	CSD - Cold Shutdown	B1-1996-321-228
1862		6/16/2005	☐	☐	☑	☐	1	5/17/1996	CSD - Cold Shutdown	B1-1996-321-321-210
1861			☐	☐	☑	☐	1	5/15/1996	CSD - Cold Shutdown	B1-1996-321-211
1860			☐	☐	☑	☐	1	5/12/1996	CSD - Cold Shutdown	B1-1996-321-214
1099			☐	☐	☑	☑	1	5/10/1996	CSD - Cold Shutdown	B1-RO-009/1996
1875			☐	☐	☐	☐	1	6/20/1995	CSD - Cold Shutdown	RA1-6031-40 (Outage Report) /RA1
1874			☐	☐	☐	☐	1	6/20/1995	CSD - Cold Shutdown	RA1-6031-40 (Outage Report)
1873			☐	☐	☐	☐	1	6/20/1995	CSD - Cold Shutdown	RA1-6031-40 (Outage Report) /RA1
1872			☐	☐	☐	☑	1	6/19/1995	CSD - Cold Shutdown	RA1-6031-40 (Outage Report) /RA1
929			☐	☐	☑	☐	1	5/19/1995	CSD - Cold Shutdown	B1-1995-313-68

Record: 16 of 447

Datasheet View

Figure 6: An Example of Nuclear Power Plant Information in OPDE

Implemented during 2006, an 'Online' version of the database (or web-OPDE) allowed for data submissions over the Internet via a secure server located at the NEA Headquarters. Access to web-OPDE is restricted and password protected. Automated e-mail notifications were issued whenever an action was required by the database user. There are four user security levels:

1. NEA Administrator. The NEA IT department is responsible for security issues, including allocation of user names and passwords. The NEA Administrator has full access to the entire database.

2. OPDE Clearinghouse has access to all data and can input new data and modify data. The Clearinghouse can also download data for quality control and upload data.

3. National Coordinators can input and modify data access all their national data, and download the data with associated supporting information when so decided by the PRG.

4. Operators can input new events, modify and access their own data. The intended user at this level would be for example an engineer at a nuclear power plant.

The structure of the Online version of the database is identical to the Microsoft® Access version (Figure 7). Relative to the latter database version, the Online version also allows the attachment of electronic supporting documents (e.g., photographs, drawings, root case analysis reports) to a database record.

