

How to Use the ISOE Database?

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*ISOE European Symposium
Uppsala, Sweden (26-28 June 2018)*

The ISOE Website (www.isoe-network.net)



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Welcome to the ISOE Website

The Information System on Occupational Exposure (ISOE) System was created in 1992 to **provide a forum for radiation protection professionals** from nuclear electricity utilities and national regulatory authorities worldwide to **share dose reduction information, operational experience and information to improve the optimisation of radiological protection at nuclear power plants.**

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Access to the ISOE Database



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Welcome to the

The Information System on Occupational Exposure provides information and resources for protection professionals from reduction information, operation and maintenance at nuclear power plants.

ISOE Database

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OECD Nuclear Energy Agency
International Atomic Energy Agency



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Content of the ISOE Database

- Dosimetric information from commercial NPPs in operation or in some stage of decommissioning, including:
 - annual collective dose for normal operation
 - maintenance/refuelling outage dose
 - forced outage dose
 - annual collective dose for certain tasks and worker categories
 - dose rates

Database Analyses and Benchmarking

- The extensive data in database provides a solid basis for analyses on issues in operational RP such as dose trends, doses related to certain jobs and tasks, identification of good performance, etc.
- Several ways to use the database:
 - a) MADRAS analysis package : Main trends in occupational exposure
 - b) Direct access to ISOE 1 questionnaires, including contact information and complementary data
 - c) Direct access to the whole database using the data extraction module

Database Analyses and Benchmarking



ISOE

ISOE

- + ISOE 1 Questionnaires
 - Database
 - Create
 - Export
- + Analysis Modules
 - MADRAS Analyses
 - Data completeness
 - Data extraction
- + Contact

ISOE > Analysis Modules

● MADRAS Analyses

Warning: In some cases in Japan and in USA, the total annual collective dose of the reactor corresponds to the site collective dose divided by the number of units of the site. Please refer to the questionnaire for detailed information.

BENCHMARKING REPORT

-  For a plant unit
-  1 unit vs. other units

ANNUAL COLLECTIVE DOSE

-  Total annual collective dose
-  Average annual collective dose per reactor
-  Rolling average collective dose per reactor
-  Average annual collective dose per energy produced

PLANT UNIT RANKINGS

-  Quartile ranking
-  Plant unit ranking

OUTAGE COLLECTIVE DOSE

-  Total Outage collective dose
-  Average Outage collective dose per reactor
-  Contribution of Outage collective dose to Total Annual collective dose

 DOSE INDEX: Outage collective dose/Outage man-hours

 JOB COLLECTIVE DOSE

 TASK COLLECTIVE DOSE

 OCCUPATIONAL CATEGORY COLLECTIVE DOSE

 DOSE RATES

● GENERAL INFORMATION

MADRAS Data Analysis Package

- A set of pre-defined data queries to facilitate analysis of main trends in occupational exposure, benchmarking between plants, sister units, etc.
 - Benchmarking at unit level
 - Annual collective dose
 - Outage collective dose
 - Plant unit ranking
 - Total annual collective dose vs. number of operating reactors
 - Total annual collective dose by reactor age
 - Job collective dose
 - Occupational category collective dose
 - Dose rates

