CSNI REPORT No. 173

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NEA

# SYSTEMATIC COLLECTION OF STATISTICAL DATA ON REACTOR SCRAMS

# 1988

Compiled by the NEA Secretariat

from Contributions by Principal Working Group No. 1

of the NEA Committee on the Safety of Nuclear Installations

**COMMITTEE ON THE SAFETY OF NUCLEAR INSTALLATIONS**
**OECD NUCLEAR ENERGY AGENCY**
38, boulevard Suchet, 75016 Paris, France

# CSNI

The NEA Committee on the Safety of Nuclear Installations (CSNI) is an international committee made up of scientists and engineers. It was set up in 1973 to develop and coordinate the activities of the Nuclear Energy Agency concerning the technical aspects of the design, construction and operation of nuclear installations insofar as they affect the safety of such installations. The Committee's purpose is to foster international co-operation in nuclear safety amongst the OECD Member countries.

CSNI constitutes a forum for the exchange of technical information and for collaboration between organisations which can contribute, from their respective backgrounds in research, development, engineering or regulation, to these activities and to the definition of its programme of work. It also reviews the state of knowledge on selected topics of nuclear safety technology and safety assessment, including operating experience. It initiates and conducts programmes identified by these reviews and assessments in order to overcome discrepancies, develop improvements and reach international consensus on technical issues of common interest. It promotes the coordination of work in different Member countries including the establishment of co-operative research projects and international standard problems, and assists in the feedback of the results to participating organisations. Full use is also made of traditional methods of co-operation, such as information exchanges, establishment of working groups, and organisation of conferences and specialist meetings.

The greater part of CSNI's current programme of work is concerned with safety technology of water reactors. The principal areas covered are operating experience and the human factor, reactor coolant system behaviour, various aspects of reactor component integrity, the phenomenology of radioactive releases in reactor accidents and their confinement, containment performance, risk assessment, and severe accidents. The Committee also studies the safety of the fuel cycle, conducts periodic surveys of reactor safety research programmes and operates an international mechanism for exchanging reports on nuclear power plant incidents.

In implementing its programme CSNI establishes co-operative mechanisms with NEA's Committee on Nuclear Regulatory Activities (CNRA), responsible for the activities of the Agency concerning the regulation, licensing and inspection of nuclear installations with regard to safety. It also co-operates with NEA's Committee on Radiation Protection and Public Health and NEA's Radioactive Waste Management Committee on matters of common interest.

# FOREWORD

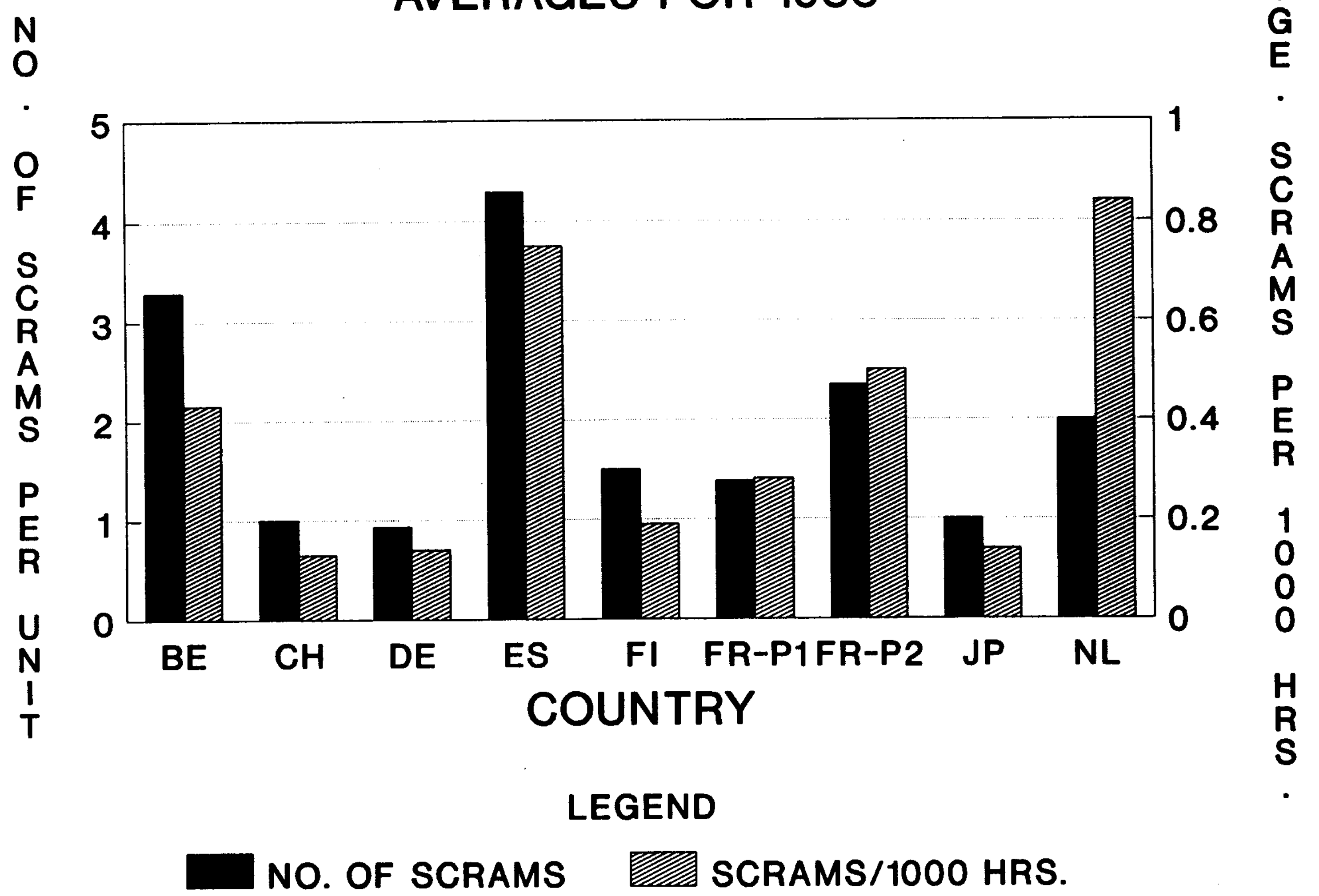
At the OECD/NEA Symposium on Reducing Reactor Scram Frequency (Tokyo, April 1986), it was recommended that the collection of statistical data on reactor scrams be continued and updated regularly; this recommendation was subsequently endorsed by the NEA Committee on the Safety of Nuclear Installations (CSNI). As a follow-up to this initiative, the NEA Secretariat compiled a second issue of the statistical data on reactor scrams for 1987; that compilation was published as CSNI Report No. 157 in May 1989.