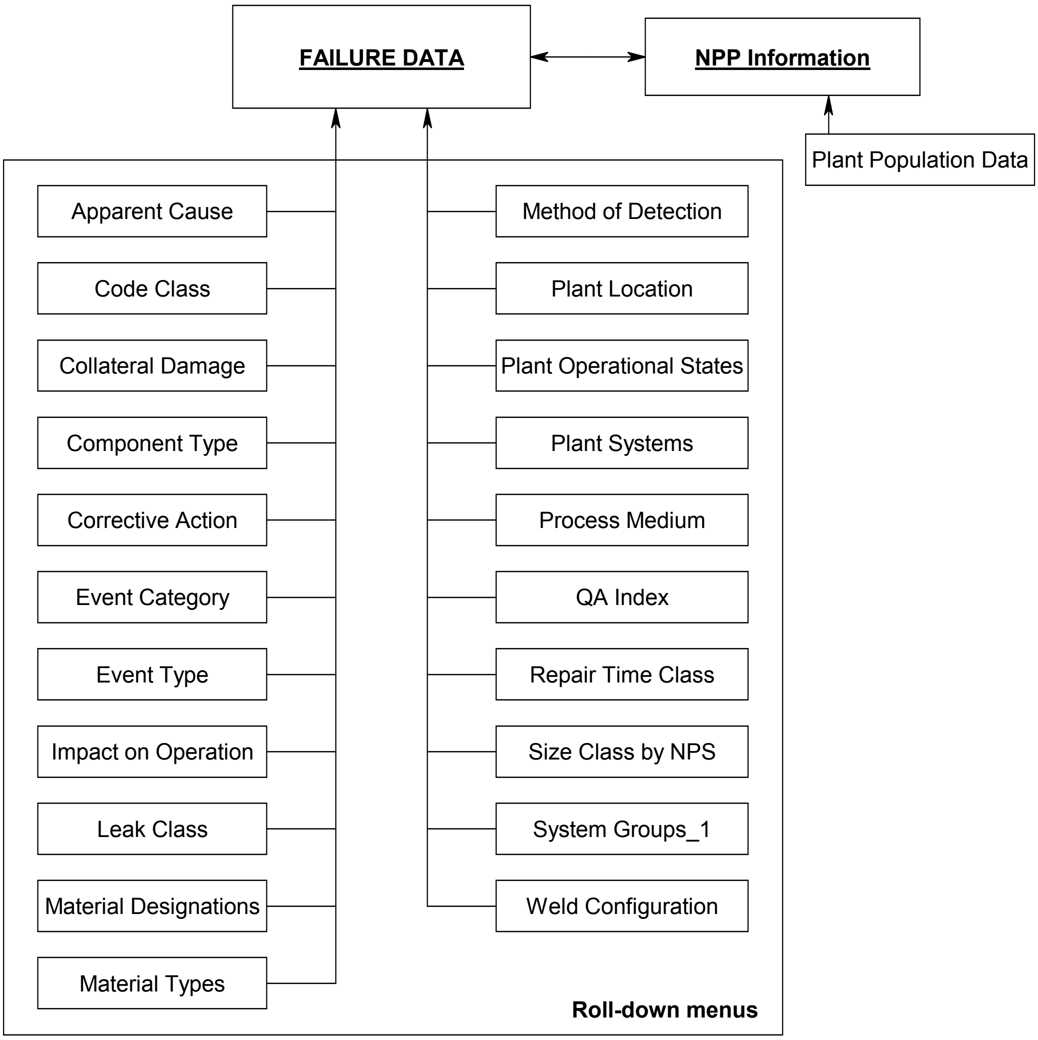


Figure 7: OPDE Database Structure

The database input process started with an event report (can be a Licensee Event Report or equivalent document) and supplemented as necessary with an associated condition report, root cause evaluation report and/or structural evaluation report. Next the event was classified per the Coding Guidelines to accurately describe the applicable piping component reliability attributes and influencing factors, as well as operational impact (if any), collateral damage (if any), etc. There are 63 database fields per data record. Most of these database fields are supported by roll-down menus that consist of carefully defined keywords. These keywords act as data filters when querying the database for a particular set of records. All database applications begin by defining a query, which consist of data filter criteria that are defined using the SQL programming language.

Throughout the project, the password protected database was distributed twice annually to respective National Coordinator on a CD. New data records could also be downloaded from the Online-version.

6. OPDE DATABASE FINAL VERSION

The final version of the 3rd term of the project, OPDE 2011:1 includes approximately 3800 records on pipe failure data from 321 nuclear power plants representing ca. 9300 reactor-years of commercial operation. 49% of the records relate to PWRs, 44% to BWRs and 4% to PHWR.[4] Tables 2 and 3 provide high-level summaries of the database content.[5]

Nominal Pipe Size (NPS) [mm]	**Number of Database Records by Failure Type**		
	Non Through-Wall Crack / Wall Thinning	**Active Leakage**	**Structural Failure**
NPS ≤ 15	55	235	21
15 < NPS ≤ 25	136	904	43
25 < NPS ≤ 50	77	307	20
50 < NPS ≤ 100	220	248	15
100 < NPS ≤ 250	322	334	39
NPS > 250	591	197	29
Total:	1401	2225	167

Table 2: High-Level Summary (i) of Database Content

Degradation / Damage Mechanism	**Number of Database Records by Failure Type**		
	Non Through-Wall Crack / Wall Thinning	**Active Leakage**	**Structural Failure**
Corrosion (incl. crevice corrosion, pitting, galvanic corrosion, microbiologically induced corrosion)	52	331	8
Design, construction & fabrication errors (flaw initiation)	83	226	9
Erosion-corrosion & flow-accelerated corrosion	203	331	51
Stress corrosion cracking (incl., ECSCC, IGSCC, PWSCC, TGSCC)	891	280	0
Thermal fatigue (incl. thermal stratification, cycling and striping)	62	59	3
Vibration fatigue (low-cycle, high-cycle)e	63	810	48
'Other' (incl., erosion-cavitation, fretting, severe overloading/water hammer, strain induced corrosion cracking (SICC).	47	188	48
Total:	1354	2225	167

Table 3: High-Level Summary (ii) of Database Content

[4] The PWR event population includes events in WWER reactors in Czech Republic and Finland.

[5] These summaries exclude on the order of 220 French records from 1980 to 2004 for which validation is still pending as of May 2012. The validation will be completed during the 1st Term of CODAP (2011-2014).

For an event to be considered for inclusion in the OPDE database the NC must screen the event for eligibility. However, the collected information reflects the different national reporting thresholds as well as different in-service inspection requirements and practices. Therefore the level of service experience coverage differs between the countries that are represented in the project.

In the database through-wall flaws are characterised by "Quantity Released", "Leak Rate Class", and "Flaw Size." Event reports may not always include details about a through-wall flaw such as duration, leak/flow rate or total quantity released. Knowledge about piping system design and operating pressure and temperature and flaw size usually enable best estimate quantitative assessment to be made of the magnitude of a pressure boundary breach.

Examples from the database are illustrated in Figures 8 to 12. All of these Figures are based on raw data from the database and do not reflect application specific data processing or analysis.

In Figure 8 the lack of events in the early 1970s is indicative of the low number of plants which had been commissioned. The outliers in the early 1980s are due mainly to the stress corrosion cracking issues in BWR plants. The flow assisted corrosion issues in the PWR class 4 systems from the 1980s are not included in the scope of the database. The apparent difference in the trends shown in Figures 8 and 9 is related to the difference in the number of plants in operation for a given year, which has increased over the period covered by the database.

