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Vol. 25

Occupational Radiation Exposure at Commercial Nuclear Power Reactors and Other Facilities 2003

Thirty-Sixth Annual Report

U.S. Nuclear Regulatory Commission
Office of Nuclear Regulatory Research
Washington, DC 20555-0001

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Prepared by:
Sheryl Burrows
D. A. Hagemeyer*

Division of Systems Analysis and Regulatory Effectiveness
Office of Nuclear Regulatory Research
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

*** Oak Ridge Associated Universities**
210 Badger Avenue
Oak Ridge, TN 37830

PREVIOUS REPORTS IN SERIES

WASH-1311	A Compilation of Occupational Radiation Exposure from Light Water Cooled Nuclear Power Plants, 1969-1973, U.S. Atomic Energy Commission, May 1974.
NUREG-75/032	Occupational Radiation Exposure at Light Water Cooled Power Reactors, 1969-1974, U.S. Nuclear Regulatory Commission, June 1975.
NUREG-0109	Occupational Radiation Exposure at Light Water Cooled Power Reactors, 1969-1975, U.S. Nuclear Regulatory Commission, August 1976.
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NUREG-0594	Occupational Radiation Exposure at Commercial Nuclear Power Reactors, 1978, U.S. Nuclear Regulatory Commission, November 1979.
NUREG-0713	Occupational Radiation Exposure at Commercial Nuclear Power Reactors 1979, Vol. 1, U.S. Nuclear Regulatory Commission, March 1981.
NUREG-0713	Occupational Radiation Exposure at Commercial Nuclear Power Reactors 1980, Vol. 2, U.S. Nuclear Regulatory Commission, December 1981.
NUREG-0713	Occupational Radiation Exposure at Commercial Nuclear Power Reactors 1981, Vol. 3, U.S. Nuclear Regulatory Commission, November 1982.
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NUREG-0713	Occupational Radiation Exposure at Commercial Nuclear Power Reactors and Other Facilities 1984, Vol. 6, U.S. Nuclear Regulatory Commission, October 1986.
NUREG-0713	Occupational Radiation Exposure at Commercial Nuclear Power Reactors and Other Facilities 1985, Vol. 7, U.S. Nuclear Regulatory Commission, April 1988.
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NUREG-0713	Occupational Radiation Exposure at Commercial Nuclear Power Reactors and Other Facilities 1990, Vol. 12, U.S. Nuclear Regulatory Commission, January 1993.
NUREG-0713	Occupational Radiation Exposure at Commercial Nuclear Power Reactors and Other Facilities 1991, Vol. 13, U.S. Nuclear Regulatory Commission, July 1993.
NUREG-0713	Occupational Radiation Exposure at Commercial Nuclear Power Reactors and Other Facilities 1992, Vol. 14, U.S. Nuclear Regulatory Commission, December 1993.
NUREG-0713	Occupational Radiation Exposure at Commercial Nuclear Power Reactors and Other Facilities 1993, Vol. 15, U.S. Nuclear Regulatory Commission, January 1995.
NUREG-0713	Occupational Radiation Exposure at Commercial Nuclear Power Reactors and Other Facilities 1994, Vol. 16, U.S. Nuclear Regulatory Commission, January 1996.
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NUREG-0713	Occupational Radiation Exposure at Commercial Nuclear Power Reactors and Other Facilities 1999, Vol. 21, U.S. Nuclear Regulatory Commission, October 2000.
NUREG-0713	Occupational Radiation Exposure at Commercial Nuclear Power Reactors and Other Facilities 2000, Vol. 22, U.S. Nuclear Regulatory Commission, September 2001.
NUREG-0713	Occupational Radiation Exposure at Commercial Nuclear Power Reactors and Other Facilities 2001, Vol. 23, U.S. Nuclear Regulatory Commission, September 2002.
NUREG-0713	Occupational Radiation Exposure at Commercial Nuclear Power Reactors and Other Facilities 2002, Vol. 24, U.S. Nuclear Regulatory Commission, October 2003.

Previous reports in the NUREG-0714 series, which are now combined with NUREG-0713, are as follows:

WASH-1350-R1 through WASH-1350-R6	First through Sixth Annual Reports of the Operation of the U.S. AEC's Centralized Ionizing Radiation Exposure Records and Reporting System, U.S. Atomic Energy Commission.
NUREG-75/108	Seventh Annual Occupational Radiation Exposure Report for Certain NRC Licensees - 1974, U.S. Nuclear Regulatory Commission, October 1975.
NUREG-0119	Eighth Annual Occupational Radiation Exposure Report for 1975, U.S. Nuclear Regulatory Commission, October 1976.
NUREG-0322	Ninth Annual Occupational Radiation Exposure Report for 1976, U.S. Nuclear Regulatory Commission, October 1977.
NUREG-0463	Tenth Annual Occupational Radiation Exposure Report for 1977, U.S. Nuclear Regulatory Commission, October 1978.
NUREG-0593	Eleventh Annual Occupational Radiation Exposure Report for 1978, U.S. Nuclear Regulatory Commission, January 1981.
NUREG-0714	Twelfth Annual Occupational Radiation Exposure Report for 1979, Vol. 1, U.S. Nuclear Regulatory Commission, August 1982.
NUREG-0714	Occupational Radiation Exposure, Thirteenth and Fourteenth Annual Reports, 1980 and 1981, Vols. 2 and 3, U.S. Nuclear Regulatory Commission, October 1983.
NUREG-0714	Occupational Radiation Exposure, Fifteenth and Sixteenth Annual Reports, 1982 and 1983, Vols. 4 and 5, U.S. Nuclear Regulatory Commission, October 1985.

ABSTRACT

This report summarizes the occupational exposure data that are maintained in the U.S. Nuclear Regulatory Commission's (NRC) Radiation Exposure Information and Reporting System (REIRS). The bulk of the information contained in the report was compiled from the 2003 annual reports submitted by five of the seven categories[1] of NRC licensees subject to the reporting requirements of 10 CFR 20.2206. The annual reports submitted by these licensees consist of radiation exposure records for each monitored individual. These records are analyzed for trends and presented in this report in terms of collective dose and the distribution of dose among the monitored individuals. Because there are no geologic repositories for high-level waste currently licensed, and no low-level waste disposal facilities in operation, only five categories will be considered in this report.

Annual reports for 2003 were received from a total of **223** NRC licensees, of which **104** were operators of nuclear power reactors in commercial operation. Compilations of the reports submitted by the 223 licensees indicated that **122,281** individuals were monitored, **63,424** of whom received a measurable dose (Table 3.1). The collective dose incurred by these individuals was **14,413** person-rem, which represents a **3% decrease** from the 2002 value. The number of workers receiving a measurable dose increased, resulting in an average measurable dose of **0.23** rem for 2003. The average measurable dose is defined as the total collective dose (TEDE) divided by the number of workers receiving a measurable dose.[2] These figures have been adjusted to account for transient reactor workers.

In calendar year 2003, the annual collective dose per reactor for light water reactor (LWR) licensees was **115** person-rem. This represents a **2% decrease** from the value reported for 2002 (117). The annual collective dose per reactor for boiling water reactors (BWRs) was **162** person-rem and, for pressurized water reactors (PWRs), it was **91** person-rem.

Analyses of transient worker data indicate that **26,102** individuals completed work assignments at two or more licensees during the monitoring year. The dose distributions are adjusted each year to account for the duplicate reporting of transient workers by multiple licensees. In 2003, the average measurable dose per worker for all licensees calculated from reported data was **0.18** rem. The corrected dose distribution resulted in an average measurable dose per worker for all licensees of **0.23** rem.

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[1] Commercial nuclear power reactors; industrial radiographers; fuel processors (including uranium enrichment), fabricators, and reprocessors; manufacturers and distributors of byproduct material; independent spent fuel storage installations; facilities for land disposal of low-level waste; and geologic repositories for high-level waste. There are currently no NRC licensees involved in low-level waste disposal or geologic repositories for high-level waste.

[2] The number of workers with measurable dose includes any individual with a dose greater than zero rem and does not include doses reported as "not detectable."

EDITOR'S NOTE

Mr. Charles Hinson assisted in the preparation of this NUREG, serving as the Office of Nuclear Reactor Regulation technical reviewer. The NRC welcomes responses from readers.

Comments should be directed to:

Sheryl Burrows: (301) 415-6086
E-Mail Address: sab2@nrc.gov
REIRS Project Manager
Office of Nuclear Regulatory Research
U.S. Nuclear Regulatory Commission
Washington, DC 20555

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PREFACE

A number of NRC licensees have inquired as to how the occupational radiation exposure data that are compiled from the individual exposure reports required by § 20.2206 are used by the NRC staff. In combination with other sources of information, the principal uses of the data are to provide facts regarding routine occupational exposures to radiation and radioactive material that occur in connection with certain NRC-licensed activities. These facts are used by the NRC staff as indicated below:

1. The data permit evaluation of trends, both favorable and unfavorable, from the viewpoint of the effectiveness of overall NRC/licensee radiation protection and as low as reasonably achievable (ALARA) efforts by licensees.

2. The external dose data assist in the evaluation of the radiological risk associated with certain categories of NRC-licensed activities and are used for comparative analyses of radiation protection performance: U.S./foreign, BWRs/PWRs, civilian/military, facility/facility, nuclear industry/other industries, etc.

3. The data are used as one of the metrics of the NRC's Reactor Oversight Program to evaluate the effectiveness of the licensee's ALARA program and also for inspection planning purposes.

4. The data provide for the monitoring of transient workers who may affect dose distribution statistics through multiple counting.

5. The data help provide facts for evaluating the adequacy of the current risk limitation system (e.g., are individual lifetime dose limits, worker population collective dose limits, and requirements for optimization needed?).

6. The data permit comparisons of occupational radiation risks with potential public risks when action for additional protection of the public involves worker exposures.

7. The data are used in the establishment of priorities for the utilization of NRC health physics resources: research, standards development, and regulatory program development.

8. The data provide facts for answering Congressional and Administration inquiries and for responding to questions raised by the public.

9. The data are used to provide radiation exposure histories to individuals who were exposed to radiation at NRC-licensed facilities.

10. The data provide information that may be used in the planning of epidemiological studies.

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FOREWORD

This report is intended to provide accurate and timely information to the public about the safety performance of NRC licensees and to support openness in our regulatory process.

NUREG-0713, Volume 25, summarizes the 2003 occupational radiation exposure data maintained in the U. S. Nuclear Regulatory Commission's (NRC's) Radiation Exposure Information and Reporting System (REIRS) database. Seven categories of NRC licensees are required to annually report individual exposure in accordance with 10 CFR 20.2206. These include commercial nuclear power plants; industrial radiographers; fuel processors (including uranium enrichment facilities), fabricators, and reprocessors; manufacturers and distributors of byproduct material; independent spent fuel storage installations; facilities for land disposal of low-level waste; and geologic repositories for high-level waste. Because there are no geologic repositories for high-level waste currently licensed, and no low-level waste disposal facilities in operation, only five categories are considered in this report. The occupational radiation exposure data were received from 223 NRC licensees, of which 104 were operators of nuclear power reactors in commercial operation.

The data submitted by these licensees consist of radiation exposure records for each monitored individual (122,281 individuals were monitored, and 63,424 received a measurable dose). These records are analyzed and presented in this report in terms of collective dose and the distribution of dose among the monitored individuals. The collective dose incurred by these individuals was 14,413 person-rem, which represents a 3% decrease from the 2002 value of 14,844 person-rem. The average measurable dose was 0.23 rem, which is a small decrease from the 2002 value of 0.24 rem. This value can be compared to the 0.30 rem that the average person in the United States receives annually from natural background radiation. Worldwide annual exposures to natural radiation would generally be expected to be in the range of 0.1 rem to 1.0 rem, with 0.24 rem being the current average worldwide value. The average measurable dose is the total collective dose divided by the number of workers receiving a measurable dose.

This annual report is useful in the evaluation of trends in occupational radiation exposures to assess the effectiveness of licensee radiation protection programs to maintain exposures as low as reasonably achievable (ALARA). For example, the data are used as one of the metrics of the NRC's Reactor Oversight Program to evaluate the effectiveness of the licensee's ALARA program.

Farouk Eltawila, Director
Division of Systems Analysis and Regulatory Effectiveness
Office of Nuclear Regulatory Research

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Section 1
INTRODUCTION

1.1 BACKGROUND

One of the basic purposes of the Atomic Energy Act and the implementing regulations in Title 10, Code of Federal Regulations (CFR), Chapter I, Part 20, is to protect the health and safety of the public, including the employees of the licensees conducting operations under those regulations. Among the regulations designed to ensure that the standards for protection against radiation set out in 10 CFR 20 are met is a requirement that licensees provide individuals likely to be exposed to radiation with devices to monitor their exposure. Each licensee is also required to maintain indefinitely records of the results of such monitoring. However, there was no initial provision that these records or any summary of them be transmitted to a central location where the data could be retrieved and analyzed.

On November 4, 1968, the U.S. Atomic Energy Commission (AEC) published an amendment to 10 CFR 20 requiring the reporting of certain occupational radiation exposure information to a central repository at AEC Headquarters. This information was required of the four categories[3] of AEC licensees that were considered to involve the greatest potential for significant occupational doses and of AEC facilities and contractors exempt from licensing. A procedure was established whereby the appropriate occupational exposure data were extracted from these reports and entered into the Commission's Radiation Exposure Information and Reporting System (REIRS), a computer system that was maintained at the Oak Ridge National Laboratory Computer Technology Center in Oak Ridge, Tennessee, until May 1990. At that time, the data were transferred to a database management system at Science Applications International Corporation (SAIC) at Oak Ridge, Tennessee. The computerization of these data ensures that they are kept indefinitely and facilitates their retrieval and analysis. The data maintained in REIRS have been summarized and published in a report every year since 1969. Annual reports for each of the years 1969 through 1973 presented the data reported by both AEC licensees and contractors and were published in six documents designated as WASH-1350-R1 through WASH-1350-R6.