Based on feedback from the participating Member Countries, the Secretariat modified the initial data collection scheme to facilitate information acquisition and subsequent use. The present report thus consists of two sections. In Section I a number of graphs is given, with each representing a certain parameter that could be used in inter-comparisons among Countries; all the figures in those graphs were taken from the tables, given in Section II, which were submitted to the Secretariat by its Members. The participating countries in the current compilation were Belgium (BE), Canada (CA), Finland (FI), France (FR), F.R.G. (DE), Japan (JP), Spain (ES), Switzerland (CH), Netherlands (NL) and U.K. (GB). Although some of the data submitted were incomplete, the report does provide some interesting insights.

It is intended that future reports addressing scram data compilations include sections giving trends of certain parameters as a function of time.

# SECTION I
# GRAPHS

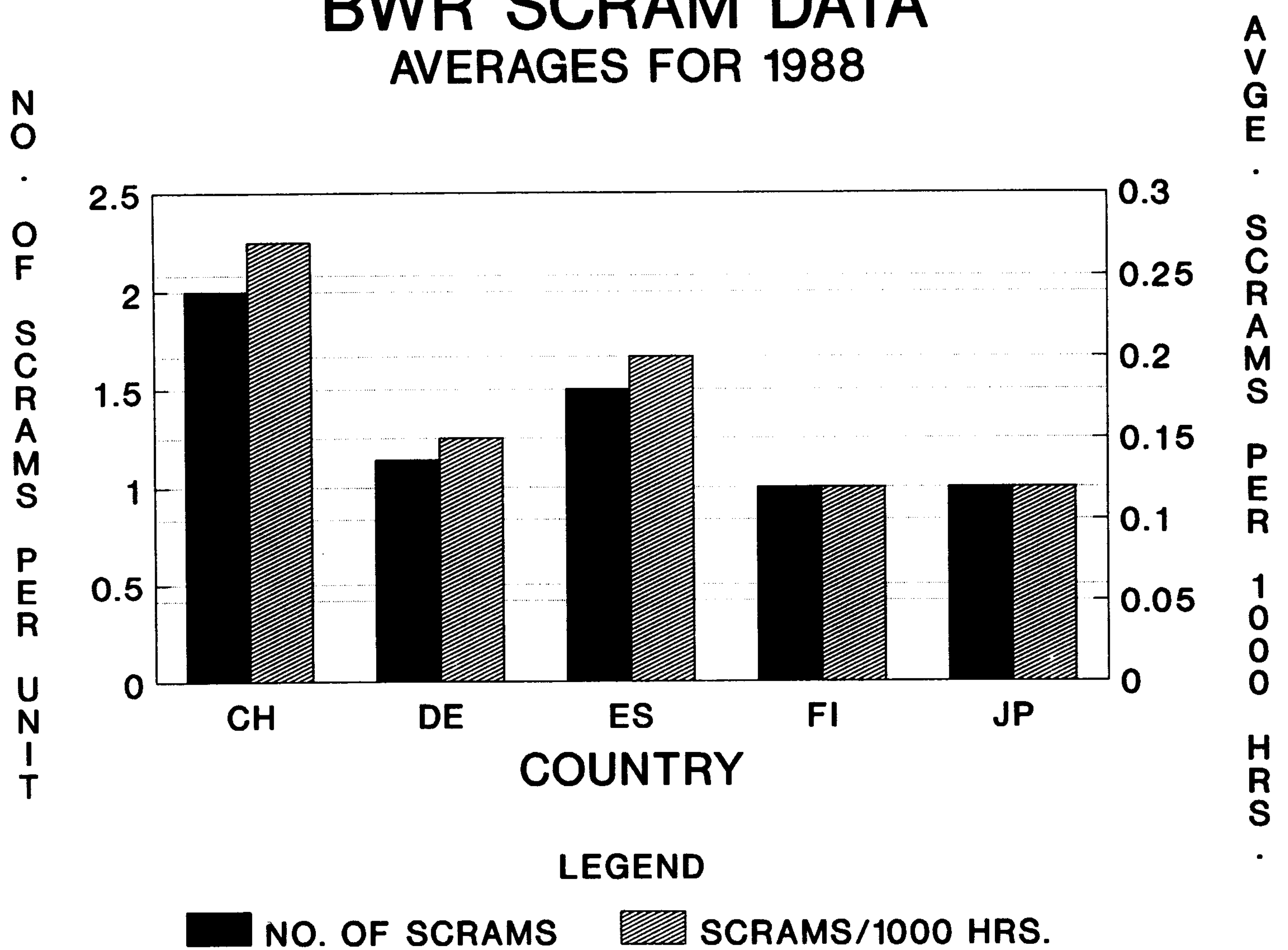
# PWR SCRAM DATA
## AVERAGES FOR 1988




FR-P1/P2 REFER TO THE 900/1300 UNITS

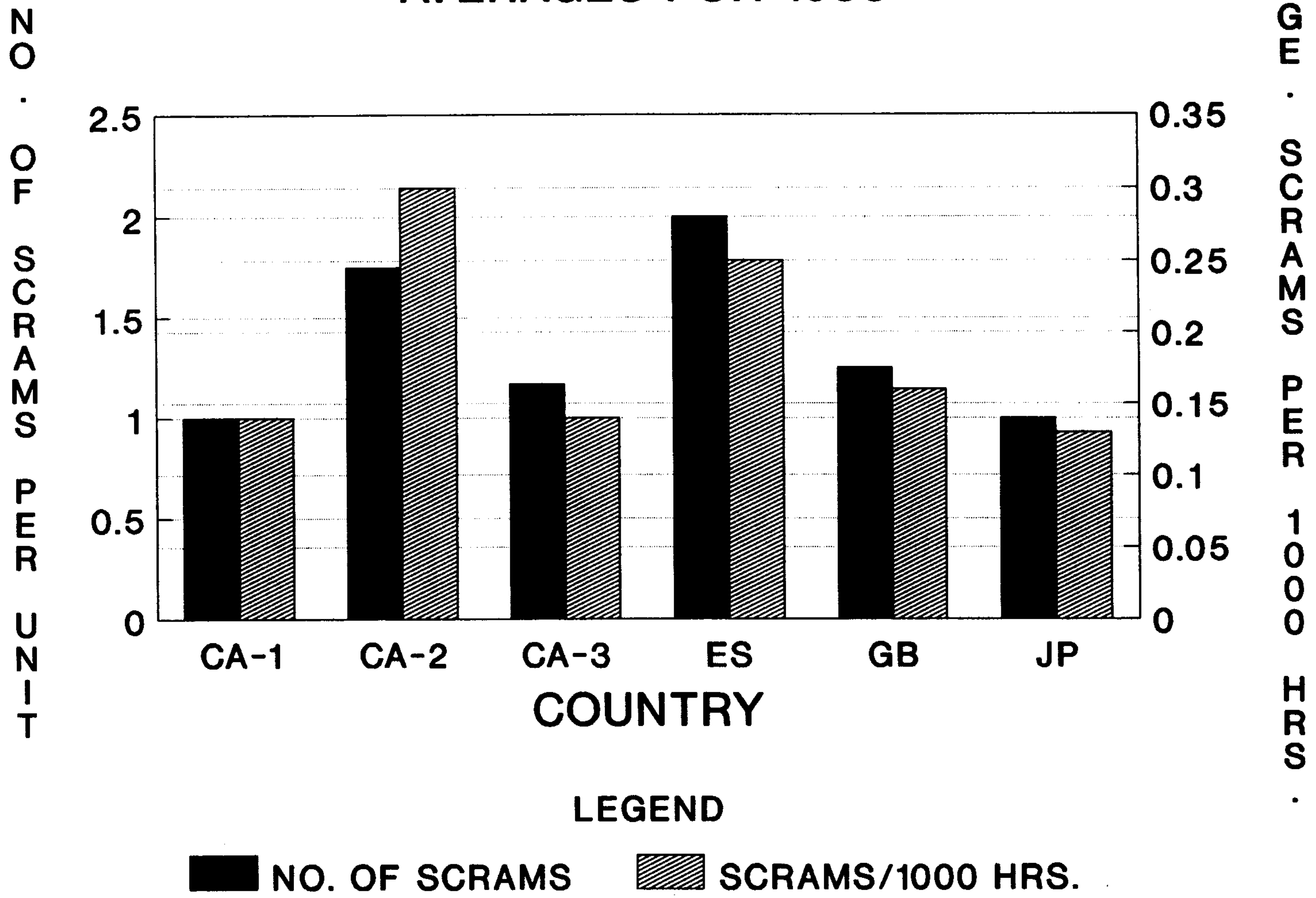
# BWR SCRAM DATA

## AVERAGES FOR 1988



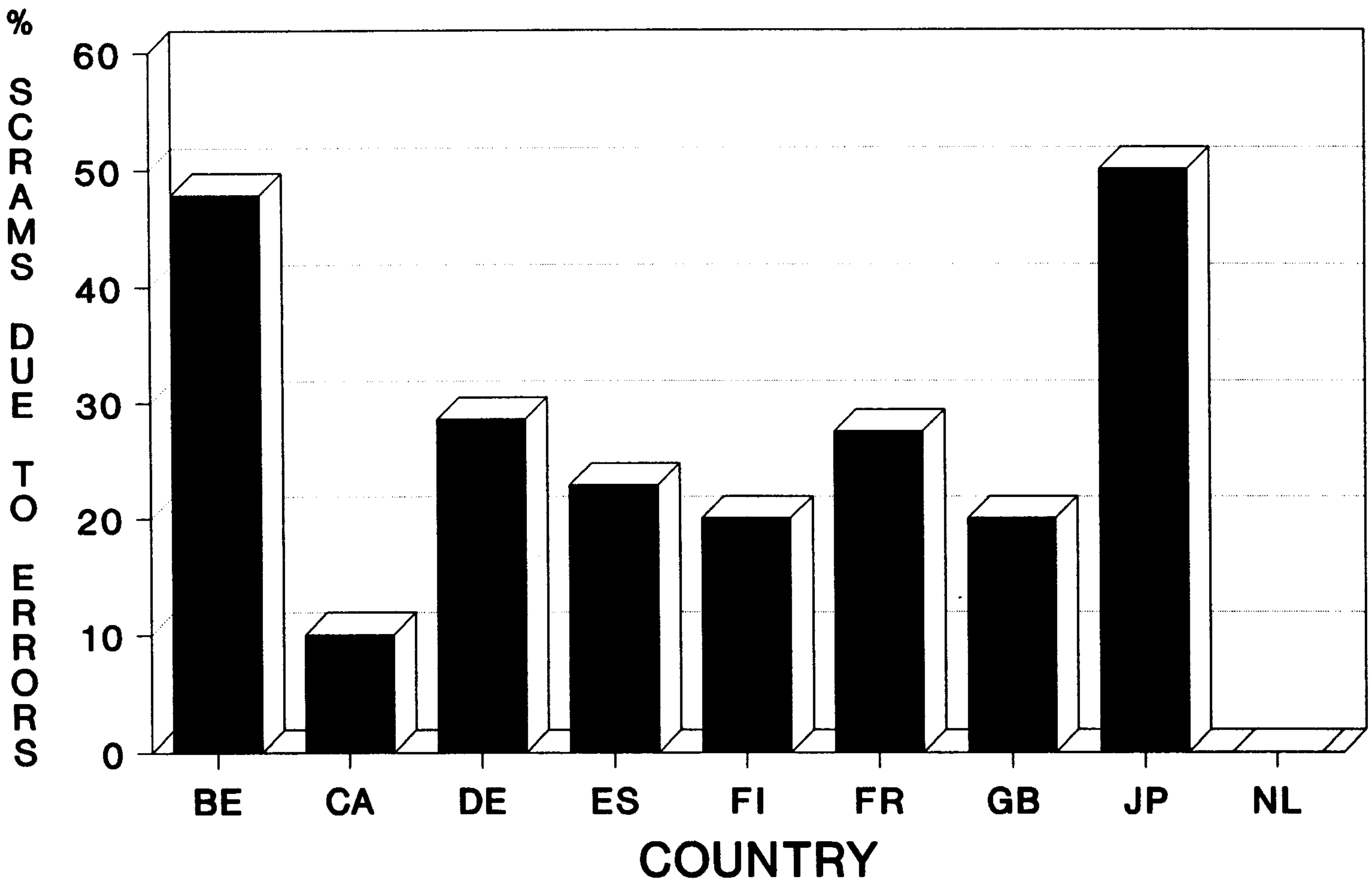
# GCR & PHWR SCRAM DATA

## AVERAGES FOR 1988



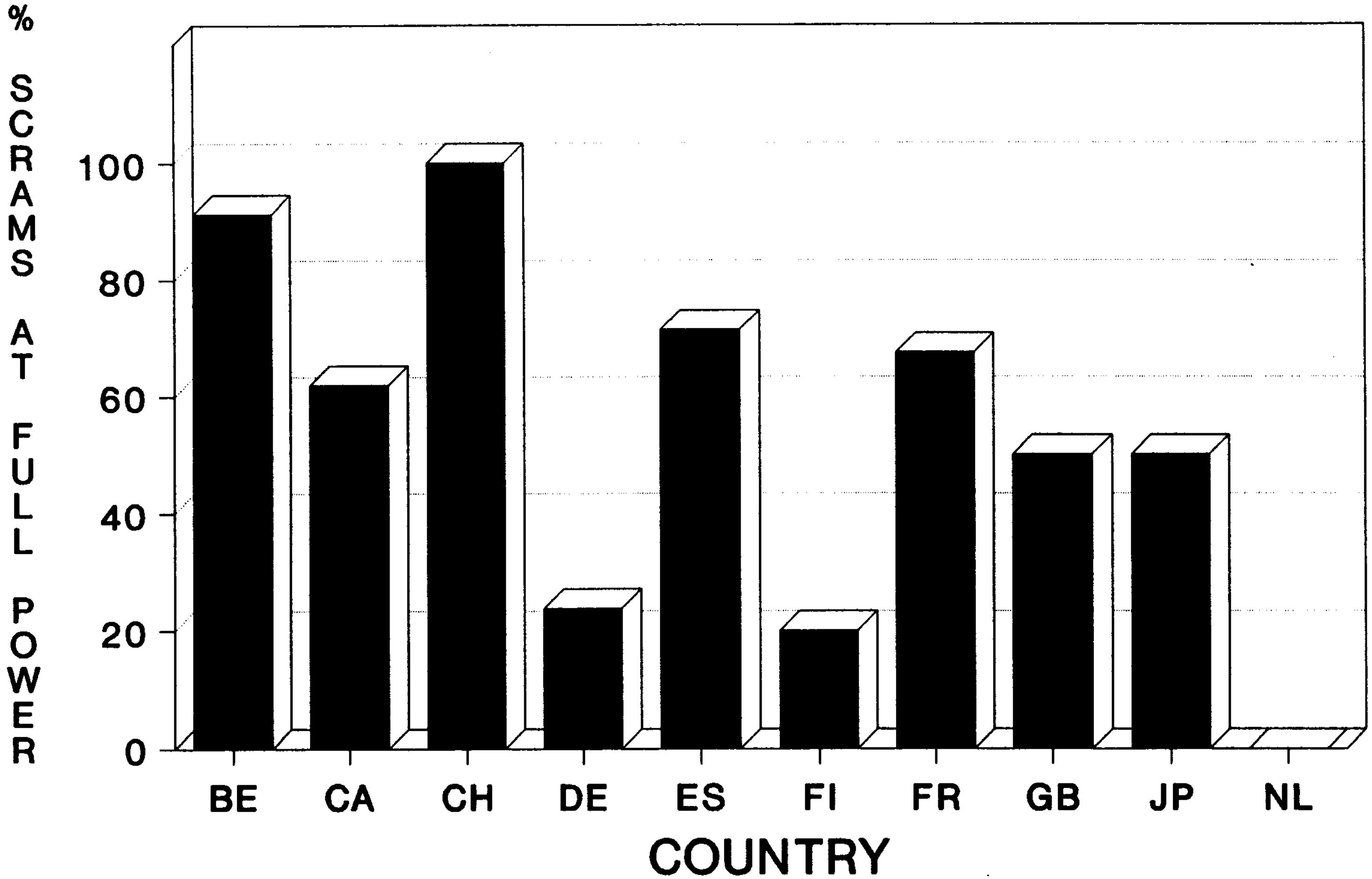

CA1/2/3 REFER TO BRUCE/PICK-A/ALL OTHERS

# NUMBER OF SCRAMS
## CAUSED BY HUMAN ERRORS




EXPRESSED AS % OF TOTAL NUMBER

# NUMBER OF SCRAMS
## FROM FULL POWER




EXPRESSED AS A % OF TOTAL SCRAMS

# SECTION II
# TABLES

COUNTRY: BELGIUM

YEAR: 1988

| PLANT | | | NUMBER OF SCRAMS PER REACTOR | NUMBER OF SCRAMS PER 1000 CRITICAL & TURBINE ON-LINE HOURS | NUMBER OF MAIN SIGNALS RESULTING IN REACTOR SCRAMS | | | | | | NUMBER OF SCRAMS OCCURRING AT VARIOUS POWER LEVELS