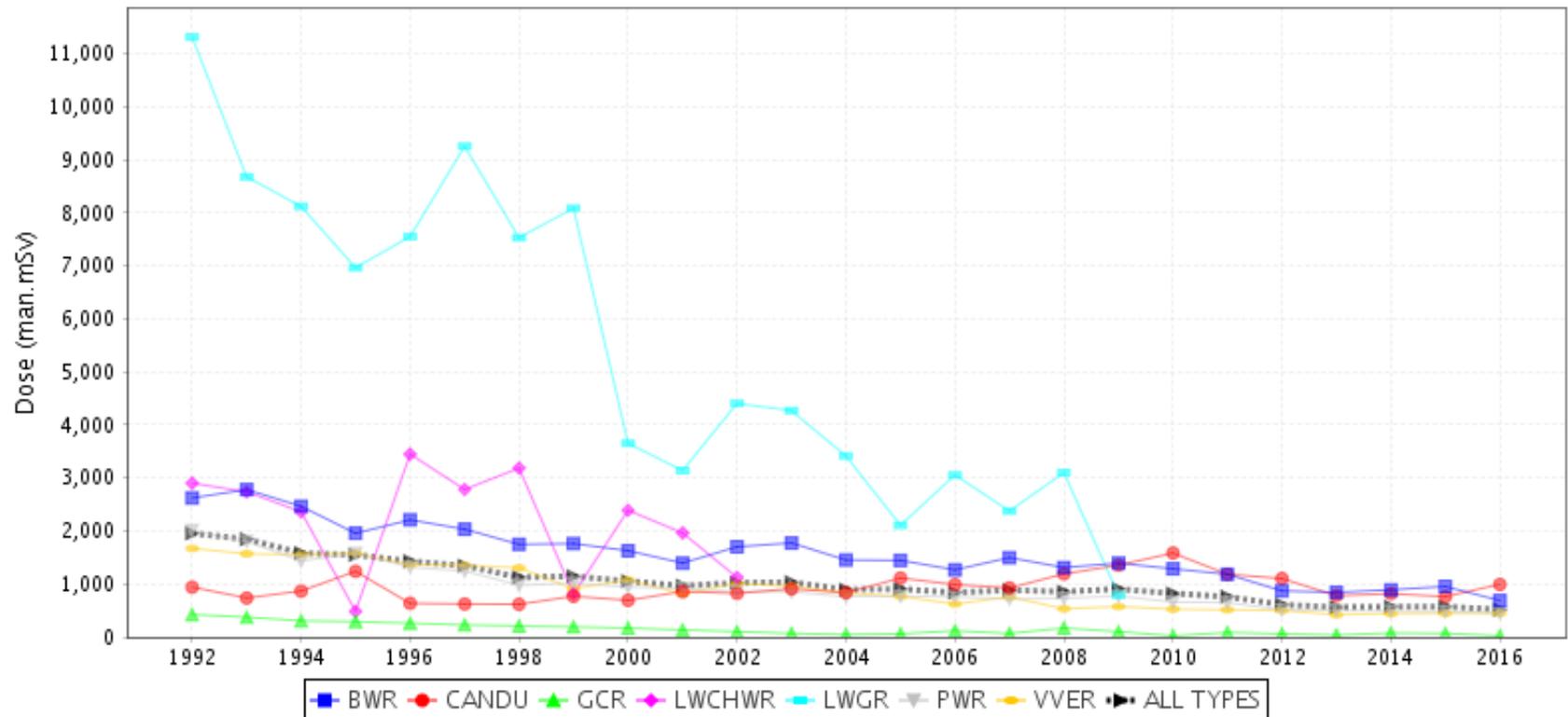
Using IAEA Database as a Benchmarking Tool

- Analyses at **country or regional level**:
 - Trends in Annual average collective dose per reactor / Annual total collective dose*
 - Between countries or regions: by country/region for a given reactor type, or all reactors, including rolling average over several years
 - Within a country: Specific unit vs. another unit or by type of reactor
- Analyses at **utility level**:
 - Specific utility vs. other utilities
 - Specific utility by reactor type
- Analyses at **unit level**
 - Specific unit vs. another unit / sister group / reactor type
 - Benchmarking at the job and task level

Global Dose Trends by Reactor Type

- The annual average collective dose per operating reactor has consistently decreased over the time period covered in by ISOE