In January 1975, with the separation of the AEC into the Energy Research and Development Administration (ERDA) and the U.S. Nuclear Regulatory Commission (NRC), each agency assumed responsibility for collecting and maintaining occupational radiation exposure information reported by the facilities under its jurisdiction. The annual reports published by the NRC on occupational exposure for calendar year 1974 and subsequent years do not contain information pertaining to ERDA facilities or contractors. Comparable information for facilities and contractors under ERDA, now the Department of Energy (DOE), is collected and published by DOE's Office of Corporate Performance Assessment, a division of Environment, Safety and Health, in Germantown, Maryland.

[3] Commercial nuclear power reactors; industrial radiographers; fuel processors (including uranium enrichment as of 1997), fabricators, and reprocessors; manufacturers and distributors of specified quantities of byproduct material.

In 1982 and 1983, paragraph 20.408(a) of Title 10 of the Code of Federal Regulations was amended to require three additional categories of NRC licensees to submit annual statistical exposure reports and individual termination exposure reports. The categories were (1) geologic repositories for high-level radioactive waste, (2) independent spent fuel storage installations, and (3) facilities for the land disposal of low-level radioactive waste. This document presents the exposure information that was reported by NRC licensees representing two of these categories. (There are no geologic repositories for high-level waste currently licensed.)

This report and each of the predecessors summarize information reported for both the current year and for previous years. More licensee-specific data for previous years, such as the annual reports submitted by each commercial power reactor pursuant to 10 CFR 20.407 and 20.2206 and their technical specifications, may be found in those documents listed on the inside of the front cover of this report for the specific year desired.

Additional operating data and statistics for each power reactor for the years 1973 through 1982 may be found in a series of reports, “Nuclear Power Plant Operating Experience” [Refs. 1-9]. These documents are available for viewing at all NRC public document rooms, as well as on the NRC public website (www.nrc.gov), or they may be purchased from the National Technical Information Service, as shown in the Reference section.

In May of 1991, 10 CFR 20 “Standards for Protection Against Radiation; Final Rule” was revised. The revision redefined the radiation monitoring and reporting requirements of NRC licensees. Instead of summary annual reports (§ 20.407) and termination reports (§ 20.408), licensees are now required to submit an annual report of the dose received by each monitored worker (§ 20.2206). Licensees were required to implement the new requirements no later than January of 1994.

Recommendations for further analysis or for different presentation of information are welcome.

1.2 RADIATION EXPOSURE INFORMATION ON THE INTERNET

In May of 1995, the NRC began pursuing the dissemination of radiation exposure information via a World Wide Web site on the Internet. This allows interested parties with the appropriate equipment to access the data electronically rather than through the published NUREG-0713 document. A web site was created for radiation exposure and linked into the main NRC web page. The web site contains up-to-date information on radiation exposure, as well as information and guidance on reporting radiation exposure information to the NRC. Interested parties may read the documents online or download information to their systems for further analysis. Software, such as the Radiation Exposure Monitoring and Information Transmittal (REMIT) System, is also available for downloading via the web site. There are also links to other web sites dealing with the topics of radiation and health physics. Individuals and organizations may also submit requests for dose records contained in REIRS on this web site. Visit the site for more details. The NRC intends to continue pursuing the dissemination of radiation exposure information via the Web and will focus more resources on the electronic distribution of information rather than the published hard-copy reports.

The main web URL address for the NRC is:

http://www.nrc.gov

The NRC radiation exposure information web URL address is:

http://www.reirs.com

Comments on this report or the NRC's radiation exposure web page should be directed to:

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U.S. Nuclear Regulatory Commission
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Section 2

LIMITATIONS OF THE DATA

All of the figures compiled in this report relating to exposures and doses are based on the results and interpretations of the readings of various types of personnel monitoring devices employed by each licensee. This information, obtained from routine personnel monitoring programs, is sufficient to characterize the radiation exposure incident to individuals' work and is used in evaluating the radiation protection program.

Monitoring requirements are specified in 10 CFR § 20.1502, which requires licensees to monitor individuals who receive or are likely to receive a dose in a year in excess of 10% of the applicable limits. For most adults, the annual limit for the whole body is 5 rem, so 0.5 rem per year is the level above which monitoring is required. Separate dose limits have been established for minors and declared pregnant workers. Monitoring is required for any individual entering a high or very high radiation area. Depending on the administrative policy of each licensee, persons such as visitors and clerical workers may also be provided with monitoring devices, although the probability of their being exposed to measurable levels of radiation is extremely small. Licensees must report the dose records of those individuals for whom monitoring is required. Many licensees elect to report the doses for every individual for whom they provided monitoring. This practice tends to increase the number of individuals that one could consider to be radiation workers.

In an effort to account for this, the number of individuals reported as having "no measurable exposure"[4] has been subtracted from the total number of individuals monitored in order to calculate an average dose per individual receiving a measurable dose, as well as the average dose per monitored individual (for example, see Table 3.1).

The average dose per individual, as well as the dose distributions shown for groups of licensees, also can be affected by the multiple reporting of individuals who were monitored by two or more licensees during the year. Licensees are only required to report the doses received by individuals at their licensed facility. A dose distribution for a single licensee does not consider that some of the individuals may have received doses at other facilities. When the data are summed to determine the total number of individuals monitored by a group of licensees, individuals may be counted more than once if they have worked at more than one facility during the calendar year. This can also affect the distribution of doses because individuals may be counted multiple times in the lower dose ranges rather than one time in the higher range corresponding to the actual accumulated dose for the year (the sum of the individual's dose accrued at all facilities). This source of error has the greatest potential impact on the data reported by power reactor facilities since they employ many short-term workers. Section 5 contains an analysis that corrects for individuals being counted more than once.

[4] The number of workers with measurable dose includes any individual with a total effective dose equivalent greater than zero rem. Workers reported with zero dose, or no detectable dose, are included in the number of workers with no measurable exposure.

Another fact that one should keep in mind when examining the annual statistical data is that all of the personnel included in the report may not have been monitored throughout the entire year. Many licensees, such as radiography firms and nuclear power facilities, may monitor numerous individuals for periods much less than a year. The average doses calculated from these data, therefore, are less than the average dose that an individual would receive if involved in that activity for the full year.

One should pay considerable attention when referencing the collective totals presented in this report. The differences between the totals presented for all licensees that reported versus only those licensees that are required to report should be noted. Likewise, one should distinguish between the doses attributed to the pressurized water reactors (PWRs), and boiling water reactors (BWRs). The totals may be inclusive or exclusive of those licensees that were in commercial operation for less than one full year. These parameters vary throughout the tables and appendices of this report. The apparent discrepancies among the various tables are a necessary side effect of this endeavor.

The data contained in this report are subject to change as licensees may submit corrections or additions to data for previous years. For the 2003 report, data for prior years have been updated to account for these corrections and additions. Users should be alert to these changes.

It should again be pointed out that this report contains information reported by NRC licensees and some Agreement State[5] licensees who also have reported to the NRC. Since the NRC licenses all commercial nuclear power reactors, fuel processors and fabricators, and independent spent fuel storage facilities, information shown for these categories reflects the total U.S. experience. This is not the case, however, for the remaining categories of industrial radiography, manufacturing and distribution of specified quantities of by-product material, and low-level waste disposal. Companies that conduct these types of activities in Agreement States are licensed by the state and are not required to submit occupational exposure reports to the NRC. More than three times as many facilities are regulated by Agreement States than the number licensed by the NRC. In addition, this report does not include compilations of non-occupational exposure, such as exposure due to medical x-rays, fluoroscopy, and accelerators when received as a patient.

All dose equivalent values in this report are given in units of rem in accordance with the general provisions for records, 10 CFR 20.2101(a). In order to convert rem into the International System of Units (SI) unit of sieverts (Sv), divide the value in rem by 100. Therefore, 1 rem = 0.01 Sv. In order to convert rem into millisieverts (mSv), multiply the value in rem by 10. Therefore, 1 rem = 10 mSv.

[5] States that have entered into an agreement with the NRC that allows each state to license organizations using radioactive materials for certain purposes. As of March 2004, there are 33 Agreement States.

Section 3

ANNUAL PERSONNEL MONITORING REPORTS - 10 CFR 20.2206

3.1 DEFINITION OF TERMS AND SOURCES OF DATA

3.1.1 Statistical Summary Reports

The total effective dose equivalent (TEDE) is summed per individual and tabulated into the appropriate dose range to generate the dose distribution for each licensee. The total collective dose is more accurate using this method because the licensee reported the dose to each individual, and the total collective dose was calculated from the sum of these doses and not statistically derived from the distribution (see Section 3.1.4). The TEDE includes the dose contribution from the committed effective dose equivalent (CEDE) for those workers who had intakes that required monitoring and reporting of internal dose.

3.1.2 Number of Monitored Workers

The number of monitored workers refers to the total number of workers that the NRC licensees (who are covered by 10 CFR 20.1502) reported as being monitored for exposure to external and internal radiation during the year. This number includes all workers for whom monitoring is required, and may include visitors, service representatives, contract workers, clerical workers, and any other workers for whom the licensee determines that monitoring devices should be provided.

For licensees submitting under 10 CFR 20.2206, the total number of workers was determined from the number of unique personal identification numbers submitted per licensee. Uniqueness is defined by the combination of identification number and identification type. [Ref. 10]

3.1.3 Number of Workers with Measurable Dose

The number of workers with measurable dose includes any individual with a TEDE greater than zero rem. This does not include workers with a TEDE reported as zero, not detectable (ND), or not required to be reported (NR). [Ref. 10]

3.1.4 Collective Dose

The concept of collective dose is used in this report to denote the summation of the TEDE received by all monitored workers and is reported in units of person-rem. 10 CFR 20.2206 requires that the TEDE be reported, so the collective dose is calculated by summing the TEDE for all monitored workers. The phrase “collective dose” is used throughout this report to mean the collective TEDE, unless otherwise specified.

It should be noted that prior to the implementation of the revised dose reporting requirements of 10 CFR 20.2206 in 1994, the collective dose was, in some cases, calculated from the dose distributions by summing the products obtained from multiplying the number of workers reported in each of the dose ranges by the midpoint of the corresponding dose range. This assumes that the midpoint of the range is equal to the arithmetic mean of the individual doses in the range. Experience has shown that the actual mean dose of workers reported in each dose range is less than the midpoint of the range. For this reason, the resultant calculated collective doses shown in this report for these licensees may be about 10% higher than the sum of the actual individual doses. Care should be taken when

comparing the actual collective dose calculated for 1994 to 2003 with the collective dose for years prior to 1994 because of this change in methodology. In addition, prior to 1994, doses only included the external whole body dose. Although the contribution of internal dose to the TEDE is minimal for most licensees, it should be considered when comparing the 2003 collective dose with the collective dose for years prior to 1994. One noted exception is for fuel fabrication licensees where the CEDE in some cases contributes the majority of the TEDE (see Section 3.3.5).

3.1.5 Average Individual Dose

The average individual dose is obtained by dividing the collective dose by the total number of workers reported as being monitored. This figure is usually less than the average measurable dose because it includes the number of those workers who received zero or less than measurable doses.

3.1.6 Average Measurable Dose

The average measurable dose is obtained by dividing the collective TEDE by the number of workers who received a measurable dose. This is the average most commonly used in this and other reports when examining trends and comparing doses received by workers in various segments of the nuclear industry because it deletes those workers receiving zero or no detectable dose, many of whom were monitored for convenience or identification purposes.

3.1.7 Number of Licensees Reporting

The number of licensees refers to the NRC licenses issued to use radioactive material for certain activities that would place the licensees in one of the seven[6] categories that are required to report pursuant to 10 CFR 20.2206. The third column in Table 3.1 shows the number of licensees that have filed such reports during the last 10 years. All nuclear power plants, fuel processors and fabricators, and independent spent fuel storage facilities are required to report occupational exposure to the NRC, whether they are in an Agreement State or not. But the other types of Agreement State licensees are not required to submit exposure reports to the NRC and are not included in this report.

3.1.8 Collective TEDE Distribution by Dose Range

The United Nations Scientific Committee on the Effects of Atomic Radiation's (UNSCEAR) 2000 report entitled "Report of the Scientific Committee on the Effects of Atomic Radiation" [Ref. 11] recommends the calculation of a parameter "SR" (previously referred to as CR or MR) to aid in the examination of the distribution of radiation exposure among workers. SR is defined as the ratio of the annual collective dose incurred by workers whose annual doses exceed a certain dose level to the total annual collective dose. UNSCEAR uses a subscript to denote the specific dose level in millisieverts. Therefore, SR_{15} is the notation for the annual

[6] Commercial nuclear power reactors; industrial radiographers; fuel processors (including uranium enrichment), fabricators, and reprocessors; manufacturers and distributors of byproduct material; independent spent fuel storage installations; facilities for land disposal of low-level waste; and geologic repositories for high-level waste. There are currently no NRC licensees involved in low-level waste disposal or geologic repositories for high-level waste.