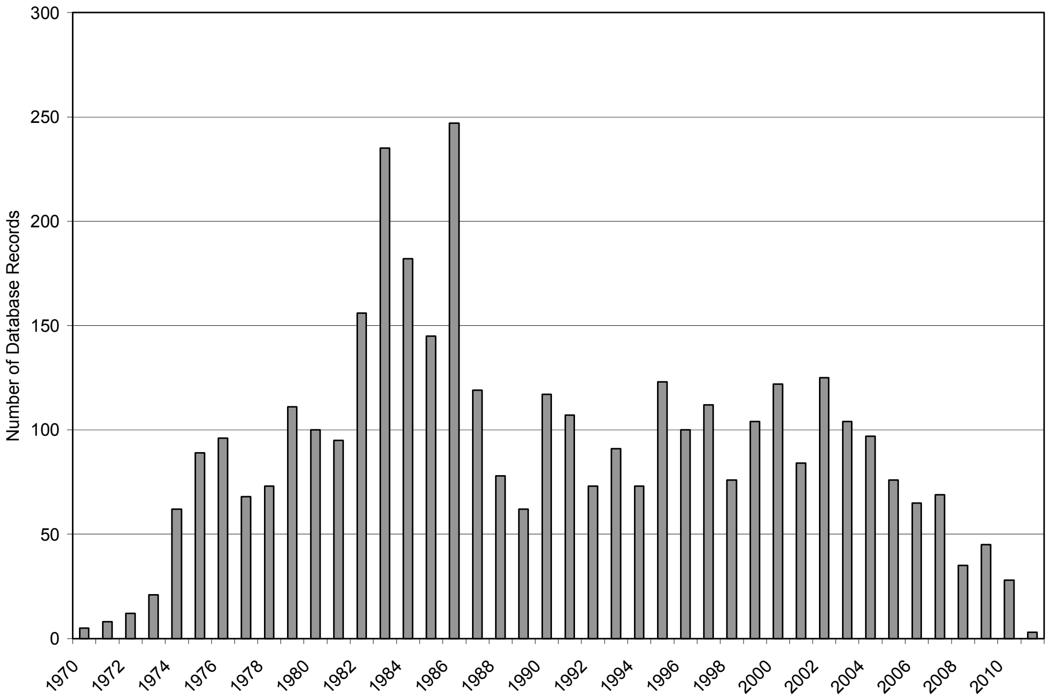


Figure 8: Pipe Degradation & Failure by Calendar Year

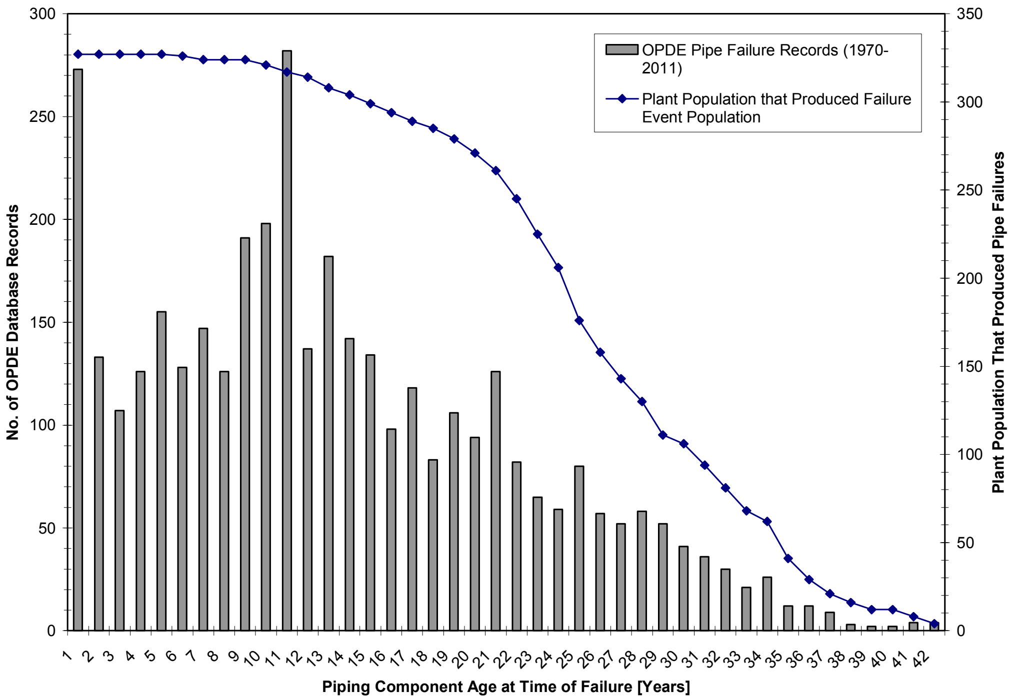


Figure 9: Pipe Degradation & Failure as a Function of In-Service Time [Years]

Figure 9 shows the event population as a function piping component age at the time of failure. Included in Figure 9 is the plant population that produced the pipe failure event population as recorded in the OPDE database. It is important to recognise that Figure 9 does not portray any possible effects of plant age on the potential degradation susceptibility of piping.