Average annual collective dose per reactor by reactor type



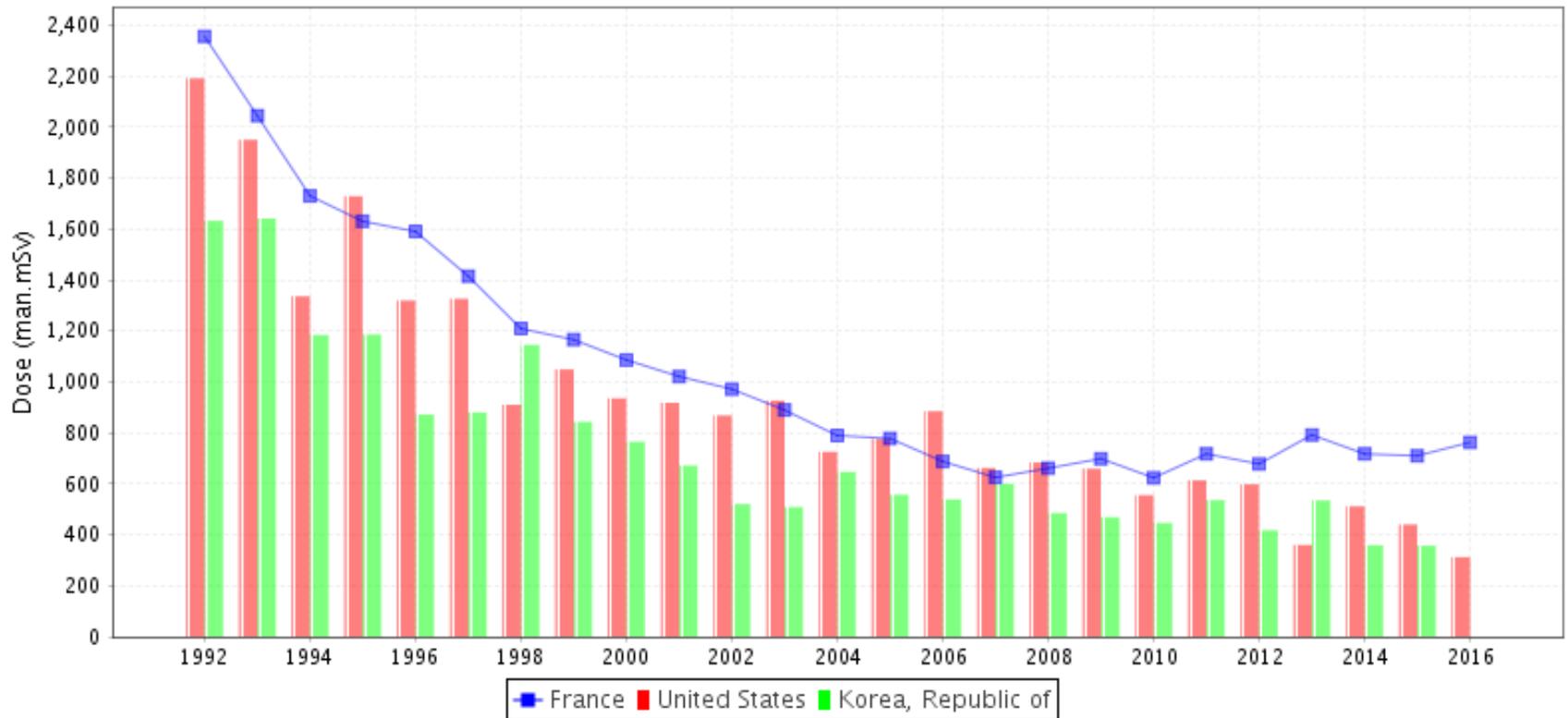
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Source: ISOE

Country Dose Trends by Reactor Type (PWRs)

- For most countries, the annual average collective