TABLE 3.1
Average Annual Exposure Data for Certain Categories of NRC Licensees
1994 - 2003

NRC License Category* and Program Code	Calendar Year	Number of Licensees Reporting	Number of Monitored Individuals	Number of Workers With Measurable TEDE	Collective TEDE (person-rem)	Average TEDE (rem)	Average Measurable TEDE per Worker (rem)
Industrial Radiography	1994	139	2,886	2,007	1,415	0.49	0.71
	1995	149	3,761	2,651	1,443	0.38	0.54
	1996	148	3,766	2,639	1,449	0.38	0.55
03310	1997	148	3,570	2,574	1,356	0.38	0.53
03320	1998	142	4,952	3,446	1,863	0.38	0.54
	1999	132	3,837	2,827	1,551	0.40	0.55
	2000	129	3,368	2,542	1,528	0.45	0.60
	2001	124	3,780	3,161	2,111	0.56	0.67
	2002	100	3,420	2,842	1,729	0.51	0.61
	2003	86	2,649	2,319	1,504	0.57	0.65
Manufacturing and Distribution	1994	44	2,941	1,251	580	0.20	0.46
	1995	36	2,666	1,222	595	0.22	0.49
	1996	38	2,631	1,241	556	0.21	0.45
	1997	33	1,154	665	397	0.34	0.60
02500	1998	31	1,986	654	402	0.20	0.61
03211	1999	39	2,181	836	419	0.19	0.50
03212	2000	39	2,461	1,188	415	0.17	0.35
03214	2001	36	1,862	1,211	351	0.19	0.29
	2002	29	1,437	1,052	328	0.23	0.31
	2003	23	1,849	1,459	394	0.21	0.27
Low-Level Waste Disposal**	1994	2	202	83	22	0.11	0.27
	1995	2	212	56	8	0.04	0.15
	1996	2	165	67	8	0.05	0.12
	1997	2	185	50	5	0.03	0.11
03231	1998	1	27	13	1	0.05	0.10
	1999	0					
Independent Spent Fuel Storage	1994	1	158	89	42	0.27	0.47
	1995	1	104	49	51	0.49	1.04
	1996	1	97	53	54	0.56	1.02
	1997	1	55	24	6	0.11	0.24
23100	1998	1	53	21	3	0.05	0.12
23200	1999	2	86	33	5	0.06	0.16
	2000	2	146	83	6	0.04	0.07
	2001	2	154	107	13	0.08	0.12
	2002	2	75	67	6	0.08	0.09
	2003	2	55	46	3	0.05	0.06
Fuel Cycle Licenses - Fabrication Processing and Uranium Enrich.	1994	8	3,596	2,847	1,147	0.32	0.40
	1995	8	4,106	2,959	1,217	0.30	0.41
	1996	8	4,369	3,061	878	0.20	0.29
	1997	10	11,214	3,910	1,006	0.09	0.26
	1998	10	10,684	3,613	950	0.09	0.26
	1999	9	9,693	3,927	1,020	0.11	0.26
	2000	9	9,336	4,649	1,339	0.14	0.29
21200	2001	9	8,145	3,980	1,162	0.14	0.29
21210	2002	8	7,937	3,886	661	0.08	0.17
	2003	8	7,738	3,633	556	0.07	0.15
Commercial Light Water Reactors***	1994	109	139,390	71,613	21,704	0.16	0.30
	1995	109	132,266	70,821	21,688	0.16	0.31
	1996	109	126,402	68,305	18,883	0.15	0.28
	1997	109	126,781	68,372	17,149	0.14	0.25
41111	1998	105	114,367	57,466	13,187	0.12	0.23
	1999	104	114,154	59,216	13,666	0.12	0.23
	2000	104	110,557	57,233	12,652	0.11	0.22
	2001	104	104,928	52,292	11,109	0.11	0.21
	2002	104	107,900	54,460	12,126	0.11	0.22
	2003	104	109,990	55,967	11,956	0.11	0.21
Grand Totals and Averages	1994	303	149,173	77,890	24,910	0.17	0.32
	1995	305	143,115	77,758	25,003	0.17	0.32
	1996	306	137,430	75,366	21,828	0.16	0.29
	1997	303	142,959	75,595	19,919	0.14	0.26
	1998	290	132,069	65,213	16,406	0.12	0.25
	1999	286	129,951	66,839	16,661	0.13	0.25
	2000	283	125,868	65,695	15,940	0.13	0.24
	2001	275	118,869	60,751	14,746	0.12	0.24
	2002	243	120,769	62,307	14,850	0.12	0.24
	2003	223	122,281	63,424	14,413	0.12	0.23

* These categories consist only of NRC licensees. Agreement State licensed organizations are not required to report occupational exposure data to the NRC.

** As of 1999, there are no longer any NRC licensees involved in this activity. All low-level waste disposal facilities are now located in Agreement States and no longer report to the NRC.

*** Includes all LWRs in commercial operation for a full year for each of the years indicated. Reactor data have been corrected to account for the multiple counting of transient reactor workers (see Section 5).

collective dose above 1.5 rem divided by the total annual collective dose. The UNSCEAR 2000 report notes that the 1.5 rem dose level may not be useful where doses are consistently lower than this level, and they recommend that research organizations report SR values lower than 1.5 rem where appropriate. For this reason, the NRC has adopted the policy of calculating and tracking the collective TEDE distribution by dose range at dose levels of 0.10 rem, 0.25 rem, 0.50 rem, 1.0 rem, and 2.0 rem. The collective TEDE distribution by dose range values in this report was calculated by summing the TEDE to each individual who received a TEDE greater than or equal to the specified dose range divided by the total collective TEDE. In addition, the distribution is presented as a percentage rather than a decimal fraction.

Figures 3.2, 3.3, 3.5, 3.6, 3.8, 3.10, 3.12, and 3.13 show the collective TEDE distribution by dose range calculated in terms of percentages of the collective dose delivered above the specified dose levels for each of the categories of NRC licensee. Two properties of these graphs help to further reveal the nature of the distribution of dose and dose trends at NRC licensees. The first is that the percentage of dose in the higher dose ranges (above 0.50 rem) should be relatively small. This would indicate that fewer workers are exposed at these higher levels of individual risk. The second property is the ability to track the shift in dose over time. For a given dose level, a reduction in the percentage from one year to the next indicates that less dose is being received by workers above this level. Therefore, these graphs can be useful in qualifying the dose received in a given year and the trend in doses from year to year.

3.2 ANNUAL TEDE DOSE DISTRIBUTIONS

Table 3.2 provides a statistical compilation of the exposure reports submitted by six categories of licensees (see Section 3.3 for a description of each licensee category). The dose distributions are generated by summing the TEDE for each individual and counting the number of individuals in each dose range. In nearly every category, a large number of workers receive doses that are less than measurable, and very few doses exceed 4 or 5 rem. Ninety-one percent of the reported workers with measurable doses were monitored by nuclear power facilities in 2003, where they received 83% of the total collective dose.

Under the regulatory limits of 10 CFR 20.1201, annual TEDE in excess of 5 rem for occupationally exposed adults is, by definition, an exposure in excess of regulatory limits (see Section 6).

Table 3.3 gives a summary of the annual exposures reported to the Commission by certain categories of NRC licensees as required by 10 CFR 20.2206. Table 3.3 shows that approximately 95% of the exposures consistently remained <2 rem between 1968 and 1984. For the past 13 years, the percentage of workers with <2 rem has been greater than 99%. The number of workers receiving an annual exposure in excess of 5 rem has been <0.01% since 1985. One individual received a dose above the 5 rem annual TEDE limit (actual TEDE dose received was 15.678 rem) in 2003 at a multiple-location radiography licensee that is among the categories required to submit data to REIRS (see Section 6).

TABLE 3.2
Distribution of Annual Collective TEDE by License Category
2003

License Category (Number of sites reporting)	*Number of Individuals with TEDE in the Ranges (rem)													Total Number Monitored	Number with Meas. Dose	Total Collective Dose (TEDE) (person-rem)
	No Meas.	Meas. <0.1	0.10-0.25	0.25-0.50	0.50-0.75	0.75-1.00	1.00-2.00	2.00-3.00	3.00-4.00	4.00-5.00	5.00-6.00	6.00-12.00	>12			
INDUSTRIAL RADIOGRAPHY																
Single Location (12)	52	35	6	3	1									97	45	3.066
Multiple Location (74)	278	586	358	369	256	196	344	115	40	9			1	2,552	2,274	1,500.885
Total (86)	330	621	364	372	257	196	344	115	40	9			1	2,649	2,319	1,503.951
MANUFACTURING AND DISTRIBUTION																
"A" - Broad (3)	89	83	48	60	40	37	55	25	1					438	349	228.922
Limited (20)	301	782	203	64	15	13	19	7	5	2				1,411	1,110	165.315
Total (23)	390	865	251	124	55	50	74	32	6	2				1,849	1,459	394.237
LOW-LEVEL WASTE DISPOSAL																
Total (0)**																
INDEPENDENT SPENT FUEL STORAGE																
Total (2)	9	34	10	2										55	46	2.791
FUEL CYCLE LICENSES* **																
Total (8)	4,105	2,194	781	353	181	78	46							7,738	3,633	556.297
COMMERCIAL POWER REACTORS** **																
Boiling Water (35)	24,934	17,042	6,344	4,326	1,714	749	556	28						55,693	30,759	5,659.434
Pressurized Water (69)	52,955	25,678	10,887	5,263	1,425	484	308	9						97,009	44,054	6,296.136
Total (104)	77,889	42,720	17,231	9,589	3,139	1,233	864	37						152,702	74,813	11,955.570
GRAND TOTALS	**82,723**	**46,434**	**18,637**	**10,440**	**3,632**	**1,557**	**1,328**	**184**	**46**	**11**			**1**	**164,993**	**82,270**	**14,412.846**

* Dose values exactly equal to the values separating ranges are reported in the next higher range.
** There are no NRC licensees currently involved in this activity. All facilities are now located in Agreement States.
*** Includes fabrication, processing and uranium enrichment plants (see Section 3.3.5).
**** Includes all reactors in commercial operation for a full year during 2003. These values have not been adjusted for the multiple counting of transient reactor workers (see Section 5).

TABLE 3.3
Summary of Annual Dose Distributions for Certain* NRC Licensees
1968 - 2003

Year	Total Number of Monitored Persons		Percent of Individuals With Doses < 2 rem***	Percent of Individuals With Doses < 5 rem***	Number of Individuals With Doses >12 rem***
	Reported Number	Corrected Number**			
1968	36,836		97.2%	99.5%	3
1969	31,176		96.5%	99.5%	7
1970	36,164		96.1%	99.4%	0
1971	36,311		96.3%	99.3%	1
1972	44,690		95.7%	99.5%	8
1973	67,862		95.0%	99.5%	1
1974	85,097		96.4%	99.7%	1
1975	78,713		94.8%	99.5%	1
1976	92,773		95.0%	99.6%	3
1977	98,212	93,438	93.8%	99.6%	1
1978	105,893	100,818	94.6%	99.8%	3
1979	131,027	125,316	95.2%	99.8%	1
1980	159,177	150,675	94.6%	99.7%	0
1981	157,874	149,314	94.6%	99.8%	1
1982	162,456	154,117	94.9%	99.9%	0
1983	172,927	164,239	94.6%	99.9%	0
1984	181,627	168,899	95.1%	99.9%	0
1985	212,217	201,339	97.6% (4,734)	>99.99% (15)	2
1986	225,582	213,017	98.0% (4,076)	>99.99% (8)	0
1987	243,562	227,997	98.8% (2,738)	>99.99% (4)	1
1988	231,234	215,662	98.6% (2,980)	>99.99% (8)	0
1989	229,353	212,474	99.1% (2,018)	>99.99% (7)	1
1990	227,777	208,513	98.9% (2,150)	>99.99% (3)	0
1991	218,519	202,731	99.4% (1,174)	>99.99% (2)	0
1992	220,717	202,998	99.6% (897)	>99.99% (1)	0
1993	208,784	189,109	99.5% (719)	>99.99% (2)	0
1994	178,987	149,173	99.5% (818)	>99.99% (1)	0
1995	179,406	143,115	99.3% (1,049)	>99.99% (1)	0
1996	173,674	137,430	99.5% (730)	>99.99% (1)	0
1997	180,814	142,959	99.5% (666)	100% (0)	0
1998	166,127	132,069	99.6% (489)	>99.99% (6)	1
1999	166,084	129,117	99.6% (534)	>99.99% (1)	0
2000	163,073	125,026	99.5% (573)	>99.99% (3)	0
2001	154,717	118,150	99.4% (734)	>99.99% (1)	0
2002	162,381	119,694	99.5% (582)	>99.99% (1)	0
2003	164,993	121,265	99.7% (414)	>99.99% (1)	1

* Licensees required to submit radiation exposure reports to the NRC under 10 CFR 20.2206.

** This column lists the actual number of persons who may have been counted more than once because they worked at more than one facility during the calendar year (see Section 5).

*** Data for 1977-2003 are based on the distribution of individual doses after adjusting for the multiple counting of transient reactor workers (see Section 5). The numbers of people exceeding both 2 and 5 rem are shown in parentheses from 1985-2003.

3.3 SUMMARY OF OCCUPATIONAL EXPOSURE DATA BY LICENSE CATEGORY

3.3.1 Industrial Radiography Licenses, Single and Multiple Locations

Industrial Radiography licenses are issued to allow the use of sealed radioactive materials, usually in exposure devices or "cameras," that primarily emit gamma rays for nondestructive testing of pipeline weld joints, steel structures, boilers, aircraft and ship parts, and other high-stress alloy parts. Some firms are licensed to conduct such activities in one location, usually in a permanent facility designed and shielded for radiography; others perform radiography at multiple, temporary sites in the field. The radioisotopes most commonly used are cobalt-60 and iridium-192. As shown in Table 3.1, annual reports were received for 86 radiography licensees in 2003. Table 3.4 summarizes the reported data for the two types of radiography licenses for 2003 and for the previous 2 years for comparison purposes.