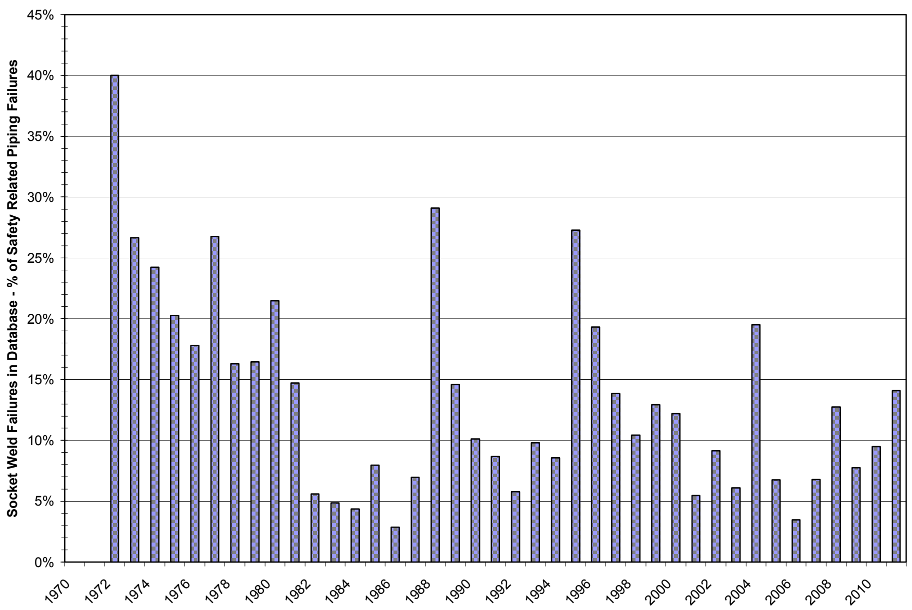


Figure 10: Socket Weld Failures in the Database

Figure 10 shows that socket weld failures continue to cause plant outage and loss of MWh produced. The chart shows the number of socket weld failures as the percentage of all pipe failures in safety-related piping systems. A large percentage of fatigue failures in commercial nuclear power plants are due to vibration fatigue of socket welds.

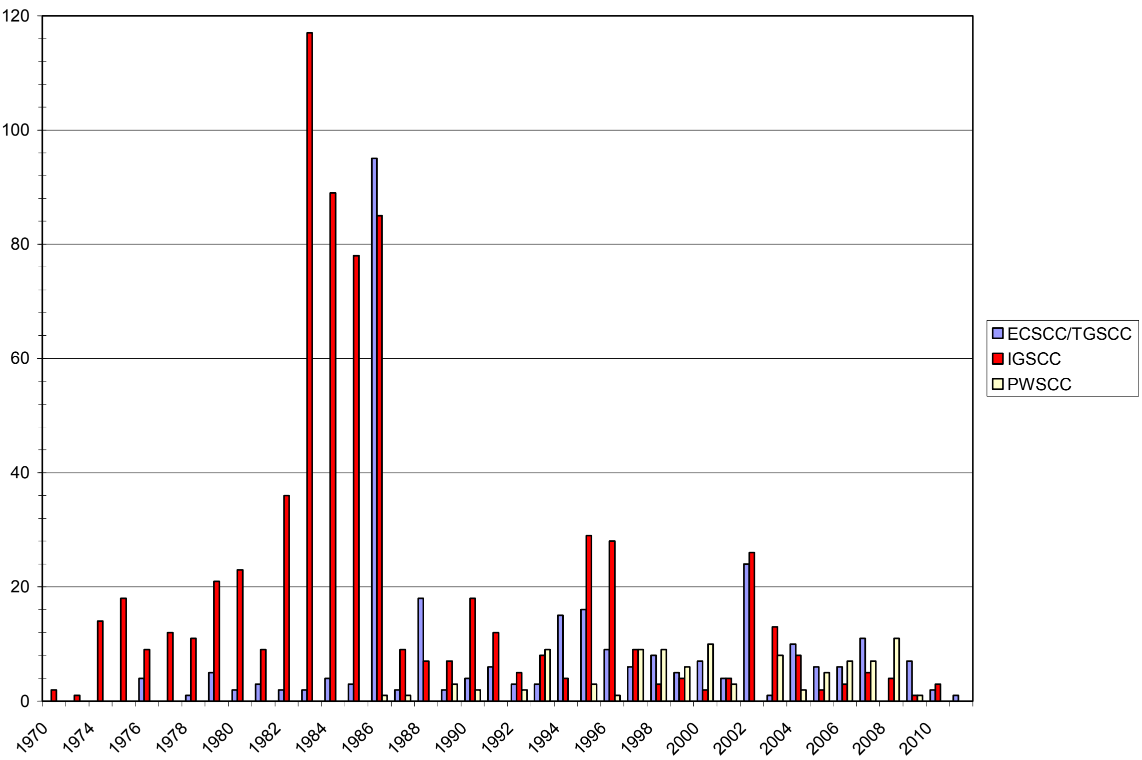


Figure 11: Stress Corrosion Cracking as a Function of Time

Figure 11 shows that stress corrosion cracking is still an issue for nuclear power plants. This Figure includes BWR SCC experience (IGSCC), PWR SCC experience (PWSCC), and LWR experience (ECSCC and TGSCC, mainly of small-bore piping systems). The IGSCC incident rate during 1983 through 1986 reflects mandated inspections. The IGSCC incident rate post 1986 reflects effects of various mitigation initiatives (e.g., improved water chemistry environment, stress improvement, new materials).

Figure 12 shows database submissions by geographical region. As noted, the collected information reflects the different national reporting thresholds as well as different in-service inspection requirements and practices. Therefore the level of service experience coverage differs between the countries that are represented in the project.