dose per operating reactor decreased over the time period

Average annual collective dose per reactor for France compared with other countries for PWR



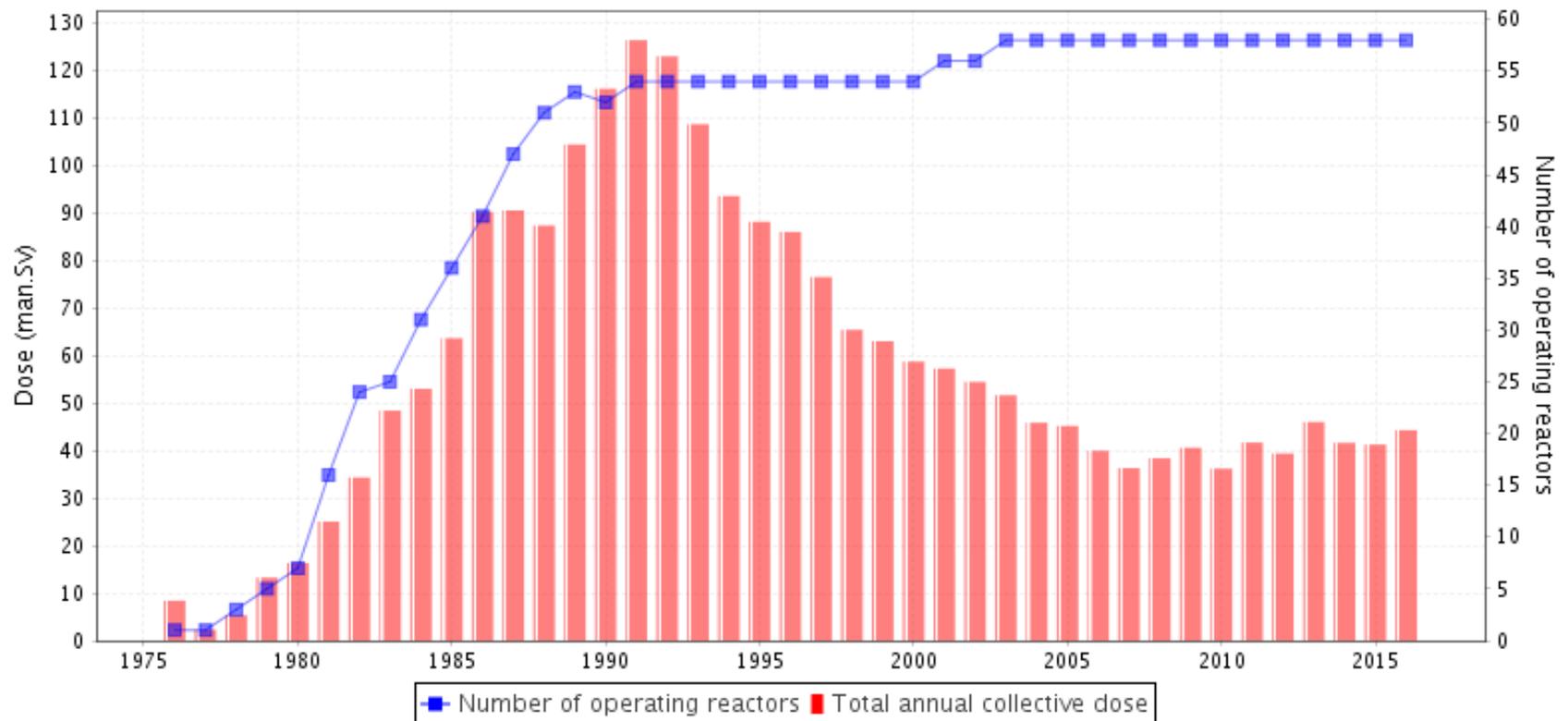
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Source: ISOE