The average measurable dose for workers performing radiography at a single location ranged from 10% to 13% of the average measurable dose of workers at multiple location facilities over the past 3 years. This is because it is more difficult for workers to avoid exposure to radiation in the field, where conditions are not optimal and may change daily. To view the contribution that each radiography licensee made to the total collective dose, see Appendix A, which presents a summary of the information reported by each of these licensees in 2003.

High exposures in radiography can be directly attributable to the type and location of the radiography field work. For example, locations such as oil drilling platforms and aerial tanks offer the radiographer little available shielding. In these situations, there may not be an opportunity to use distance as a means of minimizing exposure and achieving ALARA. Although these licensed activities usually result in average measurable doses that are higher than other licensees, they involve a relatively small number of exposed workers.

TABLE 3.4
Annual Exposure Information for Industrial Radiographers
2001 - 2003

Year	Type of License	Number of Licensees	Number of Monitored Individuals	Workers With Measurable Dose	Collective Dose (person-rem)	Average Measurable Dose (rem)
2001	Single Location	20	258	79	6	0.07
	Multiple Locations	104	3,522	3,082	2,105	0.68
	Total	**124**	**3,780**	**3,161**	**2,111**	**0.67**
2002	Single Location	15	112	55	4	0.08
	Multiple Locations	85	3,308	2,787	1,725	0.62
	Total	**100**	**3,420**	**2,842**	**1,729**	**0.61**
2003	Single Location	12	97	45	3	0.07
	Multiple Locations	74	2,552	2,274	1,501	0.66
	Total	**86**	**2,649**	**2,319**	**1,504**	**0.65**

Figure 3.1 shows the number of workers with measurable dose per licensee, the total collective dose per licensee, and the average measurable dose per worker for both types of Industrial Radiography facilities from 1973 through 2003. The number of workers with measurable TEDE per licensee decreased from 2002 to 2003, whereas the average measurable TEDE increased by 7% from 0.61 rem in 2002 to 0.65 rem in 2003. Figures 3.2 and 3.3 show the collective dose distribution by dose range (see Section 3.1.8) for single location and multiple location radiography licensees. These graphs demonstrate that multiple location licensees consistently have individuals receiving dose in the higher dose ranges and routinely have 25% to 40% of the collective dose delivered to individuals above 2 rem. From 1999 to 2001, for these licensees, there were increases in the percentage of dose for each dose range above 0.50 rem. However, for the past 2 years, the percentage of the collective dose delivered in each dose range above 0.50 rem was less than the value in 2001. In 2003, for single location licensees, the percentage of individuals above all dose ranges decreased from the 2002 values.

3.3.2 Manufacturing and Distribution Licenses, Type "A" Broad and Limited

Manufacturing and Distribution licenses are issued to allow the manufacture and distribution of radionuclides in various forms for a number of diverse purposes. The products are usually distributed to persons specifically licensed by the NRC or an Agreement State. Type "A" Broad licenses are issued to larger organizations that may use many different radionuclides in many different ways and that have a comprehensive radiation protection program. Some Type "A" Broad license firms are medical suppliers that process, package, or distribute such products as diagnostic test kits; radioactive surgical implants; and tagged radiochemicals for use in medical research, diagnoses, and therapy. The Limited licenses are usually issued to smaller firms requiring a more restrictive license. Limited firms are suppliers of industrial radionuclides and are involved in the processing, encapsulation, packaging, and distribution of the radionuclides that they have purchased in bulk quantities from production reactors and cyclotrons. Major products include gamma radiography sources, cobalt irradiation sources, well-logging sources, sealed sources for gauges and smoke detectors, and radio-chemicals for nonmedical research.

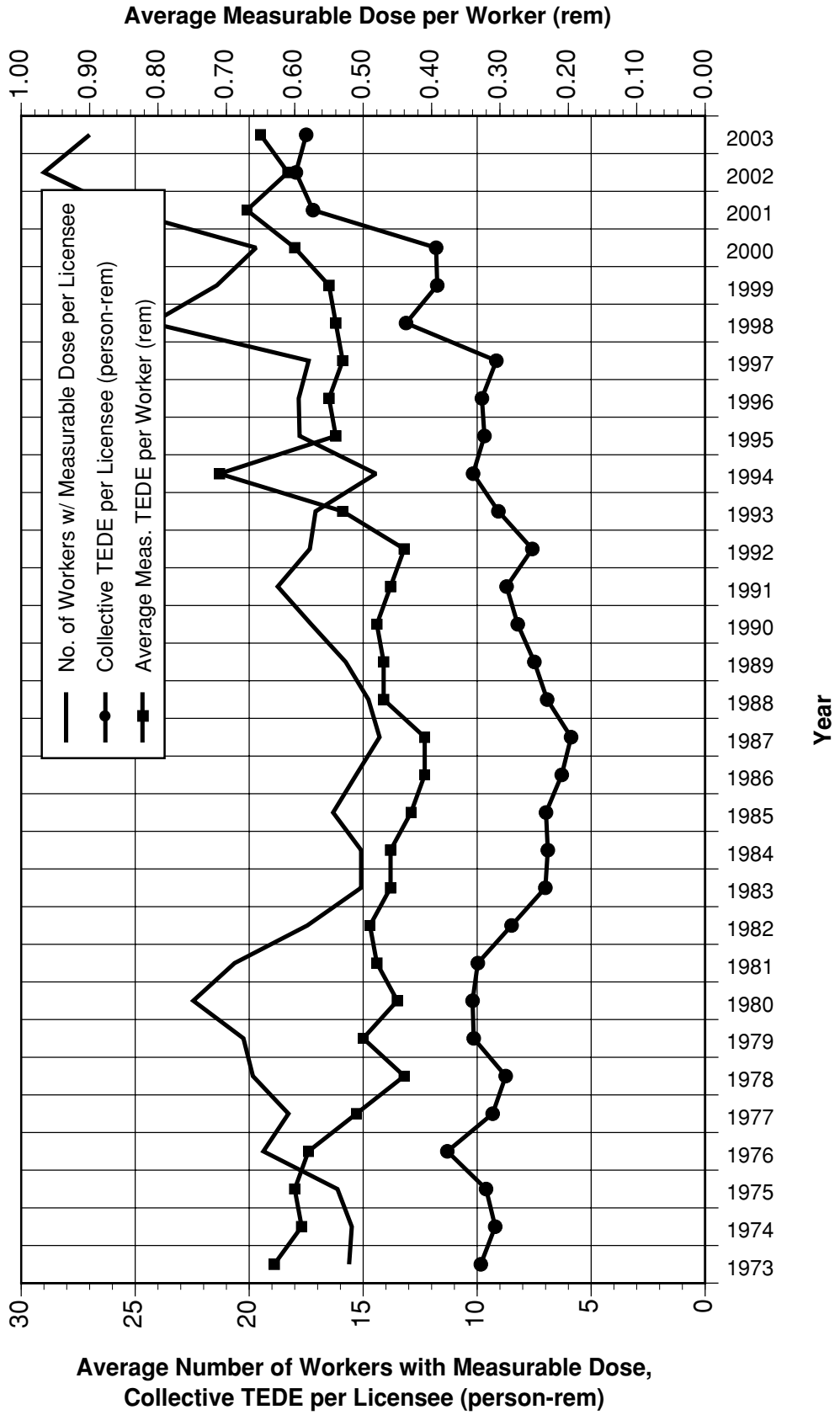

FIGURE 3.1. Average Annual Values at Industrial Radiography Facilities 1973 - 2003

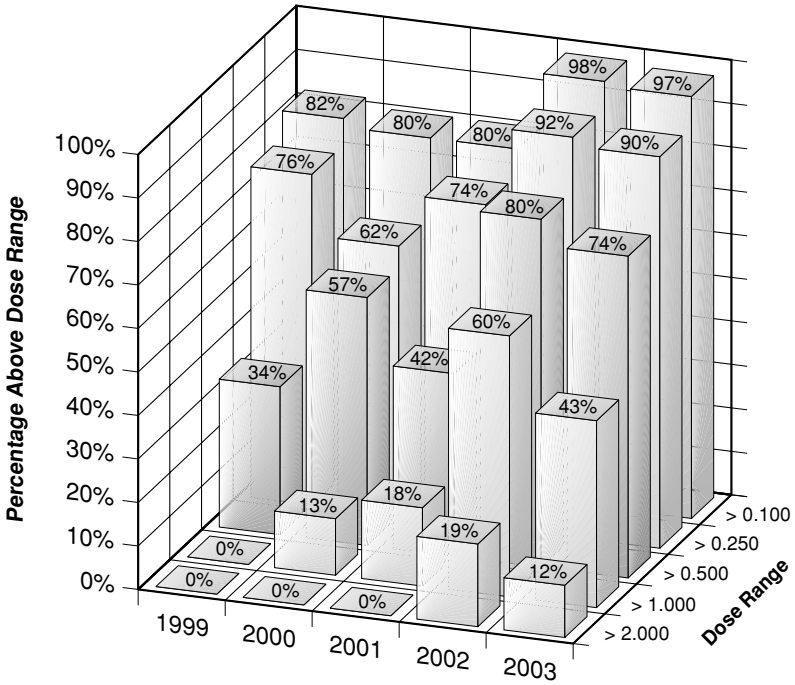

FIGURE 3.2. Collective TEDE Distribution by Dose Range
Industrial Radiographer – Single Location Licensees
1999 - 2003

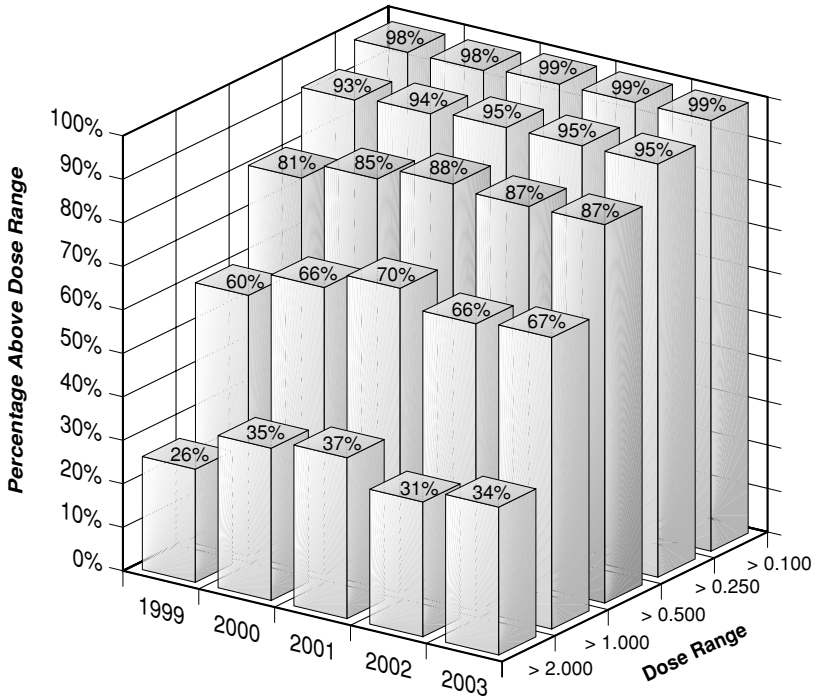

FIGURE 3.3. Collective TEDE Distribution by Dose Range
Industrial Radiographer – Multiple Location Licensees
1999 - 2003

Table 3.5 presents the annual data that were reported by the two types of licensees for 2003 and the previous 2 years. Looking at the information shown separately for the Type A Broad and Limited licensees, one can see that the values of collective and average measurable dose remain higher for the Broad licensees. However, when attempting to examine trends in the data presented for this category of licensees, it should be noted that the types and quantities of radionuclides may fluctuate from year to year, and even during the year. For this reason, some licensees may report dose data one year and not the next and may be included as a Broad licensee one year and a Limited licensee at other times. Because the number of reporting licensees is quite small, these fluctuations may have a significant impact on the values of the parameters. The number of Type A Broad licensees remained at 3 in 2003, the same as in 2002.

Figure 3.4 shows the number of workers with measurable dose per licensee, the total collective dose per licensee, and the average measurable dose per worker for both Type A Broad and Limited Manufacturing and Distribution facilities. The figures for Type A Broad licensees are primarily attributed to Mallinckrodt Medical, Inc., which accounted for 98% of the collective dose for this category of licensee in 2003. Figures 3.5 and 3.6 show the collective dose distribution by dose range (see Section 3.1.8) for Type A Broad and Limited Manufacturing and Distribution licensees. These graphs clearly show that the Type A Broad licensees consistently have individuals receiving dose in the higher dose ranges. In 1999, 64% of the collective dose was received by individuals above 2 rem. In 2003, this percentage decreased for the fourth consecutive year to 28%. Limited licensees exhibit a distribution of the collective dose where individuals below 0.50 rem receive over 50% of the collective dose. However, the percentage of the collective dose above 1 rem has been greater than or equal to 40% for the past 4 years.