OR OPERATIONAL STATES | | | | | NUMBER OF SCRAMS CAUSED BY HUMAN ERRORS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NAME | UNIT | REACTOR TYPE | | | TURBINE TRIP | OTHER SECONDARY SIDE SIGNALS | PRIMARY SIDE SIGNALS | NEUTRONIC SIGNALS | OTHER SIGNALS | SPURIOUS OR INADVERTENT SCRAMS | FULL POWER (100 %) | 10 - 100 % | LESS THAN 10 % | STARTING UP | SHUTTING DOWN | |
| DOEL | 1 | PWR | 5 | 0.65 | 1 | 2 | 1 | | 1 | | 4 | 1 | | | | 2 |
| DOEL | 2 | PWR | 4 | 0.54 | | 2 | | | 2 | | 4 | | | | | 2 |
| DOEL | 3 | PWR | 3 | 0.38 | | 2 | | | 1 | | 3 | | | | | 1 |
| DOEL | 4 | PWR | 3 | 0.39 | 1 | | 2 | | | | 2 | 1 | | | | |
| TIH. | 1 | PWR | 1 | 0.13 | | | | | | 1 | 1 | | | | | 1 |
| TIH. | 2 | PWR | 4 | 0.50 | | 3 | | | | 1 | 4 | | | | | 3 |
| TIH. | 3 | PWR | 3 | 0.39 | | 2 | 1 | | | | 3 | | | | | 2 |
| ALL PLANTS | | | 3.29 | 0.43 | 2 | 11 | 4 | | 4 | 2 | 21 | 3 | | | | 11 |