Total Dose vs. Number of Operating Reactors

- Decrease of total collective dose despite an ageing fleet and an increase of maintenance programme

Total annual collective dose compared with the number of operating reactors for France

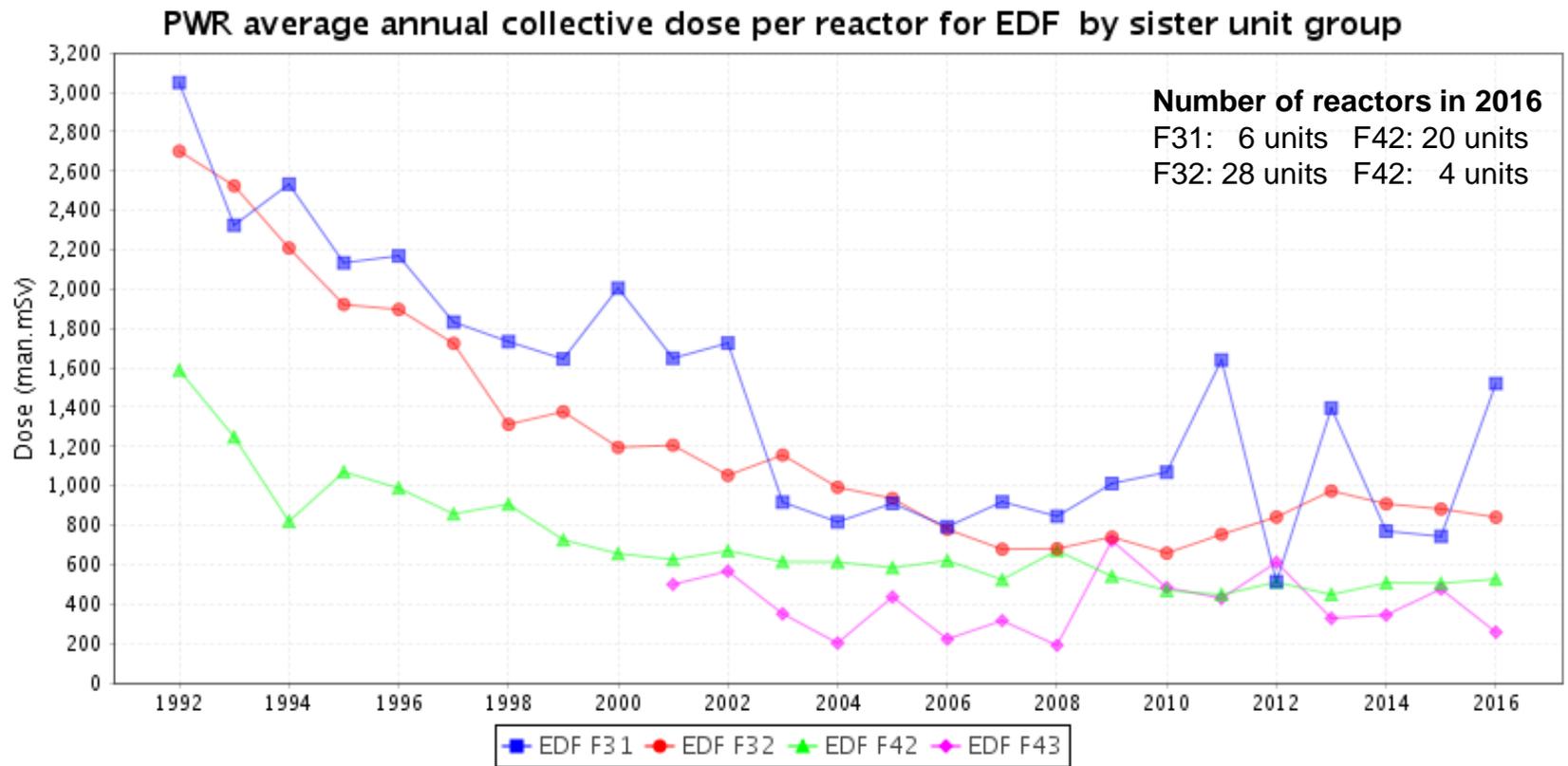


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Source: ISOE

France: Trends by Sister Unit Groups

- **Impact of the Design:** Clear decrease of average collective dose per reactor by sister unit group from F31 (oldest generation) to F43 (newest generation)



#U-72

Source: ISOE

Quartile Ranking 2014-2016 Average Collective Dose for France

Rolling average collective dose quartile ranking for France

Quartile	Plant unit	2014 - 2016 (man.mSv)	2013 - 2015 (man.mSv)	Percent change from 2013 - 2015	2013 - 2015 Quartile (if changed)
1	Golfech 1	267.64	285.34	-6%	2
	Civaux 1	314.64	340.96	-8%	
	Chooz B1	322.11	408.39	-21%	
	Nogent 2	322.70	367.80	-12%	
	Cattenom 4	344.01	602.60	-43%	
	Belleville 2	381.28	392.87	-3%	
	Chooz B2	382.23	373.37	2%	
	Saint Alban 2	382.36	423.80	-10%	
	Cattenom 2	386.24	384.90	0%	
	Penly 1	392.51	405.54	-3%	
	Saint Alban 1	394.50	376.88	5%	
	Chinon B3	404.22	528.67	-24%	
	Paluel 3	413.41	496.35	-17%	
	Civaux 2	416.14	406.95	2%	
	Flamanville 2	421.72	680.12	-38%	
2	Cattenom 3	423.26	342.81	23%	1

International Benchmarking 2016 Outage Collective Dose Ranking

Outage collective dose - Top 20 plant units for PWR

Plant unit	Country	2016 (man.mSv)
Dampierre 1	France	144.99
Chinon B3	France	149.94
Golfech 1	France	157.27
Paloverde 3	United States	157.91
Nogent 1	France	196.93
Oconee 1	United States	199.00
Chooz B2	France	199.35
Penly 1	France	202.98
Cruas 1	France	208.52
Tihange 3	Belgium	218.16
Cruas 2	France	220.52
Ringhals 4	Sweden	223.00
Tricastin 2	France	225.88
Cook 1	United States	230.68
Blayais 4	France	233.97
Chinon B1	France	235.42
Dampierre 3	France	244.83
Angra 2	Brazil	245.76
Qinshan 1	China	247.86
Civaux 1	France	249.26

**Plant unit ranking
for a reactor type**

Top 20 for PWRs

International Benchmarking 2016 Outage Collective Dose Ranking

Outage collective dose - Top 20 plant units for PWR 3-Loop reactors

Plant unit	Country	2016 (man.mSv)
Dampierre 1	France	144.99
Chinon B3	France	149.94
Cruas 1	France	208.52
Tihange 3	Belgium	218.16
Cruas 2	France	220.52
Ringhals 4	Sweden	223.00
Tricastin 2	France	225.88
Blayais 4	France	233.97
Chinon B1	France	235.42
Dampierre 3	France	244.83
Saint Laurent B1	France	249.55
Gravelines 4	France	253.07
Farley 2	United States	266.29
North Anna 2	United States	269.59
Ling Ao 3	China	270.07
Surry 1	United States	283.00
Farley 1	United States	297.19
Tricastin 1	France	312.91
Blayais 2	France	350.23
Koeberg 1	South Africa	366.66