TABLE 3.5
Annual Exposure Information for Manufacturers and Distributors
2001 - 2003

Year	Type of License	Number of Licensees	Number of Monitored Individuals	Workers With Measurable Dose	Collective Dose (person-rem)	Average Measurable Dose (rem)
2001	M & D - "A" - Broad	4	616	351	232	0.66
	M & D - Limited	32	1,246	860	119	0.14
	Total	**36**	**1,862**	**1,211**	**351**	**0.29**
2002	M & D - "A" - Broad	3	334	247	197	0.80
	M & D - Limited	26	1,103	805	131	0.16
	Total	**29**	**1,437**	**1,052**	**328**	**0.31**
2003	M & D - "A" - Broad	3	438	349	229	0.66
	M & D - Limited	20	1,411	1,110	165	0.15
	Total	**23**	**1,849**	**1,459**	**394**	**0.27**

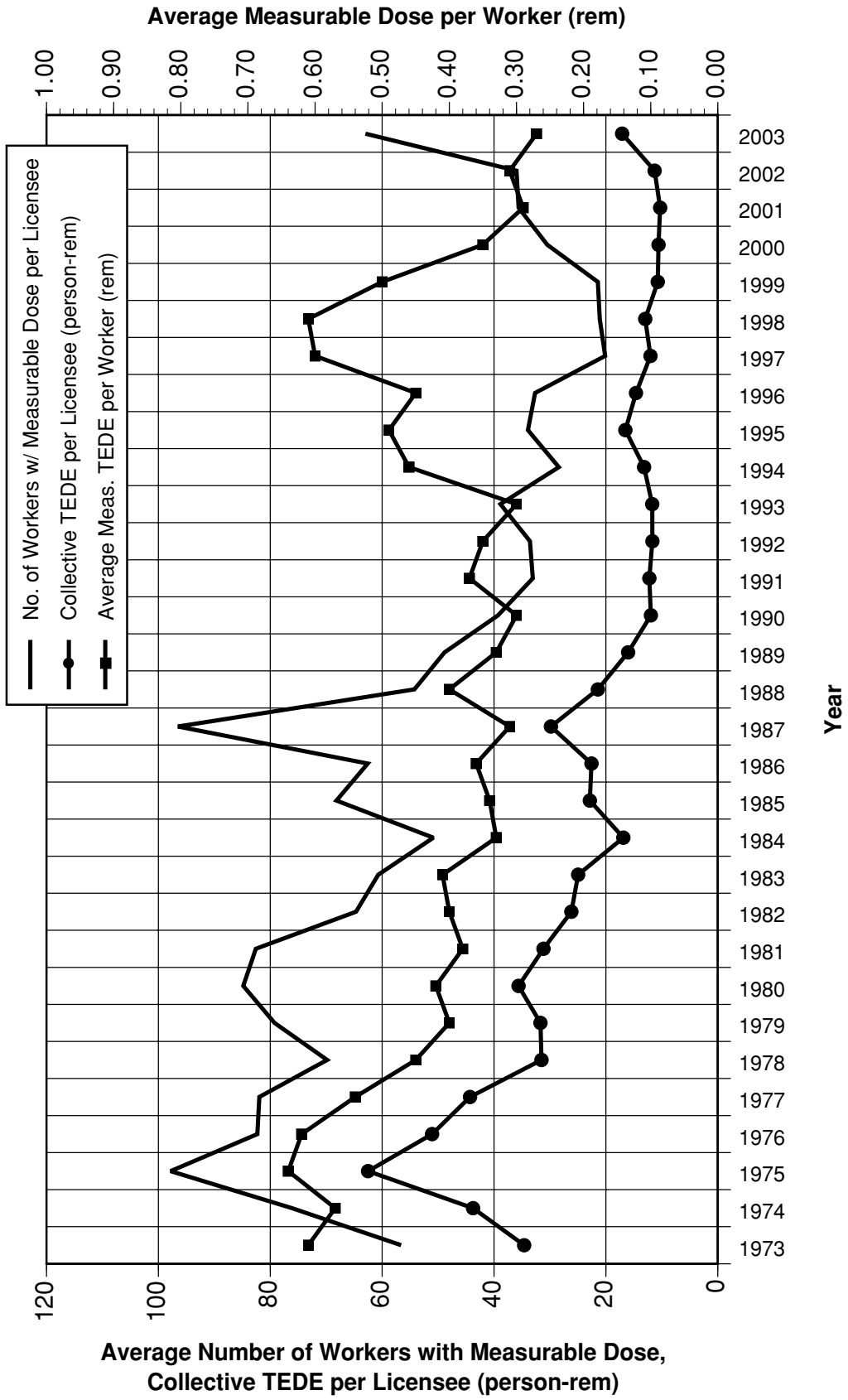

FIGURE 3.4. Average Annual Values at Manufacturing and Distribution Facilities 1973–2003

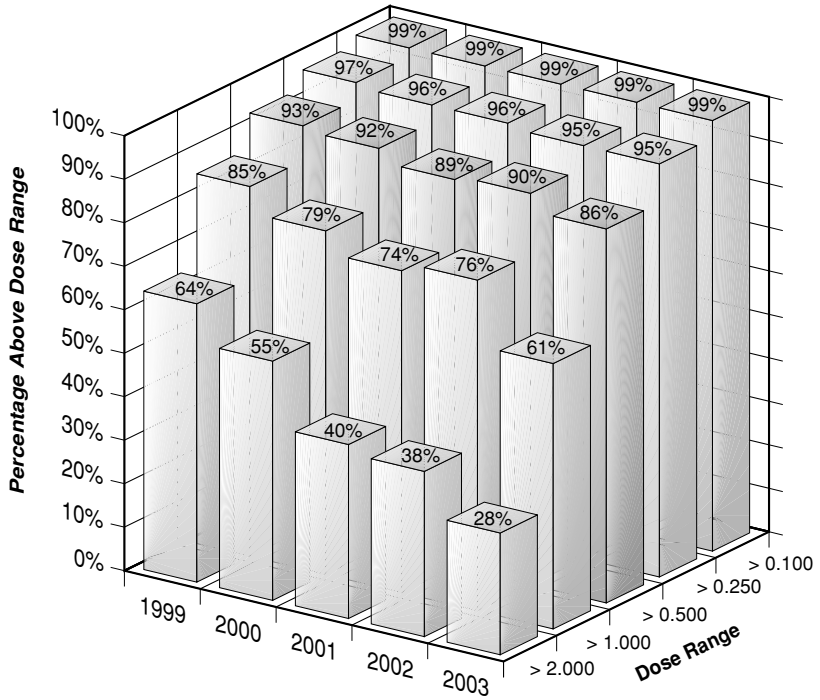

FIGURE 3.5. Collective TEDE Distribution by Dose Range
Type "A" Broad Manufacturing and Distribution Licensees
1999 - 2003

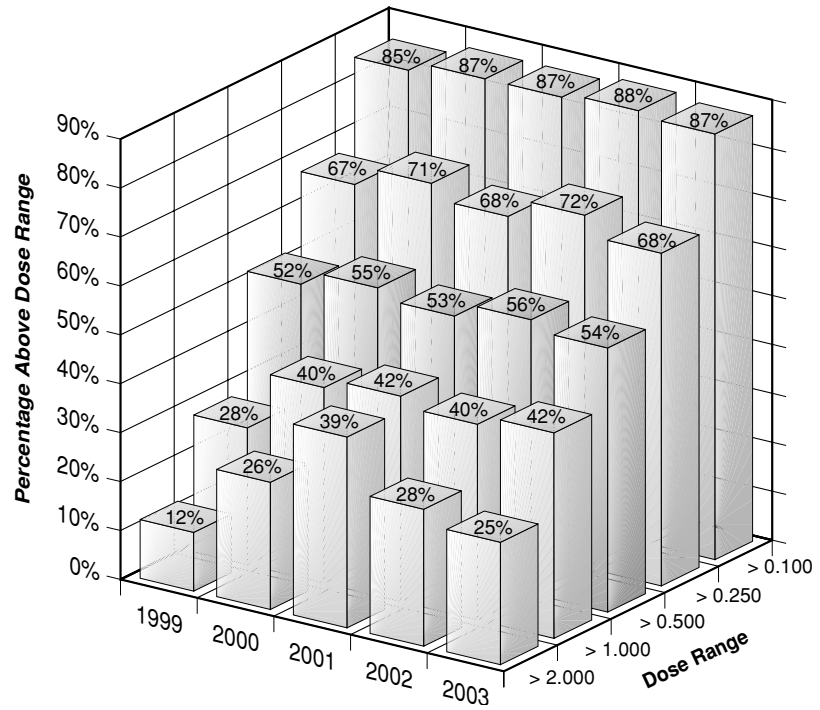

FIGURE 3.6. Collective TEDE Distribution by Dose Range
Limited Manufacturing and Distribution Licensees
1999 - 2003

Appendix A lists the contribution that each of these licensees made toward the total values of the number of workers monitored, number of workers, and collective dose for 2003.

3.3.3 Low-Level Waste Disposal Licenses

Low-Level Waste Disposal licenses are issued to allow the receipt, possession, and disposal of low-level radioactive wastes at a land disposal facility. The licensee has the appropriate facilities to receive wastes from such places as hospitals and laboratories, store them for a short time, and dispose of them in a properly prepared burial ground. The licensees in this category are located in and licensed by Agreement States which have primary regulatory authority over the licensees' activity. Since 1999, all licensees that have conducted these activities have been located in Agreement States; therefore, there are no licensees reporting radiation exposure data to REIRS. Figure 3.7 shows the number of workers with measurable dose per licensee, the total collective dose per licensee, and the average measurable dose per worker for Low-Level Waste Disposal facilities from 1982 through 1998.

3.3.4 Independent Spent Fuel Storage Installation Licenses

Independent Spent Fuel Storage Installation (ISFSI) licenses are issued to allow the possession of power reactor spent fuel and other associated radioactive materials for the purpose of storage of such fuel in an ISFSI. Here, the spent fuel, which has undergone at least 1 year of decay since being used as a source of energy in a power reactor, is provided interim storage, protection, and safeguarding for a limited time pending its ultimate disposal.

Fifty licenses were authorized to conduct these activities during 2003. Eighteen of these licenses are for activities involving cask design and storage systems. Twenty-seven are located at nuclear power plants allowing on-site temporary storage of fuel. These licensees report the dose from fuel storage activities along with the dose from reactor operations at these sites. Three additional licenses have been issued to the DOE for spent fuel storage. The two remaining licenses are located at facilities that are independent of a reactor site. One is the GE Morris facility located in Illinois. The second site was included for the first time in 1999, and is a site in Idaho operated by DOE for the storage of fuel from Three Mile Island Unit 2. Only the two sites that possess spent fuel away from a reactor site are included in the data for this licensee category in this report. Appendix A summarizes the exposure information reported by these two installations.

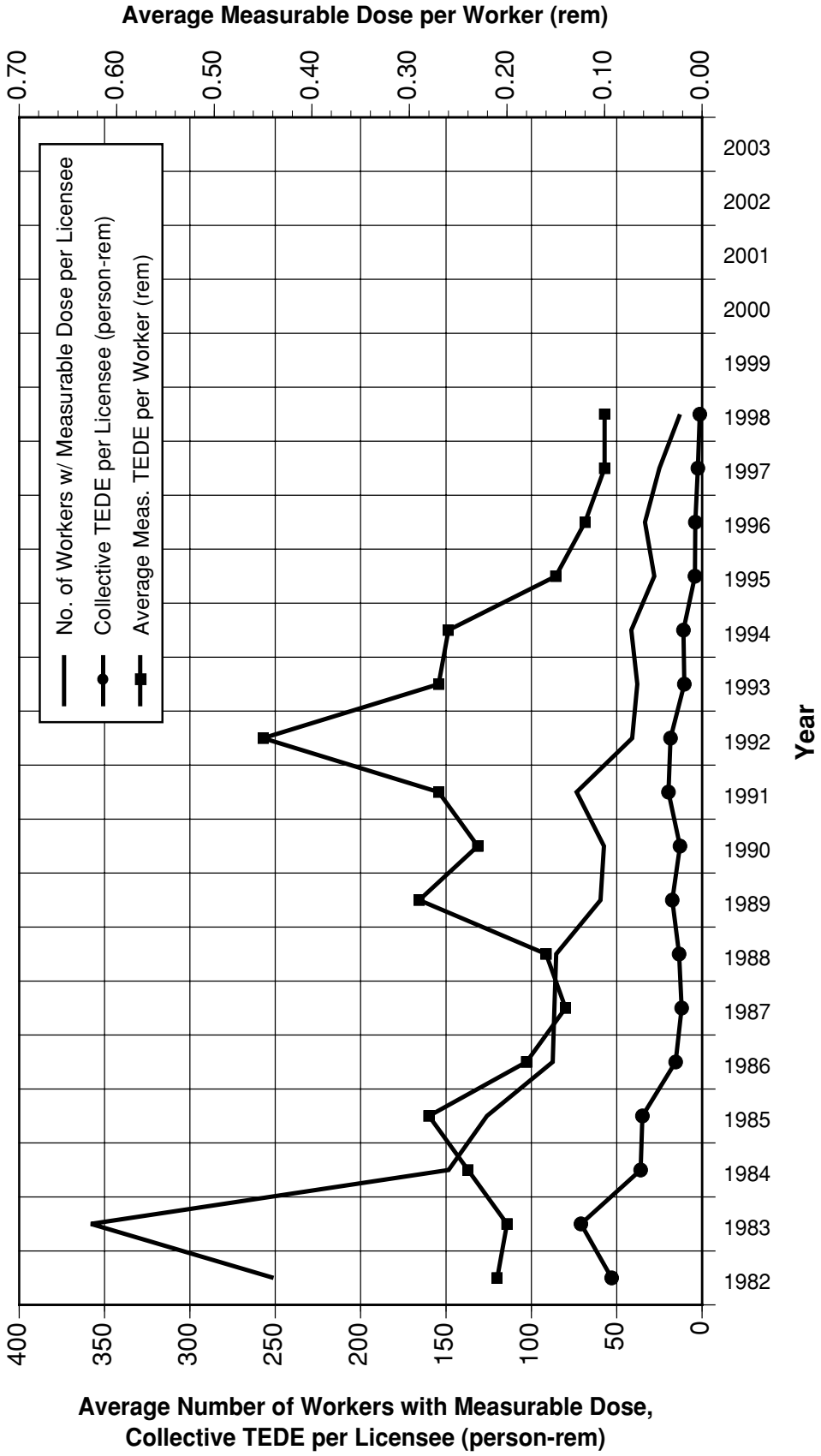

FIGURE 3.7. Average Annual Values at Low-Level Waste Disposal Facilities
1982 - 1998

Note: As of 1999, there are no longer any NRC licensees involved in this activity. All low-level waste disposal facilities are now located in Agreement States and no longer report to the NRC.