TIH. = TIHANGE

COUNTRY: CANADA YEAR: 1988

| PLANT | | | NUMBER OF SCRAMS PER REACTOR | NUMBER OF SCRAMS PER 1000 CRITICAL & TURBINE ON-LINE HOURS | NUMBER OF MAIN SIGNALS RESULTING IN REACTOR SCRAMS | | | | | | NUMBER OF SCRAMS OCCURRING AT VARIOUS POWER LEVELS OR OPERATIONAL STATES | | | | | NUMBER OF SCRAMS CAUSED BY HUMAN ERRORS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NAME | UNIT | REACTOR TYPE | | | TURBINE TRIP | OTHER SECONDARY SIDE SIGNALS | PRIMARY SIDE SIGNALS | NEUTRONIC SIGNALS | OTHER SIGNALS | SPURIOUS OR INADVERTENT SCRAMS | FULL POWER (100 %) | 10 - 100 % | LESS THAN 10 % | STARTING UP | SHUTTING DOWN | |
| Bruce A | 1-4 | PHWR | 0.75 | 0.126 | | | 2 | 1 | | | | 3 | | | | 1 |
| Bruce B | 5-8 | PHWR | 1.25 | 0.167 | | | | 2 | 1 | 2 | 2 | 2 | 1 | | | 1 |
| Pickering A | 1-4 | PHWR | 1.75 | 0.296 | | 1 | 2 | 2 | | 2 | 6 | 1 | | | | |
| Pickering B | 5-8 | PHWR | 0.50 | 0.060 | | | | 1 | | 1 | 2 | | | | | |
| Point Lepreau | 1 | PHWR | 0 | 0 | | | | | | | | | | | | |
| Gentilly | 2 | PHWR | 3.0 | 0.358 | | 1 | 1 | 1 | | | 3 | | | | | |

COUNTRY: FINLAND YEAR: 1988

| PLANT | | | NUMBER OF SCRAMS PER REACTOR | NUMBER OF SCRAMS PER 1000 CRITICAL & TURBINE ON-LINE HOURS | NUMBER OF MAIN SIGNALS RESULTING IN REACTOR SCRAMS | | | | | | NUMBER OF SCRAMS OCCURRING AT VARIOUS POWER LEVELS OR OPERATIONAL STATES | | | | | NUMBER OF SCRAMS CAUSED BY HUMAN ERRORS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NAME | UNIT | REACTOR TYPE | | | TURBINE TRIP | OTHER SECONDARY SIDE SIGNALS | PRIMARY SIDE SIGNALS | NEUTRONIC SIGNALS | OTHER SIGNALS | SPURIOUS OR INADVERTENT SCRAMS | FULL POWER (100 %) | 10 - 100 % | LESS THAN 10 % | STARTING UP | SHUTTING DOWN | |
| Loviisa | 1 | PWR | 2 | 0,26 | | | | 2 | | | | | | 2 | | |
| Loviisa | 2 | PWR | 1 | 0,12 | | | | 1 | | | | | | 1 | | 1 |
| TVO | 1 | BWR | 2 | 0,24 | 1 | 1 | | | | | 1 | | | 1 | | |
| TVO | 2 | BWR | 0 | 0 | | | | | | | | | | | | |

COUNTRY: FRG

YEAR: 1988

| PLANT | | | NUMBER OF SCRAMS PER REACTOR | NUMBER OF SCRAMS PER 1000 CRITICAL & TURBINE ON-LINE HOURS | NUMBER OF MAIN SIGNALS RESULTING IN REACTOR SCRAMS | | | | | | NUMBER OF SCRAMS OCCURRING AT VARIOUS POWER LEVELS OR OPERATIONAL STATES | | | | | NUMBER OF SCRAMS CAUSED BY HUMAN ERRORS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NAME | UNIT | REACTOR TYPE | | | TURBINE TRIP | OTHER SECONDARY SIDE SIGNALS | PRIMARY SIDE SIGNALS | NEUTRONIC SIGNALS | OTHER SIGNALS | SPURIOUS OR INADVERTENT SCRAMS | FULL POWER (100 %) | 10 - 100 % | LESS THAN 10 % | STARTING UP | SHUTTING DOWN | |
| | 7 | BWR | 1,14 | 0,15 | | 1 | 3 | 1 | 2 | 1 | 3 | 4 | 1 | | | 3 |
| | 14 | PWR | 0,93 | 0,14 | | 7 | 1 | 1 | 2 | 2 | 2 | 8 | 2 | | 1 | 3 |
| | 1 | HTR | 1 | 0,22 | | | | | 1 | | | 1 | | | | |

COUNTRY: FRANCE YEAR: 1988

: Récapitulatif tranches 900 et 1300 MWe

| PLANT | | | NUMBER OF SCRAMS PER REACTOR | NUMBER OF SCRAMS PER 1000 CRITICAL & TURBINE ON-LINE HOURS | NUMBER OF MAIN SIGNALS RESULTING IN REACTOR SCRAMS | | | | | | NUMBER OF SCRAMS OCCURRING AT VARIOUS POWER LEVELS OR OPERATIONAL STATES | | | | | NUMBER OF SCRAMS CAUSED BY HUMAN ERRORS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NAME | UNIT | REACTOR TYPE | | | TURBINE TRIP | OTHER SECONDARY SIDE SIGNALS | PRIMARY SIDE SIGNALS | NEUTRONIC SIGNALS | OTHER SIGNALS | SPURIOUS OR INADVERTENT SCRAMS | FULL POWER (100 %) | 10 - 100 % | LESS THAN 10 % | STARTING UP | SHUTTING DOWN | |
| | | 900 MWe | 47 | 0,28 | 4 | 17 | 10 | 12 | 3 | 1 | 31 | 16 | 0 | 0 | 0 | 13 |
| | | 1300 MWe | 33 | 0,5 | 11 | 1 | 12 | 10 | 2 | 0 | 23 | 10 | 0 | 0 | 0 | 9 |

COUNTRY: FRANCE YEAR: 1988

| PLANT | | | NUMBER OF SCRAMS PER REACTOR | NUMBER OF SCRAMS PER 1000 CRITICAL & TURBINE ON-LINE HOURS | NUMBER OF MAIN SIGNALS RESULTING IN REACTOR SCRAMS | | | | | | NUMBER OF SCRAMS OCCURRING AT VARIOUS POWER LEVELS OR OPERATIONAL STATES | | | | | NUMBER OF SCRAMS CAUSED BY HUMAN ERRORS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NAME | UNIT | REACTOR TYPE | | | TURBINE TRIP | OTHER SECONDARY SIDE SIGNALS | PRIMARY SIDE SIGNALS | NEUTRONIC SIGNALS | OTHER SIGNALS | SPURIOUS OR INADVERTENT SCRAMS | FULL POWER (100 %) | 10 - 100 % | LESS THAN 10 % | STARTING UP | SHUTTING DOWN | |
| FES | 01 | PWR 900 | 3 | 0,42 | | 1 | | 1 | 1 | | 1 | 2 | | | | 1 |
| FES | 02 | " | 3 | 0,49 | 1 | 1 | | 1 | | | 2 | 1 | | | | 1 |
| BUG | 02 | " | 0 | 0 | | | | | | | | | | | | |
| BUG | 03 | " | 0 | 0 | | | | | | | | | | | | |
| BUG | 04 | " | 4 | 0,88 | 1 | 1 | 1 | 1 | | | 2 | 2 | | | | 0 |
| BUG | 05 | " | 3 | 0,46 | 1 | 1 | 1 | | | | 3 | | | | | 0 |
| TRI | 01 | " | 0 | 0 | | | | | | | | | | | | |
| TRI | 02 | " | 1 | 0,15 | | 1 | | | | | | 1 | | | | 0 |