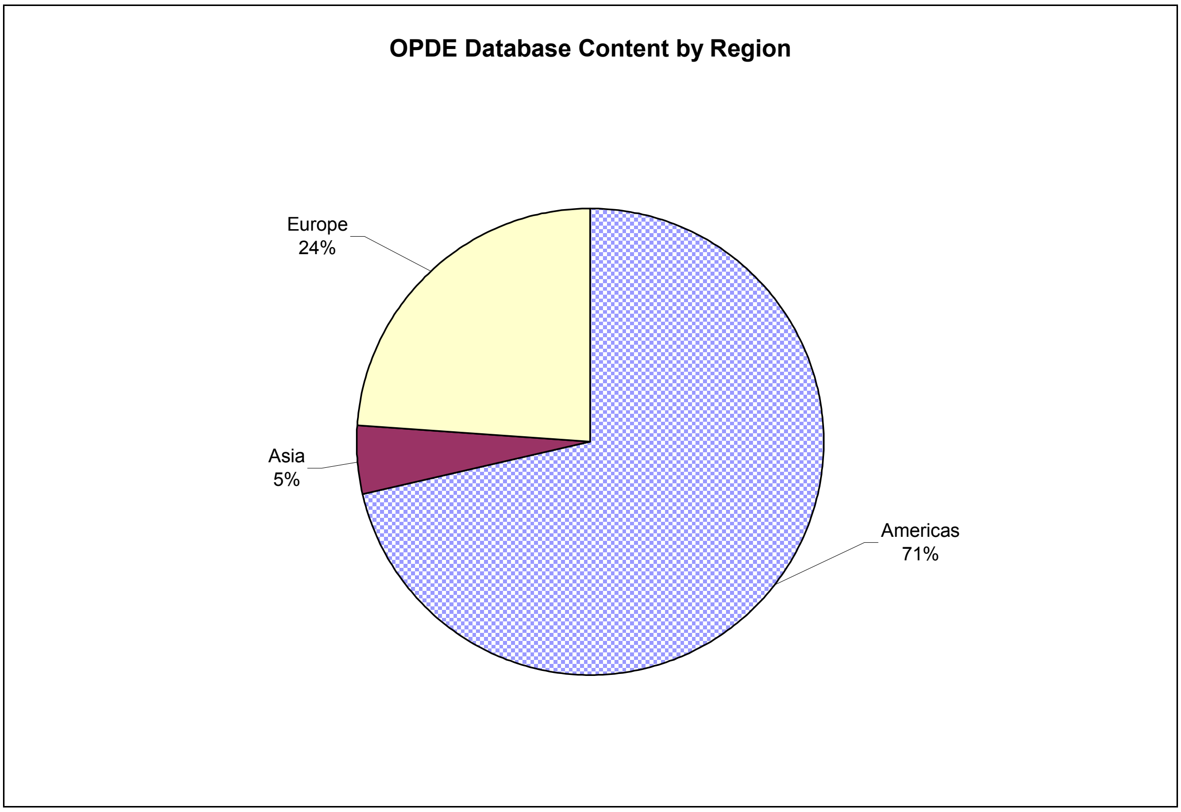


Figure 12: OPDE Data Submissions by Geographical Region

7. WORKSHOPS AND DATABASE APPLICATIONS

At the June 2004 National Coordinators Meeting hosted by the Nuclear Research Institute, REZ (Czech Republic), the Project Review Group (PRG) decided to organise a Workshop on OPDE database applications. The OPDE database is both user-oriented and application-oriented. The PRG worked extensively on these two aspects while designing the structure of the database and defining its technical content. Prior to the end of the 1st Term it was considered that the National Coordinators and their organisations could give valuable insights on this work by reporting on actual or planned applications.

The objective of the Workshop, held in Seoul, Republic of Korea on 8 December 2004, was to discuss applications of the OPDE database. The Workshop addressed two questions:

- How has OPDE database been used?
- What can OPDE database be used for?

The Workshop Proceedings are documented in OPDE/SEC(2004)4 (March 2005) [2]. These proceedings include 11 presentations covering three types of applications:

1) Qualitative evaluations of failure trends and patterns,

2) Risk-informed applications in support of RI-ISI programme development or probabilistic safety assessment, and

3) Advanced applications supporting material science research.

The main conclusions concerning possible applications are reproduced in Appendix A.

Applications for workshops were initiated by members. In order to promote use of the database in member countries the PRG has arranged a number of half day workshops and training sessions in connection with PRG meetings. In addition to these there have been several opportunities to present the OPDE database at international meetings and conferences. Examples of these contributions are listed in Chapter 10.

As an example of national initiatives to pursue database applications the Nordic PSA Group with representatives from utility groups in Finland and Sweden launched a multi-year research and development effort to develop a piping reliability parameter handbook to support future risk-informed applications involving piping reliability [3, 4]. Figure 13 illustrates the flow of information for a typical database application.