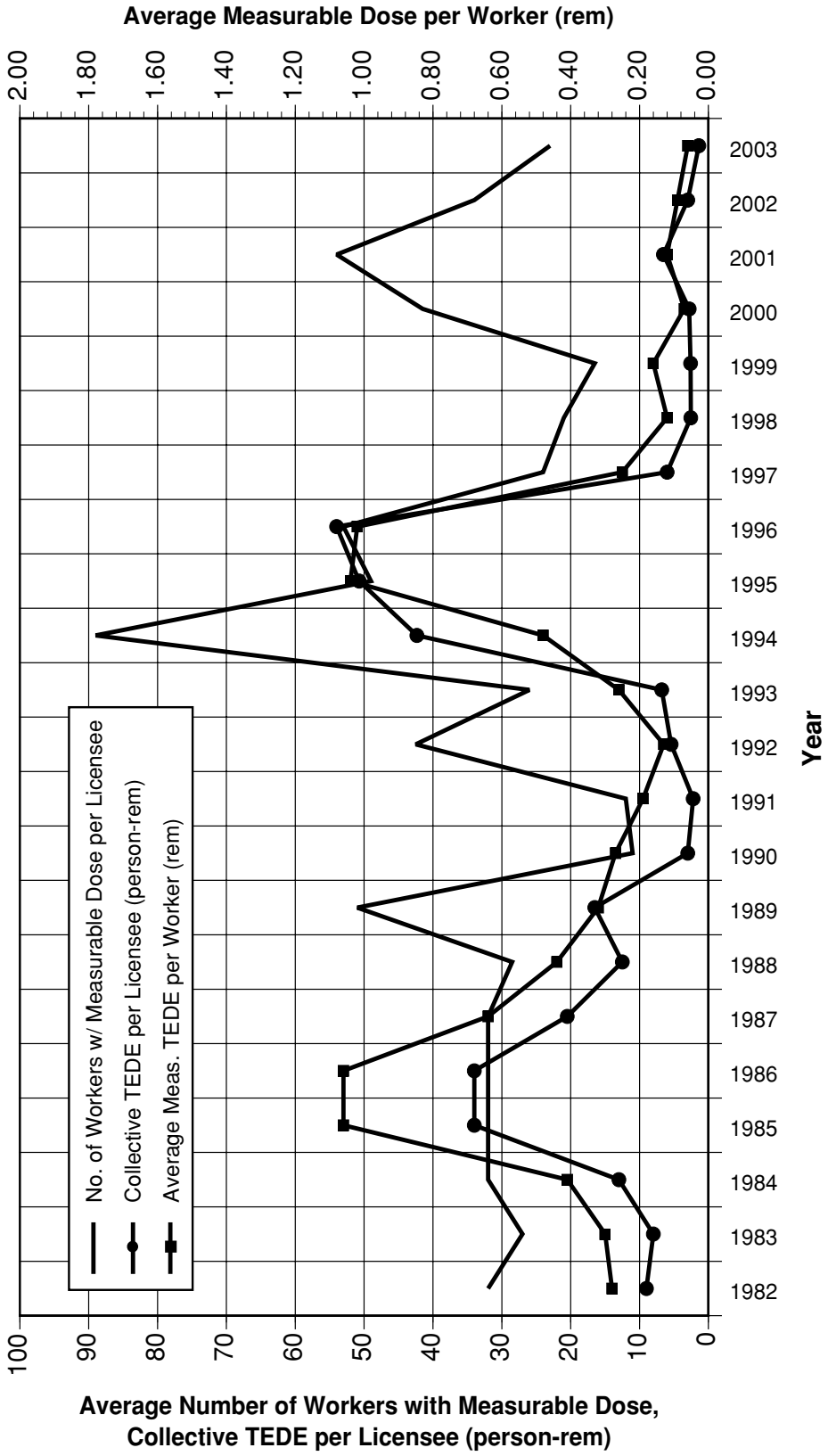

FIGURE 3.8. Average Annual Values at Independent Spent Fuel Storage Facilities 1982 - 2003

Figure 3.8 shows the number of workers with measurable dose per licensee, the total collective dose per licensee, and the average measurable dose per worker for ISFSI facilities. The large increase in the collective dose per licensee and number of workers per licensee in 1994 was mainly because only one licensee reported separately for 1994 through 1998, rather than the two licensees that reported in prior years. All parameters decreased significantly from 1996 to 1999, but increased from 2000 to 2001, and have decreased from 2001 to 2003. Figure 3.9 shows the collective dose distribution by dose range (see Section 3.1.8) for ISFSI licensees from 1999 to 2003. The percentages for each dose range have fluctuated from year to year since 1998 due to the small number of licensees involved. No individual has received a dose above 1 rem at these facilities for the past 5 years.

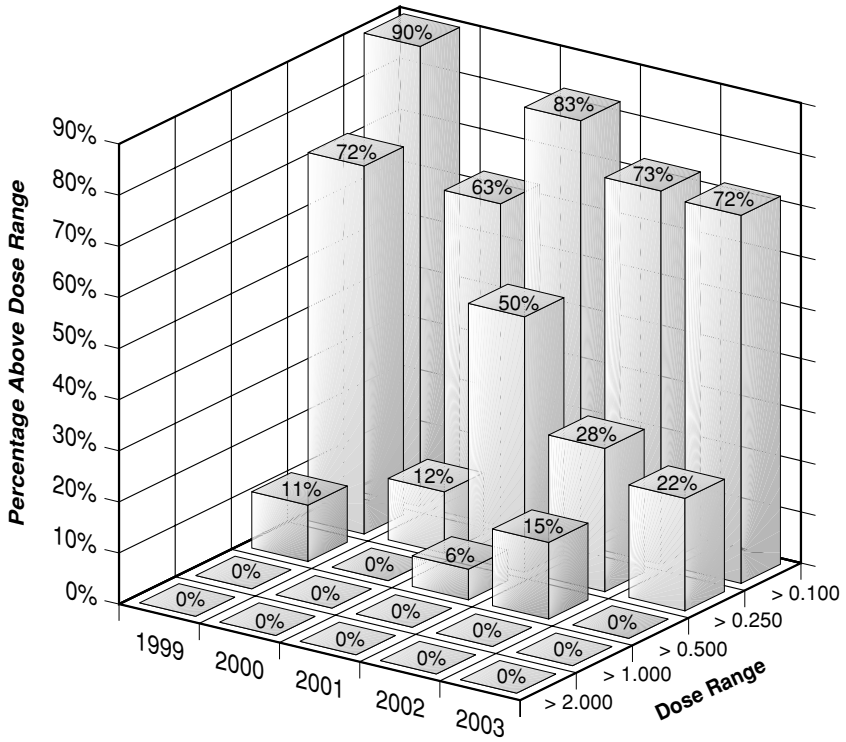

FIGURE 3.9. Collective TEDE Distribution by Dose Range
Independent Spent Fuel Storage Licensees
1999 - 2003

3.3.5 Fuel Cycle Licenses

Fuel cycle licenses are issued to allow the processing, enrichment, and fabrication of reactor fuels. In most uranium facilities where light water reactor (LWR) fuels are fabricated, enriched uranium hexafluoride is converted to solid uranium dioxide pellets and inserted into zirconium alloy tubes. The tubes are fabricated into fuel assemblies that are shipped to nuclear power plants. Some facilities also perform chemical operations to recover the uranium from scrap and other off-specification materials prior to disposal of these materials. For 1997 to 2003, this category also includes the two uranium enrichment facilities at Portsmouth, Ohio, and Paducah, Kentucky. The regulatory oversight for these facilities was transferred from DOE to the NRC in 1997.

Figure 3.10 shows the number of workers with measurable dose per licensee, the total collective dose per licensee, and the average measurable dose per worker for Fuel Cycle licensees. In addition to the TEDE collective and average measurable dose, the Deep Dose Equivalent (DDE) collective dose and DDE average measurable dose are shown. Both doses are shown since the CEDE is a significant contribution to the TEDE for Fuel Fabrication facilities. Figure 3.11 shows the collective dose distribution by dose range (see Section 3.1.8) for Fuel Cycle licensees from 1999 to 2003. The percentage of the collective dose above each dose range increased in almost every dose range from 1999 to 2001. However, from 2001 to 2003, there was a significant decrease in the percentage of the collective dose above each dose range. Most of the decrease is due to reductions in the collective dose reported by Westinghouse Electric Co., at the Commercial Nuclear Fuel Division in South Carolina. Both the external DDE and internal CEDE decreased from 2002 to 2003, with an 18% decrease in the collective CEDE at fuel cycle facilities.

Appendix A lists each of the licensees reporting in 2003, with the number of workers monitored, the number of workers receiving measurable external doses, and the collective dose for each licensee. Table 3.6 shows that there were 8 licensed Fuel Cycle (Fabrication and Enrichment) facilities reporting in 2003.

TABLE 3.6
Annual Exposure Information for Fuel Cycle Licenses
2001-2003

Year	Type of License	Number of Licensees	Number of Monitored Individuals	Workers With Meas. TEDE	Collective TEDE (person-rem)	Average Meas. TEDE (rem)	Workers With Meas. DDE	Collective DDE (person-rem)	Average Meas. DDE (rem)	Workers With Meas. CEDE	Collective CEDE (person-rem)	Average Meas. CEDE (rem)
2001	Fuel Cycle	9	8,145	3,980	1,162	0.29	3,295	362	0.11	2,577	800	0.31
2002	Fuel Cycle	8	7,937	3,886	661	0.17	3,021	296	0.10	2,404	365	0.15
2003	Fuel Cycle	8	7,738	3,633	556	0.15	2,815	258	0.09	2,255	298	0.13