FES FESSENHEIM
BUG BUGEY
TRI TRICASTIN

COUNTRY: FRANCE YEAR: 1988

| PLANT | | | NUMBER OF SCRAMS PER REACTOR | NUMBER OF SCRAMS PER 1000 CRITICAL & TURBINE ON-LINE HOURS | NUMBER OF MAIN SIGNALS RESULTING IN REACTOR SCRAMS | | | | | | NUMBER OF SCRAMS OCCURRING AT VARIOUS POWER LEVELS OR OPERATIONAL STATES | | | | | NUMBER OF SCRAMS CAUSED BY HUMAN ERRORS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NAME | UNIT | REACTOR TYPE | | | TURBINE TRIP | OTHER SECONDARY SIDE SIGNALS | PRIMARY SIDE SIGNALS | NEUTRONIC SIGNALS | OTHER SIGNALS | SPURIOUS OR INADVERTENT SCRAMS | FULL POWER (100 %) | 10 - 100 % | LESS THAN 10 % | STARTING UP | SHUTTING DOWN | |
| TRI | 03 | PWR 900 | 2 | 0,28 | | | | 1 | | 1 | 1 | 1 | | | | 2 |
| TRI | 04 | " | 2 | 0,42 | 1 | 1 | | | | | 1 | 1 | | | | 0 |
| GRA | 01 | " | 0 | 0 | | | | | | | | | | | | |
| GRA | 02 | " | 1 | 0,14 | | | | 1 | | | 1 | | | | | 0 |
| GRA | 03 | | 1 | 0,15 | | 1 | | | | | 1 | | | | | 0 |
| GRA | 04 | " | 1 | 0,13 | | 1 | | | | | 1 | | | | | 0 |
| GRA | 05 | " | 0 | 0 | | | | | | | | | | | | |
| GRA | 06 | " | 0 | 0 | | | | | | | | | | | | |

TRI TRICASTIN
GRA GRAVELINES

COUNTRY: FRANCE

YEAR: 1988

| PLANT | | | NUMBER OF SCRAMS PER REACTOR | NUMBER OF SCRAMS PER 1000 CRITICAL & TURBINE ON-LINE HOURS | NUMBER OF MAIN SIGNALS RESULTING IN REACTOR SCRAMS | | | | | | NUMBER OF SCRAMS OCCURRING AT VARIOUS POWER LEVELS OR OPERATIONAL STATES | | | | | NUMBER OF SCRAMS CAUSED BY HUMAN ERRORS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NAME | UNIT | REACTOR TYPE | | | TURBINE TRIP | OTHER SECONDARY SIDE SIGNALS | PRIMARY SIDE SIGNALS | NEUTRONIC SIGNALS | OTHER SIGNALS | SPURIOUS OR INADVERTENT SCRAMS | FULL POWER (100 %) | 10 - 100 % | LESS THAN 10 % | STARTING UP | SHUTTING DOWN | |
| DAM | 01 | PWR 900 | 1 | 0,19 | | | | 1 | | | 1 | | | | | 1 |
| DAM | 02 | " | 2 | 0,33 | | 2 | | | | | 1 | 1 | | | | 0 |
| DAM | 03 | " | 2 | 0,31 | | 1 | | 1 | | | 1 | 1 | | | | 2 |
| DAM | 04 | " | 1 | 0,15 | | | 1 | | | | | 1 | | | | 0 |
| BLA | 01 | " | 4 | 0,56 | | 3 | 1 | | | | 2 | 2 | | | | 0 |
| BLA | 02 | " | 0 | 0 | | | | | | | | | | | | |
| BLA | 03 | " | 0 | 0 | | | | | | | | | | | | |
| BLA | 04 | " | 3 | 0,53 | | 1 | 1 | 1 | | | 3 | | | | | 1 |

DAM DAMPIERRE
BLA BLAYAIS

COUNTRY: FRANCE

YEAR: 1988

| PLANT | | | NUMBER OF SCRAMS PER REACTOR | NUMBER OF SCRAMS PER 1000 CRITICAL & TURBINE ON-LINE HOURS | NUMBER OF MAIN SIGNALS RESULTING IN REACTOR SCRAMS | | | | | | NUMBER OF SCRAMS OCCURRING AT VARIOUS POWER LEVELS OR OPERATIONAL STATES | | | | | NUMBER OF SCRAMS CAUSED BY HUMAN ERRORS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NAME | UNIT | REACTOR TYPE | | | TURBINE TRIP | OTHER SECONDARY SIDE SIGNALS | PRIMARY SIDE SIGNALS | NEUTRONIC SIGNALS | OTHER SIGNALS | SPURIOUS OR INADVERTENT SCRAMS | FULL POWER (100 %) | 10 - 100 % | LESS THAN 10 % | STARTING UP | SHUTTING DOWN | |
| CRU | 01 | PWR 900 | 2 | 0,36 | | | 1 | 1 | | | 1 | 1 | | | | 1 |
| CRU | 02 | " | 0 | 0 | | | | | | | | | | | | |
| CRU | 03 | " | 0 | 0 | | | | | | | | | | | | |
| CRU | 04 | " | 1 | 0,23 | | 1 | | | | | 1 | | | | | 1 |
| CHB | 01 | " | 3 | 0,42 | | | 1 | | 2 | | 3 | | | | | 1 |
| CHB | 02 | " | 0 | 0 | | | | | | | | | | | | |
| CHB | 03 | " | 3 | 0,56 | | 1 | | 2 | | | 2 | 1 | | | | 2 |
| CHB | 04 | " | 0 | 0 | | | | | | | | | | | | |