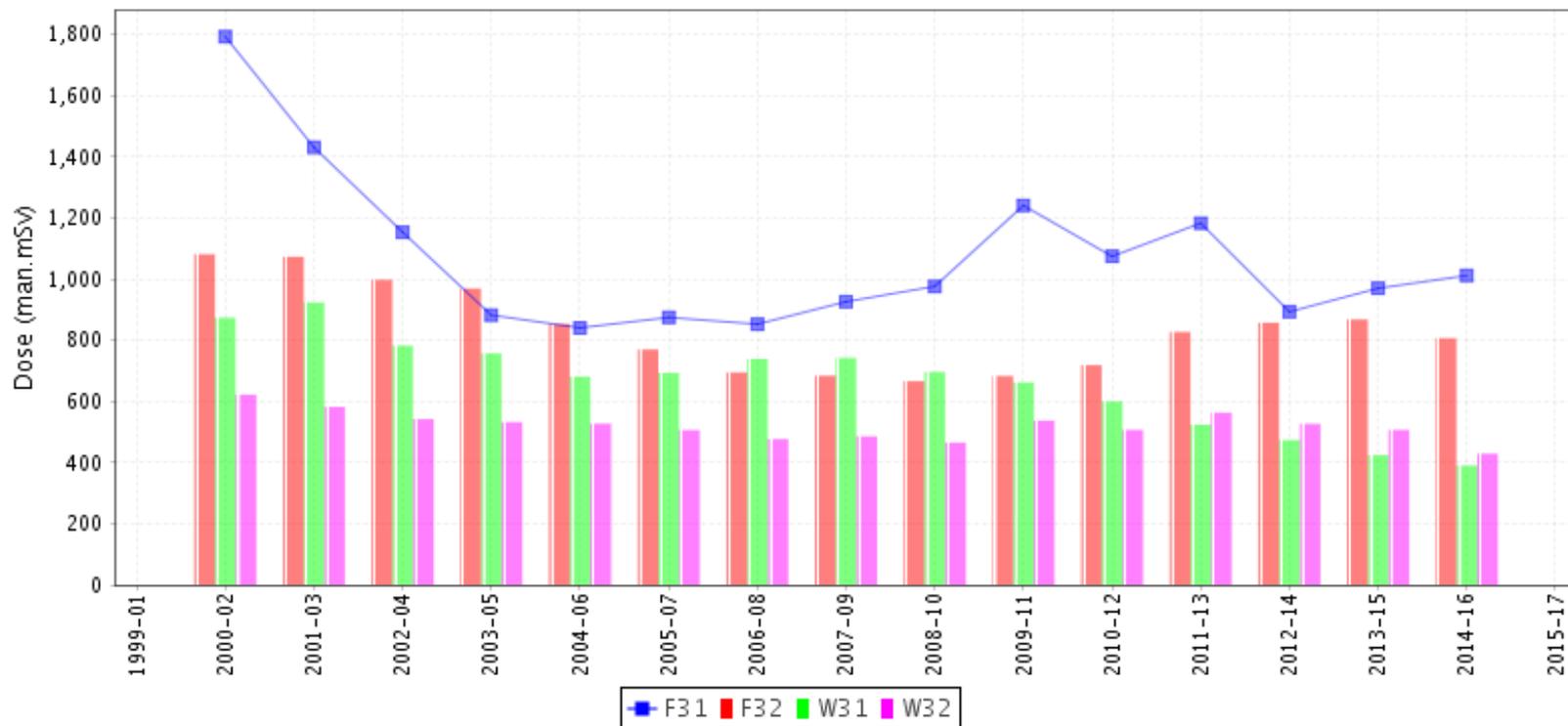
**Plant unit ranking
by number of loops**

Top 20 for PWRs

Collective Dose Trends by Sister Unit Group Comparison Framatome – Westinghouse reactors

- **3-Loops reactors:** 1st and 2nd generation of Westinghouse reactors shows lower dose than respective generations of Framatome reactors

3-Year rolling average collective dose per reactor for F31 compared with other sister unit groups