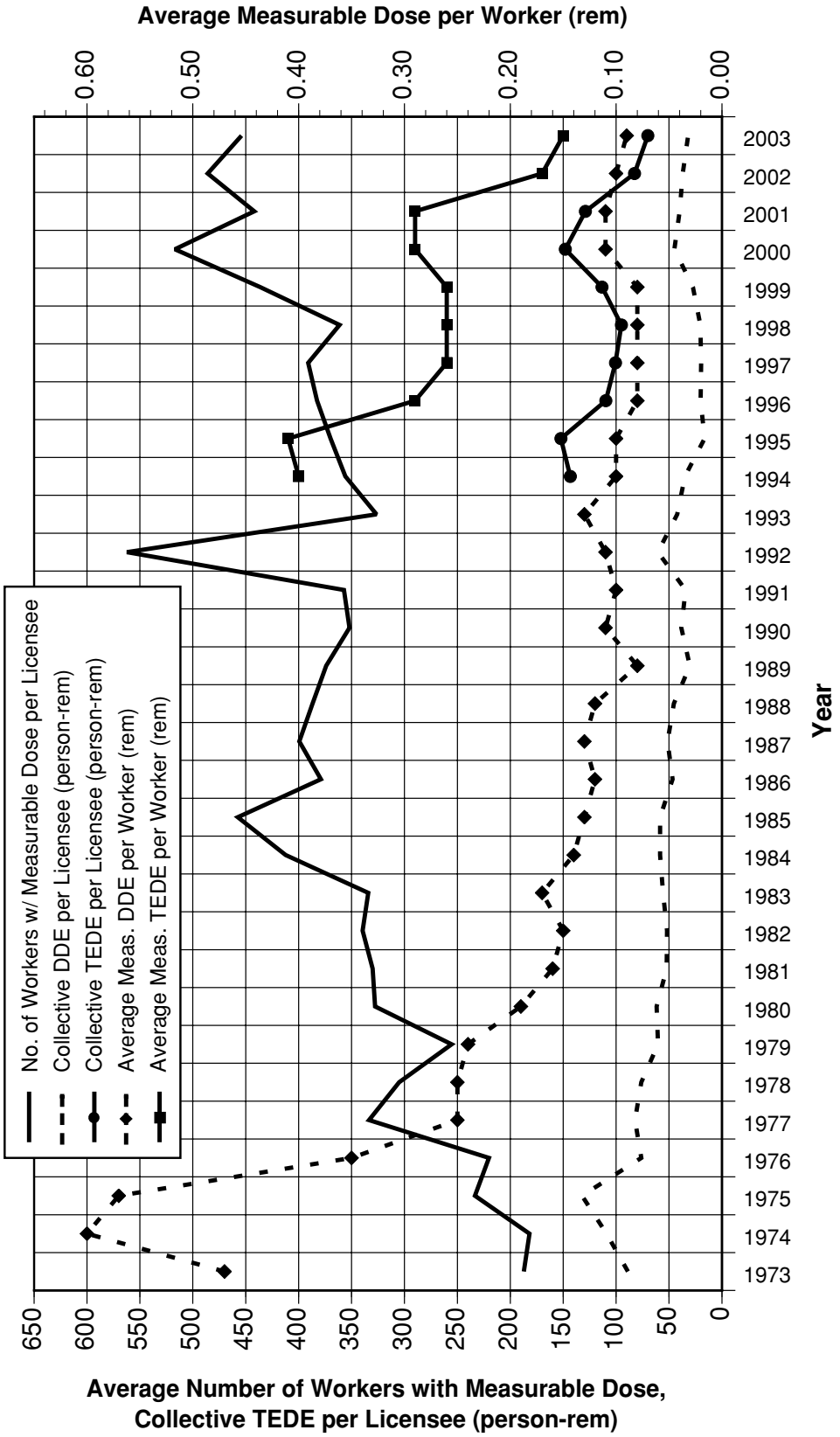

FIGURE 3.10. Average Annual Values at Fuel Cycle Licensees
1973 - 2003

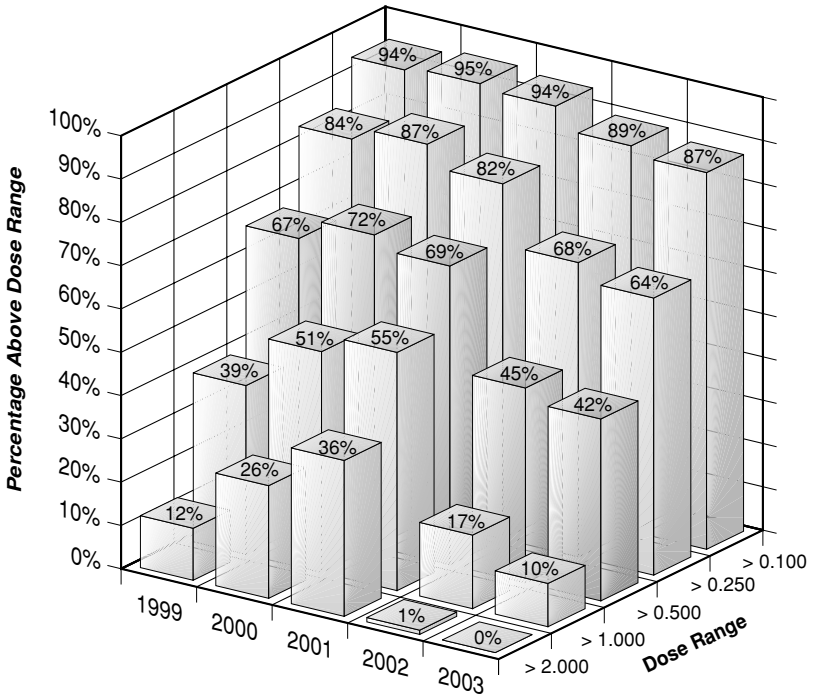

FIGURE 3.11. Collective TEDE Distribution by Dose Range
Fuel Cycle Licensees
1999 - 2003

3.3.6 Light-Water-Cooled Power Reactor Licenses

LWR licenses are issued to utilities to allow them to use special nuclear material in a reactor that produces heat to generate electricity to be sold to consumers. There are two major types of commercial LWRs in the United States – PWRs and BWRs, each of which uses water as the primary coolant.

Table 3.1 shows the number of licensees, total number of monitored workers, the number of workers with measurable dose, the total collective dose, and average dose per worker for reactor facilities that were in commercial operation for a full year for each of the years 1994 through 2003. The values do not include reactors that have been permanently shut down or were not yet in commercial operation. These figures have been adjusted for the multiple counting of transient workers (see Section 5.) The reported dose distribution of workers monitored at each plant site for the year 2003 is presented in alphabetical order by site name in Appendix B.

Figure 3.12 shows the collective dose distribution by dose range (see Section 3.1.8) for Reactor licensees from 1999 to 2003. The distribution of collective dose has been fairly constant over the past 5 years, with a slight decrease noted from 2002 to 2003 in each dose range.

More detailed presentations and analyses of the annual exposure information reported by nuclear power facilities can be found in Sections 4 and 5.

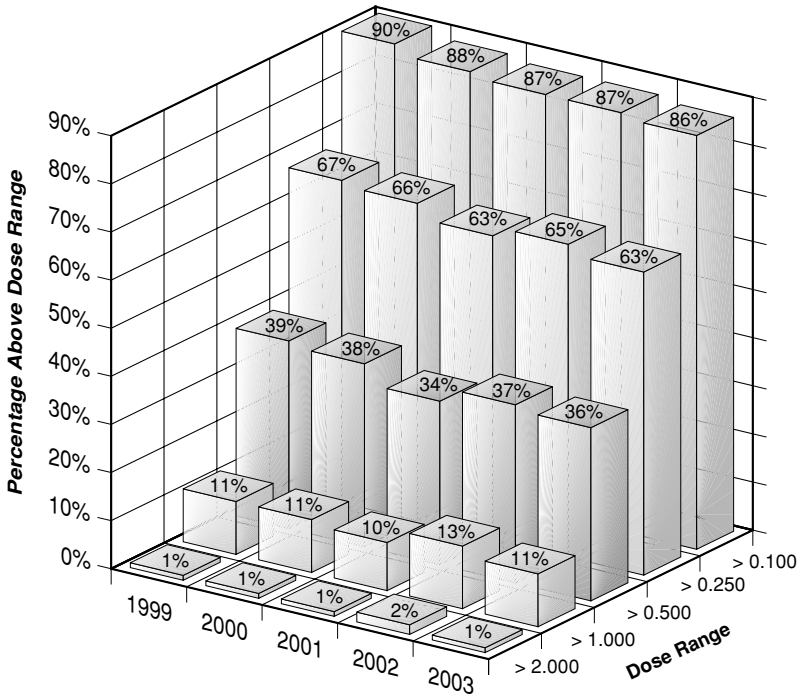

FIGURE 3.12. Collective TEDE Distribution by Dose Range
Reactor Licensees
1999 - 2003

3.4 SUMMARY OF INTAKE DATA BY LICENSE CATEGORY

10 CFR 20 requires licensees to report additional data to the NRC concerning intakes of radioactive material. Licensees are required to list for each intake the radionuclide that was taken into the body, the pulmonary clearance class, intake mode, and amount of the intake in microcuries. An NRC Form 5 report containing this information is required to be completed and submitted to the NRC under 10 CFR 20.2206.

Tables 3.7 and 3.8 summarize the intake data reported to the NRC during 2003. The data are categorized by licensee type and are listed in order of radionuclide and pulmonary clearance class. Table 3.7 lists the intakes where the mode of intake into the body was recorded as ingestion or other mode. Table 3.8 lists the intakes where the mode of intake was inhalation from ambient airborne radioactive material in the workplace. The pulmonary clearance class is recorded as D, W, or Y corresponding to its clearance half-time in the order of days, weeks, or years from the pulmonary region of the lung into the blood and gastrointestinal tract. The amount of material taken into the body is given in microcuries, a unit of measure of the quantity of radioactive material. For each category of licensee, the maximum number of intake records and the maximum intake is highlighted in the table in bold for ease of reference.

Table 3.9 lists the number of individuals with measurable CEDE, the collective CEDE, and the average measurable CEDE per individual for each licensee category. Fuel fabrication facilities have the majority of internal dose (96%) in 2003 and the highest average CEDE per individual. This is due to the worker's exposure to uranium during the processing and fabrication of the uranium fuel.

Table 3.10 shows the distribution of internal dose (CEDE) from 1994 to 2003 for licensees required to report under 10 CFR 20.2206. For the purposes of this table, the definition of a "measurable CEDE" is any reported value greater than zero. As noted above, the vast majority of the internal doses is received by individuals working at fuel fabrication facilities.

TABLE 3.7
Intake by Licensee Type and Radionuclide Mode of Intake – *Ingestion and Other*
2003

Mode	Licensee Type	Program Code	Radionuclide	Number of Intake Records*	Collective Intake in Microcuries**	Collective Intake in Microcuries (sci. notation)
Absorption	Power Reactors	41111	PU-241	1	0.000	2.59E-04
Ingestion	Power Reactors	41111	AG-110M	2	0.038	3.83E-02
		41111	AM-241	5	0.000	3.26E-05
		41111	CM-242	5	0.000	2.21E-05
		41111	CM-243	2	0.000	1.43E-05
		41111	CM-244	3	0.000	1.29E-05
		41111	CO-58	14	6.991	6.99E+00
		41111	CO-60	**19**	**9.853**	**9.85E+00**
		41111	CR-51	2	4.444	4.44E+00
		41111	CS-134	2	0.034	3.41E-02
		41111	CS-137	3	0.052	5.20E-02
		41111	FE-55	5	3.603	3.60E+00
		41111	FE-59	4	1.247	1.25E+00
		41111	MN-54	4	1.784	1.78E+00
		41111	NB-95	2	0.058	5.79E-02
		41111	NI-63	5	0.152	1.52E-01
		41111	PU-238	5	0.000	2.83E-05
		41111	PU-239	4	0.000	1.27E-05
		41111	PU-240	1	0.000	2.37E-06
		41111	PU-241	5	0.002	1.90E-03
		41111	SB-124	2	0.019	1.86E-02
		41111	SR-89	2	0.005	5.46E-03
		41111	SR-90	5	0.007	6.62E-03
		41111	SR-92	2	0.013	1.34E-02
		41111	ZN-65	3	0.626	6.26E-01
		41111	ZR-95	2	0.030	3.00E-02

* An intake event may involve multiple nuclides, and individuals may incur multiple intakes during the year. The number of intake records given here indicates the number of separate intake reports that were submitted on NRC Form 5 reports under 10 CFR 20.2206.

** A microcurie is one millionth of a Curie.

TABLE 3.8
Intake by Licensee Type and Radionuclide Mode of Intake – ***Inhalation***
2003

Licensee Type	Program Code	Radionuclide	Pulmonary Clearance Class	Number of Intake Records*	Collective Intake in Microcuries**	Collective Intake in Microcuries (sci. notation)
Radiopharmaceutical	02500	I-123	D	38	15.992	1.60E+01
	02500	I-131	D	**108**	7.515	7.52E+00
	02500	I-131	W	40	**20.632**	**2.06E+01**
Uranium Enrichment	21200	NP-237	W	3	0.000	3.46E-05
	21200	TH-230	W	8	0.000	8.17E-05
	21200	U-234	D	**34**	**0.026**	**2.57E-02**
Fuel Fabrication	21210	AM-241	W	19	0.000	5.83E-06
	21210	CO-60	Y	15	0.020	2.00E-02
	21210	PU-239	W	253	0.008	7.57E-03
	21210	PU-239	Y	1	0.000	8.30E-05
	21210	TH-228	Y	119	0.001	1.20E-03
	21210	TH-230	Y	1	0.000	0.00E+00
	21210	TH-232	Y	294	0.004	3.78E-03
	21210	U-234	D	631	0.392	3.92E-01
	21210	U-234	S	1,162	**4.631**	**4.63E+00**
	21210	U-234	W	438	0.026	2.58E-02
	21210	U-234	Y	**1,802**	2.302	2.30E+00
	21210	U-235	D	204	0.008	8.47E-03
	21210	U-235	S	623	0.161	1.61E-01
	21210	U-235	Y	362	0.020	2.02E-02
	21210	U-236	D	204	0.000	3.46E-04
	21210	U-236	S	108	0.002	1.60E-03
	21210	U-236	Y	360	0.001	8.29E-04
	21210	U-238	D	280	0.034	3.42E-02
	21210	U-238	S	484	0.487	4.87E-01
	21210	U-238	W	162	0.004	3.59E-03
	21210	U-238	Y	1,344	0.346	3.46E-01
Power Reactors	41111	AG-110M	Y	1	0.001	1.00E-03
	41111	AM-241	W	30	0.000	2.54E-04
	41111	CM-242	W	26	0.000	3.03E-04
	41111	CM-243	W	21	0.000	1.83E-04
	41111	CM-244	W	8	0.000	3.28E-05
	41111	CO-58	W	9	0.081	8.05E-02
	41111	CO-58	Y	16	11.355	1.14E+01
	41111	CO-60	Y	**75**	**38.227**	**3.82E+01**
	41111	CR-51	Y	1	0.109	1.09E-01
	41111	CS-134	D	1	0.001	8.00E-04
	41111	CS-137	D	10	0.990	9.90E-01
	41111	FE-55	W	10	4.693	4.69E+00
	41111	FE-59	W	6	0.351	3.51E-01

* An intake event may involve multiple nuclides, and individuals may incur multiple intakes during the year. The number of intake records given here indicates the number of separate intake reports that were submitted on NRC Form 5 reports under 10 CFR 20.2206.
** A microcurie is one millionth of a Curie.

TABLE 3.8 (continued)
Intake by Licensee Type and Radionuclide Mode of Intake – ***Inhalation***
2003

Licensee Type	Program Code	Radionuclide	Pulmonary Clearance Class	Number of Intake Records*	Collective Intake in Microcuries**	Collective Intake in Microcuries (sci. notation)
	41111	I-131	D	2	0.404	4.04E-01
	41111	I-131	Y	1	0.050	4.95E-02
	41111	MN-54	W	18	1.673	1.67E+00
	41111	MN-54	Y	1	0.006	5.62E-03
	41111	NB-95	Y	5	0.004	3.63E-03
	41111	NI-63	W	10	0.056	5.65E-02
	41111	PU-238	W	6	0.000	3.50E-05
	41111	PU-238	Y	24	0.000	2.27E-04
	41111	PU-239	W	3	0.000	4.75E-06
	41111	PU-239	Y	19	0.000	9.80E-05
	41111	PU-240	Y	7	0.000	1.79E-05
	41111	PU-241	W	10	0.003	2.88E-03
	41111	PU-241	Y	16	0.003	3.36E-03
	41111	SB-124	W	5	0.001	1.35E-03
	41111	SB-125	W	4	0.004	4.06E-03
	41111	SR-89	Y	6	0.013	1.29E-02
	41111	SR-90	Y	11	0.010	1.04E-02
	41111	SR-92	Y	1	0.000	3.00E-04
	41111	ZN-65	Y	12	2.113	2.11E+00
	41111	ZR-95	Y	1	0.001	7.00E-04

* An intake event may involve multiple nuclides, and individuals may incur multiple intakes during the year. The number of intake records given here indicates the number of separate intake reports that were submitted on NRC Form 5 reports under 10 CFR 20.2206.
** A microcurie is one millionth of a Curie.