CRU CRUAS
CHB CHINON B

COUNTRY: FRANCE YEAR: 1988

| PLANT | | | NUMBER OF SCRAMS PER REACTOR | NUMBER OF SCRAMS PER 1000 CRITICAL & TURBINE ON-LINE HOURS | NUMBER OF MAIN SIGNALS RESULTING IN REACTOR SCRAMS | | | | | | NUMBER OF SCRAMS OCCURRING AT VARIOUS POWER LEVELS OR OPERATIONAL STATES | | | | | NUMBER OF SCRAMS CAUSED BY HUMAN ERRORS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NAME | UNIT | REACTOR TYPE | | | TURBINE TRIP | OTHER SECONDARY SIDE SIGNALS | PRIMARY SIDE SIGNALS | NEUTRONIC SIGNALS | OTHER SIGNALS | SPURIOUS OR INADVERTENT SCRAMS | FULL POWER (100 %) | 10 - 100 % | LESS THAN 10 % | STARTING UP | SHUTTING DOWN | |
| SLB | 01 | PWR 900 | 1 | 0,15 | | | | 1 | | | 1 | | | | | 0 |
| SLB | 02 | " | 3 | 0,48 | | | 3 | | | | 2 | 1 | | | | 0 |
| PAL | 01 | PWR 1300 | 4 | 0,55 | 1 | | 1 | 1 | 1 | | 4 | | | | | 1 |
| PAL | 02 | " | 3 | 0,5 | | | 1 | 2 | | | 3 | | | | | 2 |
| PAL | 03 | " | 2 | 0,37 | 1 | | 1 | | | | 2 | | | | | 0 |
| PAL | 04 | " | 0 | 0 | | | | | | | | | | | | |
| FLA | 01 | " | 2 | 0,35 | 2 | | | | | | 2 | | | | | 0 |
| FLA | 02 | " | 6 | 1,06 | 2 | 1 | 1 | 2 | | | 5 | 1 | | | | 2 |

SLB SAINT LAURENT B.
PAL PALUEL
FLA FLAMANVILLE

COUNTRY: FRANCE YEAR: 1988

| PLANT | | | NUMBER OF SCRAMS PER REACTOR | NUMBER OF SCRAMS PER 1000 CRITICAL & TURBINE ON-LINE HOURS | NUMBER OF MAIN SIGNALS RESULTING IN REACTOR SCRAMS | | | | | | NUMBER OF SCRAMS OCCURRING AT VARIOUS POWER LEVELS OR OPERATIONAL STATES | | | | | NUMBER OF SCRAMS CAUSED BY HUMAN ERRORS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NAME | UNIT | REACTOR TYPE | | | TURBINE TRIP | OTHER SECONDARY SIDE SIGNALS | PRIMARY SIDE SIGNALS | NEUTRONIC SIGNALS | OTHER SIGNALS | SPURIOUS OR INADVERTENT SCRAMS | FULL POWER (100 %) | 10 - 100 % | LESS THAN 10 % | STARTING UP | SHUTTING DOWN | |
| SAL | 01 | PWR 1300 | 3 | 0,81 | 2 | | | 1 | | | 3 | | | | | 1 |
| SAL | 02 | " | 4 | 0,93 | 2 | | 1 | 1 | | | 1 | 3 | | | | 1 |
| CAT | 01 | " | 1 | 0,23 | | | | 1 | | | 1 | | | | | 0 |
| CAT | 02 | " | 0 | 0 | | | | | | | | | | | | |
| BEL | 01 | " | 3 | 0,68 | 1 | | | 1 | 1 | | | 3 | | | | 1 |
| BEL | 02 | " | | | | | | | | | | | | | | |
| NOG | 01 | " | 4 | 0,66 | | | 4 | | | | 2 | 2 | | | | 1 |
| NOG | 02 | " | | | | | | | | | | | | | | |

SAL SAINT-ALBAN
CAT CATTENOM
BEL BELLEVILLE
NOG NOGENT

COUNTRY: JAPAN YEAR: 1988

| PLANT | | | NUMBER OF SCRAMS PER REACTOR | NUMBER OF SCRAMS PER 1000 CRITICAL & TURBINE ON-LINE HOURS | NUMBER OF MAIN SINGLS RESULTING IN REACTOR SCRAMS | | | | | | NUMBER OF SCRAMS OCCURRING AT VARIOUS POWER LEVELS OR OPERATIONAL STATES | | | | | NUMBER OF SCRAMS CAUSED BY HUMAN ERRORS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NAME | UNIT | REACTOR TYPE | | | TURBINE TRIP | OTHER SECONDARY SIDE SIGNALS | PRIMARY SIDE SIGNALS | NEUTRONIC SIGNALS | OTHER SIGNALS | SPURIOUS OR INADVERTENT SCRAMS | FUCL POWER (100%) | 10 - 100% | LESS THAN 10 % | STARTING UP | SHUTTING DOWN | |
| TAKAHAMA P.S. | 3 | PWR | 1 | 0. 14 | | | | 1 | | | 1 | | | | | |
| TSURUGA P.S. | 2 | PWR | 1 | 0. 14 | | | | | | 1 | | 1 | | | | 1 |
| FUKUSHIMA DAINI N.P.S. | 3 | BWR | 1 | 0. 12 | | | | 1 | | | 1 | | | | | |
| TOKAI P.S. | | GCR | 1 | 0. 13 | | | | 1 | | | | | | | 1 | 1 |

COUNTRY: JAPAN YEAR: 1988

| PLANT | | | NUMBER OF SCRAMS PER REACTOR | NUMBER OF SCRAMS PER 1000 CRITICAL & TURBINE ON-LINE HOURS | NUMBER OF MAIN SIGNALS RESULTING IN REACTOR SCRAMS | | | | | | NUMBER OF SCRAMS OCCURRING AT VARIOUS POWER LEVELS OR OPERATIONAL STATES | | | | | NUMBER OF SCRAMS CAUSED BY HUMAN ERRORS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NAME | UNIT | REACTOR TYPE | | | TURBINE TRIP | OTHER SECONDARY SIDE SIGNALS | PRIMARY SIDE SIGNALS | NEUTRONIC SIGNALS | OTHER SIGNALS | SPURIOUS OR INADVERTENT SCRAMS | FULL POWER (100 %) | 10 - 100 % | LESS THAN 10 % | STARTING UP | SHUTTING DOWN | |
| FUGEN | 1 | LWC-HWR | 1/1 | 0.1556 | | | 1 | | | | | 1 | | | | 0 |

COUNTRY: NETHERLANDS  YEAR: 1988

| PLANT | | | NUMBER OF SCRAMS PER REACTOR | NUMBER OF SCRAMS PER 1000 CRITICAL & TURBINE ON-LINE HOURS | NUMBER OF MAIN SIGNALS RESULTING IN REACTOR SCRAMS | | | | | | NUMBER OF SCRAMS OCCURRING AT VARIOUS POWER LEVELS OR OPERATIONAL STATES | | | | | NUMBER OF SCRAMS CAUSED BY HUMAN ERRORS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NAME | UNIT | REACTOR TYPE | | | TURBINE TRIP | OTHER SECONDARY SIDE SIGNALS | PRIMARY SIDE SIGNALS | NEUTRONIC SIGNALS | OTHER SIGNALS | SPURIOUS OR INADVERTENT SCRAMS | FULL POWER (100 %) | 10 - 100 % | LESS THAN 10 % | STARTING UP | SHUTTING DOWN | |
| PZEM | KCB | PWR | 2 | 0,84 | | | | | | 2 (manual) | | | | 1 | 1 | |