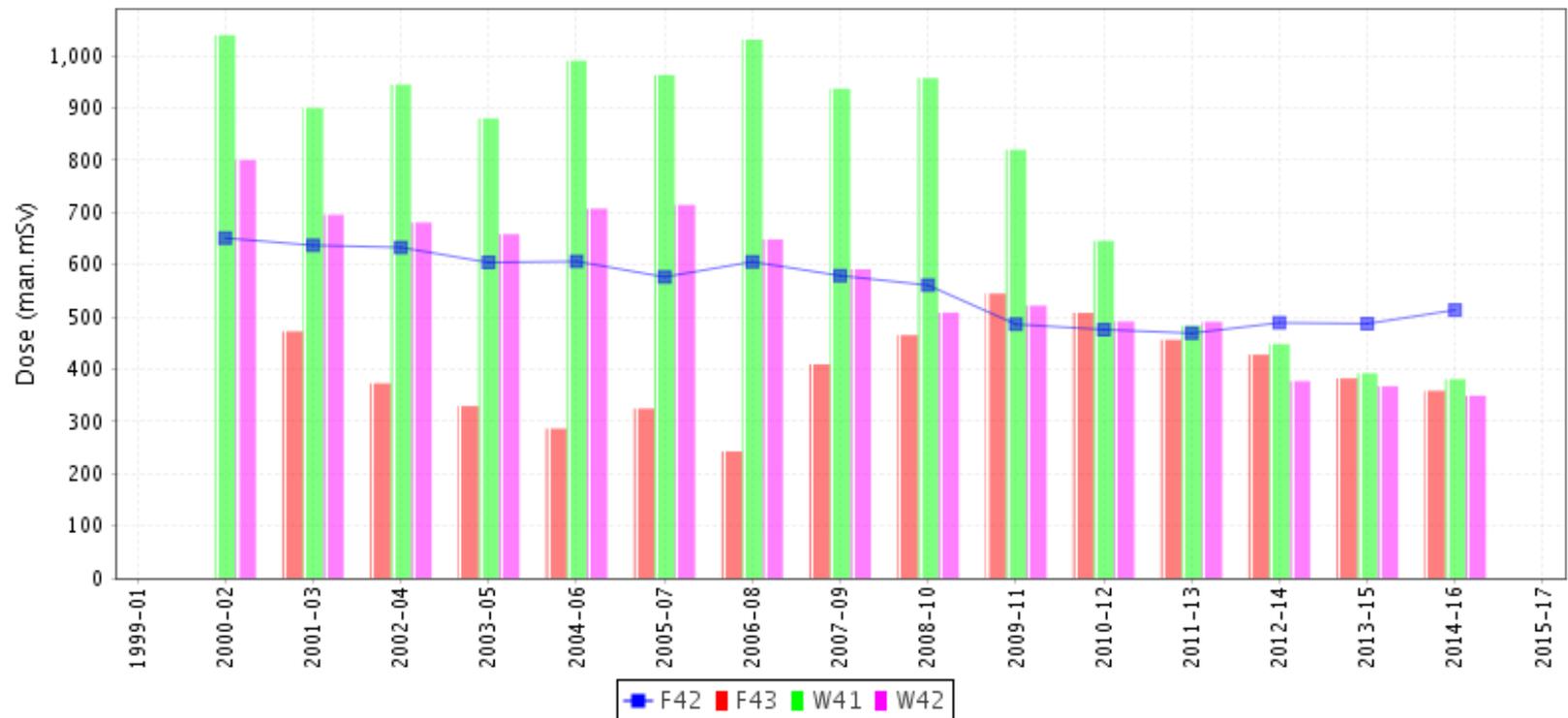
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Source: ISOE

Collective Dose Trends by Sister Unit Group Comparison Framatome – Westinghouse reactors

- **4-Loops reactors:** 2nd generation of Framatome reactors shows lower dose than Westinghouse reactors except for recent periods