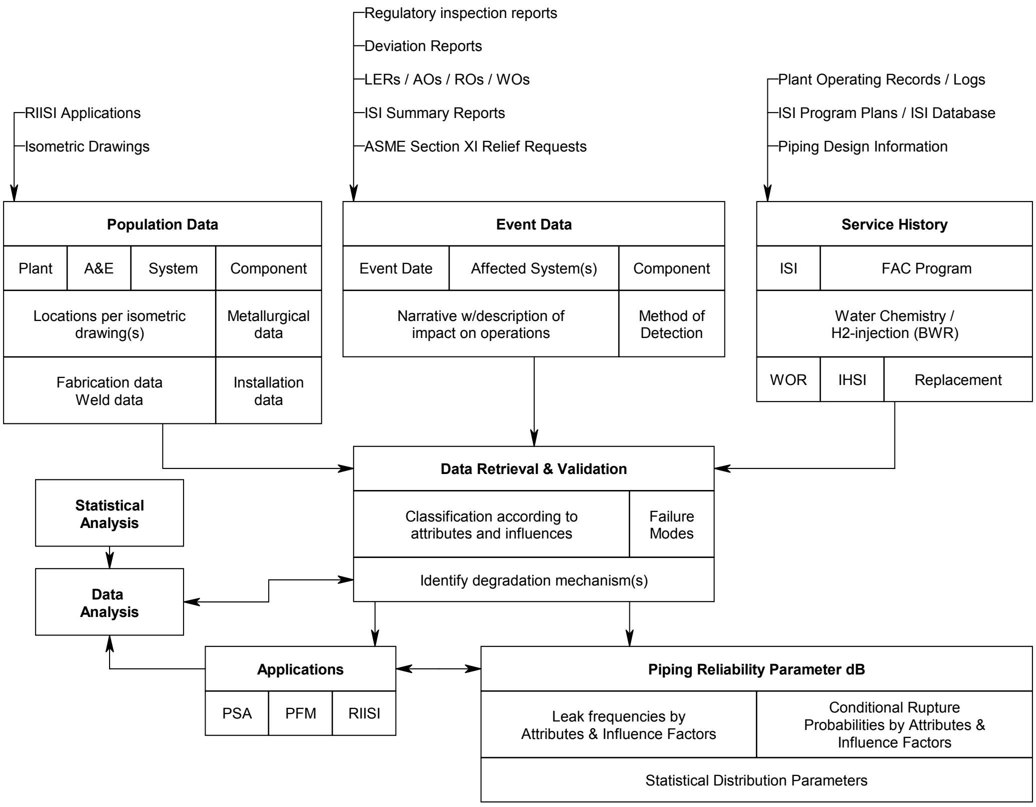


Figure 13: Flow of Information for a Typical Database Application

In 2008 the Committee on the Safety of Nuclear Installations (CSNI) of the OECD-NEA and the European Commission Joint Research Centre (EC-JRC) sponsored the "Workshop on Risk-Informed Piping Integrity Management" [5]. The main objectives of this workshop were to examine and discuss the results and conclusions of the OECD/NEA and EC-JRC coordinated risk-informed in-service inspection (RI-ISI) methodologies benchmark (RISMET) [6] and to present and discuss the results and applications of OPDE.

In 2011 the CSNI Working Group on Risk (WGRisk) launched a project entitled "Use of OECD Data Project Products in Probabilistic Safety Assessment (PSA)." The objectives of the project are to identify and characterize current uses of the OECD data projects, including OPDE and CODAP. The OPDE/CODAP PRG members are responding to a WGRisk survey directed at the development of recommendations for enhancing the usefulness of data project products.

8. DATABASE ACCESSIBILITY

OPDE is a restricted database and its access is limited to participating organisations that provide input data including nuclear power plants. In the course of 2012 the OPDE and SCAP-SCC databases will be merged into CODAP. The CODAP database is available on the Internet via a secure server located at the OECD-NEA Headquarters. Access to the CODAP database (with the embedded OPDE 2011:1 database) is restricted to the CODAP PRG members.

9. CONCLUSIONS AND FUTURE PLANS

9.1 Conclusions

During the first term the original objectives of the project were achieved and an operational database was launched successfully. Participating organisations committed to continued involvement in the project.

One of the main activities of the 1st and 2nd Terms of the project was continuous database maintenance. That is populating the database with new information as it becomes available. The database format was simplified and finalised during the 1st Term and has not been changed. The main activities of the 3rd Term of the project focused on continuous database maintenance and finalization of the Online version of the database.

Throughout the three project terms, the database was run under Microsoft® Access. A recognised limitation or problem with the Access software is the incompatibility of the different software versions. The database was distributed to participating organisations on a CD in three versions (Access 97/98, Access 2000 and Access 2003). To improve and streamline database input and database distribution a web based user interface was introduced during the 2nd term of the project. Data input became independent of Microsoft® Access. The 'Online' version of database is located at NEA Headquarters in Issy-les-Moulineaux (France) and project participants have access via a secure server.

9.2 Planned Activities – 2011 & Beyond

In May 2011 the Project Review Group (PRG) approved the transition of OPDE to a new, expanded OECD-NEA "Component Operational Experience, Degradation & Ageing Programme" (CODAP). A first CODAP National Coordinators Meeting was held at NEA Headquarters in November 2011. The CODAP PRG Membership corresponds to that of the OPDE, with two additional signatories (Slovak Republic and Chinese Taipei). The CODAP project builds on the success of OPDE and a related OECD-NEA data project, the SCAP-SCC Working Group.