COUNTRY: SPAIN

YEAR: 1988

| PLANT | | | NUMBER OF SCRAMS PER REACTOR | NUMBER OF SCRAMS PER 1000 CRITICAL & TURBINE ON-LINE HOURS | NUMBER OF MAIN SIGNALS RESULTING IN REACTOR SCRAMS | | | | | | NUMBER OF SCRAMS OCCURRING AT VARIOUS POWER LEVELS OR OPERATIONAL STATES | | | | | NUMBER OF SCRAMS CAUSED BY HUMAN ERRORS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NAME | UNIT | REACTOR TYPE | | | TURBINE TRIP | OTHER SECONDARY SIDE SIGNALS | PRIMARY SIDE SIGNALS | NEUTRONIC SIGNALS | OTHER SIGNALS | SPURIOUS OR INADVERTENT SCRAMS | FULL POWER (100 %) | 10 - 100 % | LESS THAN 10 % | STARTING UP | SHUTTING DOWN | |
| VANDEL-LOS | 1 | GCR | 2 | 0,25 | | | | | 2 | | 2 | | | | | |
| JOSE CABRERA | | PWR | 6 | 0,76 | 1 | 1 | 2 | 1 | | 1 | 4 | 2 | | | | 2 |
| SANTA MARIA DE GARONA | | BWR | 1 | 0,15 | | | | 1 | | | | 1 | | | | |
| ALMARAZ | 1 | PWR | 3 | 0,43 | 1 | 2 | | | | | 3 | | | | | 1 |
| ALMARAZ | 2 | PWR | 3 | 0,38 | 1 | | 1 | | 1 | | 2 | 1 | | | | 2 |
| ASCO | 1 | PWR | 5 | 0,65 | 3 | 2 | | | | | 3 | 2 | | | | 1 |
| ASCO | 2 | PWR | 2 | 0,25 | 1 | | | | 1 | | 2 | | | | | |
| CO-FRENTES | | BWR | 2 | 0,25 | 1 | | 1 | | | | 2 | | | | | |
| TRILLO | 1 | PWR | 0 | 0 | | | | | | | | | | | | |

COUNTRY: SPAIN

YEAR: 1988

| PLANT | | | NUMBER OF SCRAMS PER REACTOR | NUMBER OF SCRAMS PER 1000 CRITICAL & TURBINE ON-LINE HOURS | NUMBER OF MAIN SIGNALS RESULTING IN REACTOR SCRAMS | | | | | | NUMBER OF SCRAMS OCCURRING AT VARIOUS POWER LEVELS OR OPERATIONAL STATES | | | | | NUMBER OF SCRAMS CAUSED BY HUMAN ERRORS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NAME | UNIT | REACTOR TYPE | | | TURBINE TRIP | OTHER SECONDARY SIDE SIGNALS | PRIMARY SIDE SIGNALS | NEUTRONIC SIGNALS | OTHER SIGNALS | SPURIOUS OR INADVERTENT SCRAMS | FULL POWER (100 %) | 10 - 100 % | LESS THAN 10 % | STARTING UP | SHUTTING DOWN | |
| VANDEL-LOS | 2 | PWR | 11 | 2,78 | 7 | 3 | | | | 1 | 7 | 4 | | | | 2 |

COUNTRY: Switzerland YEAR: 1988

| PLANT | | | NUMBER OF SCRAMS PER REACTOR | NUMBER OF SCRAMS PER 1000 CRITICAL & TURBINE ON-LINE HOURS | NUMBER OF MAIN SIGNALS RESULTING IN REACTOR SCRAMS | | | | | | NUMBER OF SCRAMS OCCURRING AT VARIOUS POWER LEVELS OR OPERATIONAL STATES | | | | | NUMBER OF SCRAMS CAUSED BY HUMAN ERRORS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NAME | UNIT | REACTOR TYPE | | | TURBINE TRIP | OTHER SECONDARY SIDE SIGNALS | PRIMARY SIDE SIGNALS | NEUTRONIC SIGNALS | OTHER SIGNALS | SPURIOUS OR INADVERTENT SCRAMS | FULL POWER (100 %) | 10 - 100 % | LESS THAN 10 % | STARTING UP | SHUTTING DOWN | |
| Beznau | I | PWR | 0 | 0 | | | | | | | 0 | | | | | |
| Beznau | II | PWR | 1 | 0.13 | | | | | 1 | | 1 | | | | | |
| Gösgen | | PWR | 2 | 0.27 | | 2 | | | | | 2 | | | | | |
| Mühleberg | | BWR | 1 | 0.13 | | | | | | | 1 | | | | | |
| Leibstadt | | BWR | 3 | 0.40 | 1 | | 2 | | | | 3 | | | | | |

COUNTRY: United Kingdom

YEAR: 1988

| PLANT | | | NUMBER OF SCRAMS PER REACTOR | NUMBER OF SCRAMS PER 1000 CRITICAL & TURBINE ON-LINE HOURS | NUMBER OF MAIN SIGNALS RESULTING IN REACTOR SCRAMS | | | | | | NUMBER OF SCRAMS OCCURRING AT VARIOUS POWER LEVELS OR OPERATIONAL STATES | | | | | NUMBER OF SCRAMS CAUSED BY HUMAN ERRORS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NAME | UNIT | REACTOR TYPE | | | TURBINE TRIP | OTHER SECONDARY SIDE SIGNALS | PRIMARY SIDE SIGNALS | NEUTRONIC SIGNALS | OTHER SIGNALS | SPURIOUS OR INADVERTENT SCRAMS | FULL POWER (100 %) | 10 - 100 % | LESS THAN 10 % | STARTING UP | SHUTTING DOWN | |
| BNFL | CX1 | GCR | 2 | 0.250 | | | 1 | | 1 | | 1 | 1 | | | | |
| | CX2 | | 1 | 0.127 | | | 1 | | | | 1 | | | | | |
| | CX3 | | 1 | 0.132 | | | | | | 1 | | 1 | | | | 1 |
| | CX4 | | 3 | 0.389 | | | 1 | | | 2 | 2 | 1 | | | | |
| | CH1 | | 1 | 0.132 | | | | 1 | | | | 1 | | | | 1 |
| | CH2 | | 0 | 0 | | | | | | | | | | | | |
| | CH3 | | 1 | 0.138 | | | | | | 1 | 1 | | | | | |
| | CH4 | | 1 | 0.139 | | | 1 | | | | | | | 1 | | |