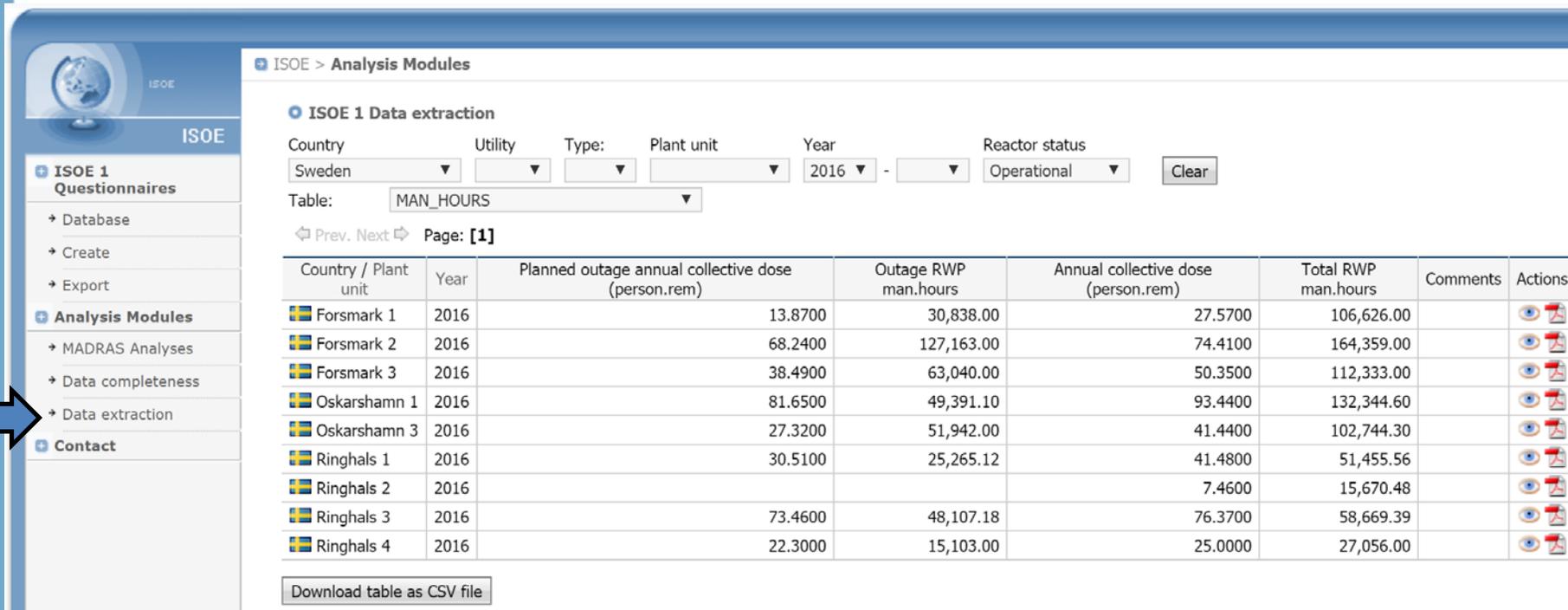
3-Year rolling average collective dose per reactor for F42 compared with other sister unit groups



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Source: ISOE

- MADRAS Analysis module is improved every year with new developments based on user feedback and requests
- **New analyses planned for 2018:**
10 queries based on outage dose per day



ISOE > Analysis Modules

ISOE 1 Data extraction

Country: Sweden | Utility: | Type: | Plant unit: | Year: 2016 | Reactor status: Operational | Clear

Table: MAN_HOURS

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Country / Plant unit	Year	Planned outage annual collective dose (person.rem)	Outage RWP man.hours	Annual collective dose (person.rem)	Total RWP man.hours	Comments	Actions
Sweden Forsmark 1	2016	13.8700	30,838.00	27.5700	106,626.00		 
Sweden Forsmark 2	2016	68.2400	127,163.00	74.4100	164,359.00		 
Sweden Forsmark 3	2016	38.4900	63,040.00	50.3500	112,333.00		 
Sweden Oskarshamn 1	2016	81.6500	49,391.10	93.4400	132,344.60		 
Sweden Oskarshamn 3	2016	27.3200	51,942.00	41.4400	102,744.30		 
Sweden Ringhals 1	2016	30.5100	25,265.12	41.4800	51,455.56		 
Sweden Ringhals 2	2016			7.4600	15,670.48		 
Sweden Ringhals 3	2016	73.4600	48,107.18	76.3700	58,669.39		 
Sweden Ringhals 4	2016	22.3000	15,103.00	25.0000	27,056.00		 

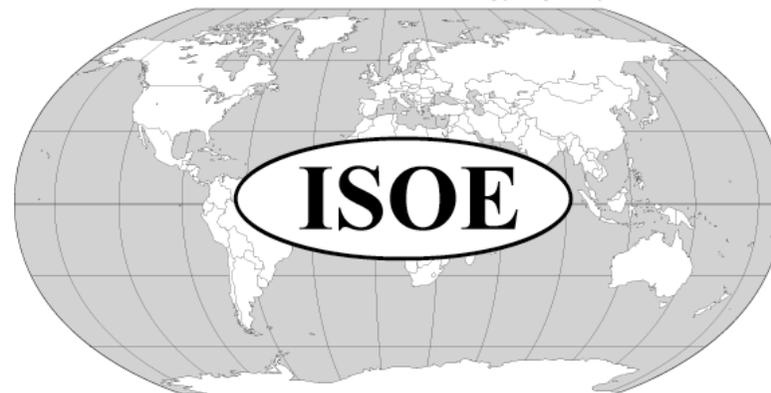
Download table as CSV file

Possibility to extract any type of data of the ISOE 1 Questionnaire in order to perform your own analyses

The ISOE Website and Database

Thank you for your attention!

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INFORMATION SYSTEM ON OCCUPATIONAL EXPOSURE

For more information, please visit:
www.isoe-network.net