At the end of 2011, the OPDE and SCAP-SCC databases were merged to form the new CODAP event database; an entirely web-based system both for entering new events and also for downloading the database. During the 1st Term of CODAP focus will be on enhancing the user interface of the Online Version to allow for advanced database queries and report generation. CODAP will continue to encourage and promote practical database applications. The Project will therefore continue to arrange workshops in member countries as requested to promote use of the database, industry involvement, and training of personnel.

In parallel with the new event database, CODAP will establish an online Knowledge Base (KB). The objective of the KB is to improve the understanding of degradation mechanisms, and to make available information on regulatory responses to passive component failures. The KB will include basic information on safety assessment approaches, regulations, codes and standards, inspection, monitoring and qualification practices, preventative maintenance, mitigation, repair and replacement. Specific activities planned for the 1st Term of CODAP include:

- Implementation of the Online CODAP Event Database (CODAP-ED). During the first year of the first term, respective National Coordinator will submit event data on flow accelerated corrosion (FAC) for calendar years 2000 to date.
- Implementation of the Online CODAP Knowledgebase (CODAP-KB). Starting with FAC, degradation mechanism specific information will be uploaded to the KB.

10. REFERENCES

[1] OECD Nuclear Energy Agency. Technical Basis for Commendable Practices on Ageing Management – SCC and Cable Ageing Project) SCAP), NEA/CSNI/R(2010)5, 2010.

[2] Nuclear Energy Agency, OPDE Workshop on Database Applications, OPDE/SEC(2004)4, Issy-les-Moulineaux, France, 2005.

[3] Swedish Radiation Safety Authority. Reliability Data for Piping Components in Nordic Nuclear Power Plants "R-Book" Project Phase I, Research Report 2008:01, Stockholm (Sweden), 2008.

[4] Swedish Radiation Safety Authority. Reliability Data for Piping Components in Nordic Nuclear Power Plants – R Book, Phase 2, Research Report 2011:06, Stockholm (Sweden), 2011

[5] OECD Nuclear Energy Agency. Risk-Informed Piping Integrity Management. Workshop Proceedings, NEA/CSNI/R(2009)2.

[6] OECD Nuclear Energy Agency. EC-JRC/OECD-NEA Benchmark Study on Risk Informed In-Service Inspection Methodologies (RISMET), NEA/CSNI/R(2010)13, 2010.

11. BIBLIOGRAPHY

[1] Lydell, B., Mathet, E. and Gott, K., "OECD Pipe Failure Data Exchange (OPDE) Project: A Framework for International Cooperation in Piping Reliability," Proc. American Nuclear Society International Topical Meeting on Probabilistic Safety Assessment, Detroit, Michigan, 2002.

[2] Lydell, B., Mathet, E. and Gott, K., "OECD Pipe Failure Data Exchange Project (OPDE) – 2003 Progress Report," ICONE12-49217, Proc. ICONE-12: 12th International Conference on Nuclear Engineering, Arlington, Virginia, 2004.

[3] Reck, H. and Schulz, S., "Internationale Betriebserfahrung mit Rohrleitungen in Kernkraftwerken: Fortschritt des OECD Pipe Failure Data Exchange (OPDE) Datenbank Projektes," MPA Seminar 32, Stuttgart, Germany, 2006.

[5] Viglasky, T et al, "The OECD Pipe Failure Data Exchange Project – Validation of Canadian Data," ICONE12-89176, Proc. ICONE-14: 14th International Conference on Nuclear Engineering, Miami, Florida, 2006.

[6] Choi, Y.H. and Choi, S.Y., "Socket Weld Integrity in Nuclear Piping under Fatigue Loading Conditions," Nuclear Engineering and Design, 237:213-218, 2007.

[7] Simonen, F.A., Gosselin, S.R., Lydell, B.O.Y. and Rudland, D.L., "Application of Failure Event Data to Benchmark Probabilistic Fracture Mechanics Computer Codes," PVP2007-26373, Proc. 2007 ASME Pressure Vessel and Piping Division Conference, San Antonio, Texas, 2007.

[8] Lydell, B., Huerta, A. and Gott, K., "Progress with the International Pipe Failure Data Exchange Project,: PVP2007-26278, Proc. 2007 ASME Pressure Vessel and Piping Division Conference, San Antonio, Texas, 2007.

[9] Lydell, B., "The Probability of Pipe Failure on the Basis of Operating Experience, PVP2007-26281, Proc. 2007 ASME Pressure Vessel and Piping Division Conference, San Antonio, Texas, 2007.

[10] Lydell, B., Huerta, A. and Gott, K., "Characteristics of Damage & Degradation Mechanisms in Nuclear Power Plant Piping Systems," PVP2008-61914, Proc. 2008 ASME Pressure Vessel and Piping Division Conference, Chicago, Illinois, 2008.

[12] Nuclear Energy Agency, OPDE 2011:1 Coding Guideline (OPDE-CG) & User's Guide, OPDE PR01, Version 05, Issy-les-Moulineaux, France, 2011.

[13] Lydell, B. and Riznic, J., "OPDE – The International Pipe Failure Data Exchange Project," Nuclear Engineering and Design, 238:2115-2123, 2008.

APPENDIX A: LIST OF POTENTIAL DATABASE APPLICATIONS

Workshop on database applications and possible improvements to the database held in Seoul, Republic of Korea, on December 8, 2004.

Applications

- Trend analyses of degradation processes: general and related to specific systems or components
- Identification of new degradation mechanisms
- Effectiveness of ISI programmes – flaws not detected by prior inspections
- Effectiveness of mitigation measures
- Understanding of root causes of failures
- Hazard plots
- Comparison of service data and probabilistic fracture mechanic calculations using different codes
- Leak rate versus flaw size correlations
- Flooding risk assessment
- LBB
- Risk informed inspection – support to expert panels
- Piping damage frequency
- Piping rupture frequency for PSA
- Aging management programme
- Source of information for solving practical piping problems
- Source of information for specifying locations for measurements such as temperature
- Classing of piping
- Recommendation for content of incident reports
- Experience feedback, operational experience
- Input to Structural reliability codes
- LOCA frequencies
- Significance determination process
- Accident sequence precursor
- Generic structural integrity
- Proactive materials degradation assessment

Advancing the OPDE database

- Inclusion of pipe stress data in database
- Roles of service data versus statistical estimation versus PFM input
- Inclusion of passive component failures in risk informed applications
- Pipe failure parameter handbook
  Operating temperatures for PWSCC

APPENDIX B: OPDE PROJECT REVIEW GROUP PRG ACTIVITY REPORT

During the nine years of the OPDE Project, the Project Review Group met on eight-teen (18) occasions (Table 4). In addition two joint OPDE & SCAP SCC Working Group meetings were held to formulate the transition of the two database projects into the new CODAP event database and knowledge base.

Table 4: Project Review Group Meetings 2002-2011

Meeting	Date(s)	Location	Note
OPDE1, Project Kick-off Meeting	May 17, 2002	NEA Headquarters	
OPDE2, National Coordinators Meeting	November 18-19, 2002	Stockholm, Sweden	Hosted by the Swedish Nuclear Power Inspectorate (now Swedish Radiation Safety Authority, SSM)
OPDE3, National Coordinators Meeting	April 28-29, 2003	Washington, DC, USA	Hosted by the U.S. Nuclear Regulatory Commission (NRC)
OPDE4, National Coordinators Meeting	November 13-14, 2003	Cologne, Germany	Hosted by Gesellschaft für Anlagen- und Reaktorsicherheit (GRS)
OPDE5, National Coordinators Meeting	June 1-2, 2004	Rez, Czech Republic	Hosted by the Nuclear Research Institute
OPDE6, National Coordinators Meeting	December 8-10, 2004	Seoul, Republic of Korea	Hosted by Korea Institute of Nuclear Safety (KINS) and Korea Atomic Energy Research Institute (KAERI). OPDE Applications Workshop was held on December 8, 2004
OPDE7, National Coordinators Meeting	May 11-12, 2005	Leuven, Belgium	Hosted by Electrabel/Tractebel
OPDE8, National Coordinators Meeting	October 25-26, 2005	Ottawa, Canada	Hosted by the Canadian Nuclear Safety Commission (CNSC)
OPDE9, National Coordinators Meeting	April 20-21, 2006	NEA Headquarters	
OPDE10, National Coordinators Meeting	November 16-17, 2006	Madrid, Spain	Hosted by Consejo de Seguridad Nuclear (CSN)
OPDE11, National Coordinators Meeting	May 14-15, 2007	Villigen, Switzerland	Hosted by the Swiss Federal Nuclear Safety Inspectorate (ENSI)
OPDE12, National Coordinators Meeting	November 7-8, 2007	NEA Headquarters	
OPDE13, National Coordinators Meeting	June 2-4, 2008	Madrid, Spain	Hosted by CSN and meeting held in conjunction with the "Risk-Informed Piping Integrity Workshop"
OPDE14, National Coordinators Meeting	November 4-5, 2008	Tokyo, Japan	Hosted by the Japan Nuclear Energy Safety Organization (JNES)
OPDE15, National Coordinators Meeting	May 27-28, 2009	NEA Headquarters	
OPDE16, National Coordinators Meeting	February 16-16, 2010	NEA Headquarters	
1st Joint OPDE & SCAP-SCC Meeting	February 17, 2010	NEA Headquarters	Agreement-in-principle to establish a new project by combining the OPDE and SCAP-SCC projects

Meeting	Date(s)	Location	Note
OPDE17, National Coordinators Meeting	October 13-14, 2010	OECD Convention Centre, Paris, France	
2nd Joint OPDE & SCAP-SCC WG Meeting	October 15, 2010	OECD Convention Centre, Paris, France	NEA Secretariat presented the Joint OPDE & SCAP-SCC project. Name of new project: OECD-NEA Component Operational Experience, Degradation & Ageing Programme (CODAP)
OPDE18, National Coordinators Meeting	May 17, 2011	OECD Convention Centre, Paris, France	Final OPDE meeting (Figure 14). The first CODAP meeting was held on May 18-19, 2011

Figure 2: OPDE Class of 2011