TABLE 3.9
Collective and Average CEDE by Licensee
2003

Licensee Type	Licensee Name	License Number	Number with Meas. CEDE	Collective CEDE (person-rem)	Average Meas. CEDE (rem)
Nuclear Pharmacies	MALLINCKRODT INC.	24-04206-00MD	1	0.019	0.019
02500	EASTERN ISOTOPES, INC.	45-25221-01MD	37	0.972	0.026
	SYNCOR INTERNATIONAL CORP.	04-26507-01MD	**63**	**4.146**	**0.066**
		Total	**101**	**5.137**	**0.051**
Uranium Enrichment	U. S. ENRICHMENT CORP. - PADUCAH	GDP-1	**16**	**0.077**	**0.005**
21200	U. S. ENRICHMENT CORP. - PORTSMOUTH	GDP-2	8	0.040	**0.005**
		Total	**24**	**0.117**	**0.005**
Fuel Fabrication	FRAMATOME ANP, INC.	SNM-1168	44	3.242	0.074
21210	FRAMATOME ANP, INC.	SNM-1227	298	64.119	0.215
	BABCOCK & WILCOX CO.	SNM-0042	246	29.161	0.119
	NUCLEAR FUEL SERVICES, INC.	SNM-0124	**763**	56.292	0.074
	WESTINGHOUSE ELECTRIC COMPANY LLC	SNM-1107	376	**99.484**	**0.265**
	GLOBAL NUCLEAR FUEL - AMERICAS, LLC	SNM-1097	504	45.411	0.090
		Total	**2,231**	**297.709**	**0.133**
Power Reactors	BIG ROCK POINT	DPR-06	6	0.131	0.022
41111	BROWNS FERRY	DPR-33	169	1.187	0.007
	BRUNSWICK	DPR-62	3	0.045	0.015
	CALVERT CLIFFS	DPR-53	5	0.073	0.015
	COLUMBIA GENERATING	NPF-21	2	0.038	0.019
	COOK	DPR-58	19	0.101	0.005
	DAVIS-BESSE	NPF-03	2	0.064	0.032
	DIABLO CANYON	DPR-80	5	0.095	0.019
	DRESDEN	DPR-19	2	0.035	0.018
	FARLEY	NPF-02	5	0.117	0.023
	HADDAM NECK	DPR-61	12	0.119	0.010
	HUMBOLDT BAY	DPR-07	2	0.052	0.026
	LASALLE	NPF-11	4	0.061	0.015
	LIMERICK	NPF-39	14	0.038	0.003
	MAINE YANKEE	DPR-36	1	0.007	0.007
	MILLSTONE 1	DPR-21	5	0.117	0.023
	MONTICELLO	DPR-22	1	0.007	0.007
	NINE MILE POINT	DPR-63	2	0.021	0.011
	NORTH ANNA	NPF-04	2	0.008	0.004
	OCONEE	DPR-38	7	0.148	0.021
	OYSTER CREEK	DPR-16	1	0.013	0.013
	PALISADES	DPR-20	18	0.301	0.017
	PALO VERDE	NPF-41	2	0.057	0.029
	PEACH BOTTOM	DPR-44	4	0.083	0.021
	PERRY	NPF-58	2	0.130	**0.065**
	PILGRIM	DPR-35	13	0.039	0.003
	QUAD CITIES	DPR-29	7	0.175	0.025
	RIVER BEND	NPF-47	5	0.143	0.029
	SAN ONOFRE	DPR-13	7	0.022	0.003
	SEQUOYAH	DPR-77	**840**	**3.659**	0.004
	ST. LUCIE	DPR-67	8	0.022	0.003
	SUMMER	NPF-12	1	0.008	0.008
	SUSQUEHANNA	NPF-14	51	0.092	0.002
	TURKEY POINT	DPR-31	1	0.003	0.003
	VERMONT YANKEE	DPR-28	1	0.010	0.010
	WATTS BAR	NPF-90	302	1.431	0.005
	WOLF CREEK	NPF-42	6	0.026	0.004
		Total	**1,537**	**8.678**	**0.006**
Grand Totals			**3,893**	**311.641**	**0.080**

TABLE 3.10
Internal Dose (CEDE) Distribution
1994 - 2003

Year	Number of Individuals with CEDE in the Ranges (rem)										Total with Meas. CEDE	Collective CEDE (person-rem)	Average Meas. CEDE (rem)
	Meas. 0.020	0.020 - 0.100	0.100 - 0.250	0.250 - 0.500	0.500 - 0.750	0.750 - 1.000	1 - 2	2 - 3	3 - 4	4 - 5			
1994	3,425	577	287	351	196	138	293	69	2	-	5,338	1,033.688	0.194
1995	2,868	691	338	362	216	145	288	49	2	-	4,959	1,019.045	0.205
1996	3,096	598	305	317	190	121	185	22	2	2	4,838	741.373	0.153
1997	3,835	869	381	366	242	148	169	30	-	-	6,040	826.280	0.137
1998	3,310	932	426	355	230	140	153	21	2	-	5,569	779.148	0.140
1999	3,399	630	402	425	206	117	173	29	-	-	5,381	792.586	0.147
2000	3,248	891	514	373	214	98	224	58	7	1	5,628	969.792	0.172
2001	1,767	766	572	277	109	51	146	82	15	1	3,786	810.128	0.214
2002	1,759	739	555	370	95	20	23	3	-	-	3,564	377.016	0.106
2003	2,208	727	572	271	98	13	4	-	-	-	3,893	311.641	0.080

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Section 4

COMMERCIAL LIGHT WATER REACTORS – FURTHER ANALYSIS

4.1 INTRODUCTION

General trends in occupational radiation exposures at nuclear power reactors are best evaluated within the context of other pertinent information. In this chapter, some of the tables and appendices that summarize exposure data also show the type, capacity, amount of electricity generated, and age of the reactor. Exposure data are then presented as a function of these data.

4.2 DEFINITION OF TERMS AND SOURCES OF DATA

4.2.1 Number of Reactors

The *number of reactors* shown in Tables 4.1, 4.2, and 4.3 is the number of BWRs, PWRs, and LWRs, respectively, that had been in commercial operation for at least 1 full year as of December 31 of each of the indicated years. This is the number of reactors on which the *average number of workers with measurable dose* and *average collective dose per reactor* is based. Excluded are reactors that have been in commercial operation for less than 12 months during the first year and reactors that have been permanently defueled. This yields conservative values for many of the averages shown in the tables. The date that each reactor was declared to be in commercial operation was taken from Ref. 12.

Three Mile Island (TMI) 2 was included in the compilation of data for commercially operating reactors through 1988, even though the reactor was shut down following the 1979 accident, since TMI 2 was in the process of defueling and decommissioning during those years. TMI 2 has not been included in the data analysis since 1988. Data for this reactor, however, will be listed in Appendix B for reference purposes. The dose data presented in Appendix D for TMI includes the dose data for Unit 2 prior to 1986.

There were no changes to the count of operating reactors in 2003. The number of operating BWRs remains the same as in 2002 at 35 and the number of operating PWRs remains the same at 69. The dose information for these reactors and others that are no longer in commercial operation is listed at the end of Appendix B.

4.2.2 Electric Energy Generated

The electric energy generated in megawatt years (MW-yr) each year by each reactor is graphically represented in Appendix D. This number was obtained by dividing the megawatt hours of electricity annually produced by each facility by 8,760, the number of hours in the year, except for leap years, when the number is 8,784 hours. For the years 1973 to 1996, the electricity generated is the gross electricity output of the reactor. For 1997 to 2003, the

TABLE 4.1
Summary of Information Reported by Commercial Boiling Water Reactors 1973 - 2003

Year	Number of Reactors Included*	Annual Collective Dose (person-rem)	No. of Workers With Measurable Dose**	Electricity Generated*** (MW-yrs)	Average Measurable Dose Per Worker (rem)**	Average Collective Dose Per Reactor (person-rem)	Average No. Personnel With Measurable Doses Per Reactor**	Average Collective Dose per MW-yr (person-rem/ MW-yr)	Average Electricity Generated Per Reactor (MW-yr)	Average Maximum Dependable capacity Net (MWe)	Percent of Maximum Dependable Capacity Achieved
1973	12	4,564	5,340	3,393.9	0.86	380	445	1.35	283	438	65%
1974	14	7,095	8,769	4,060.2	0.81	507	626	1.75	290	485	60%
1975	18	12,633	17,350	5,786.4	0.73	702	964	2.18	321	595	54%
1976	22	12,298	16,927	8,137.9	0.73	559	769	1.51	370	630	59%
1977	23	19,054	21,515	9,102.5	0.89	828	935	2.09	396	637	62%
1978	25	15,257	20,381	11,856.0	0.75	610	815	1.29	474	660	72%
1979	25	18,251	25,425	11,671.0	0.72	730	1,017	1.56	467	660	71%
1980	26	29,472	34,220	10,868.2	0.86	1,134	1,316	2.71	418	663	63%
1981	26	25,490	34,873	10,899.2	0.73	980	1,341	2.34	419	663	63%
1982	26	24,447	32,318	10,614.6	0.76	940	1,243	2.30	408	663	62%
1983	26	27,467	33,581	9,730.1	0.82	1,056	1,292	2.82	374	663	56%
1984	27	27,111	41,315	10,019.2	0.66	1,004	1,530	2.71	371	754	49%
1985	29	20,578	38,336	12,284.0	0.54	710	1,322	1.68	424	775	55%
1986	30	19,353	37,999	12,102.1	0.51	645	1,267	1.60	403	786	51%
1987	32	16,722	41,806	15,109.0	0.40	523	1,306	1.11	472	832	57%
1988	34	17,986	40,371	16,665.4	0.45	529	1,187	1.08	490	845	58%
1989	36	15,550	44,384	17,543.5	0.35	432	1,233	0.89	487	857	57%
1990	37	15,781	41,585	21,336.1	0.38	427	1,124	0.74	577	862	67%
1991	37	12,007	38,508	21,505.8	0.31	325	1,041	0.56	581	860	68%
1992	37	13,312	42,107	20,592.2	0.32	360	1,138	0.65	557	859	65%
1993	37	12,221	39,352	21,995.6	0.31	330	1,064	0.56	594	798	74%
1994	37	12,098	39,171	22,139.0	0.31	327	1,059	0.55	598	801	75%
1995	37	9,471	35,686	24,737.0	0.27	256	964	0.38	669	835	80%
1996	37	9,466	37,792	24,322.2	0.25	256	1,021	0.39	657	838	78%
1997	37	7,603	34,021	22,866.1	0.22	205	919	0.33	618	845	73%
1998	36	6,829	32,899	23,781.2	0.21	190	914	0.29	661	874	76%
1999	35	6,434	31,482	26,962.6	0.20	184	899	0.24	770	885	87%
2000	35	6,090	31,186	28,476.9	0.20	174	891	0.21	814	893	91%
2001	35	4,835	28,797	28,730.4	0.17	138	823	0.17	821	895	92%
2002	35	6,108	30,978	29,460.0	0.20	175	885	0.21	842	907	93%
2003	35	5,659	30,759	29,094.4	0.18	162	879	0.19	831	912	91%

* Includes only those reactors that had been in commercial operation for at least one full year as of December 31 of each of the indicated years.
** Figures are not adjusted for the multiple reporting of transient individuals. See Section 5.
*** Electricity Generated reflects the gross electricity generated for the years 1973 - 1996. Beginning in 1997, it reflects the net electricity generated.

TABLE 4.2
Summary of Information Reported by Commercial Pressurized Water Reactors 1973 - 2003

Year	Number of Reactors Included*	Annual Collective Dose (person-rem)	No. of Workers With Measurable Dose**	Electricity Generated*** (MW-yrs)	Average Measurable Dose Per Worker (rem)**	Average Collective Dose Per Reactor (person-rem)	Average No. Personnel With Measurable Doses Per Reactor**	Average Collective Dose per MW-yr (person-rem/ MW-yr)	Average Electricity Generated Per Reactor (MW-yr)	Average Maximum Dependable capacity Net (MWe)	Percent of Maximum Dependable Capacity Achieved
1973	12	9,398	9,440	3,770.2	1.00	783	787	2.49	314	544	58%
1974	19	6,555	9,370	6,530.7	0.70	345	493	1.00	344	591	58%
1975	26	8,268	10,884	11,982.5	0.76	318	419	0.69	461	647	71%
1976	30	13,807	17,588	13,325.0	0.79	460	586	1.04	444	701	63%
1977	34	13,467	20,878	17,345.8	0.65	396	614	0.78	510	688	74%
1978	39	16,528	25,700	19,840.5	0.64	424	659	0.83	509	706	72%
1979	42	21,657	38,828	18,255.0	0.56	516	924	1.19	435	746	58%
1980	42	24,267	46,237	18,289.3	0.53	578	1,101	1.33	435	746	58%
1981	44	28,673	47,351	20,553.7	0.61	652	1,076	1.40	467	752	62%
1982	48	27,754	52,149	22,140.6	0.53	578	1,086	1.25	461	777	59%
1983	49	29,017	52,170	23,195.5	0.56	592	1,065	1.25	473	785	60%
1984	51	28,140	56,994	26,478.4	0.49	552	1,118	1.06	519	809	64%
1985	53	22,470	54,632	29,470.7	0.41	424	1,031	0.76	556	820	68%
1986	60	23,033	62,998	33,593.0	0.37	384	1,050	0.69	560	878	64%
1987	64	23,684	62,597	37,007.3	0.38	370	978	0.64	578	900	64%
1988	68	22,786	62,923	42,929.7	0.36	335	925	0.53	631	885	71%
1989	71	20,381	63,894	44,679.5	0.32	287	900	0.46	629	897	70%
1990	73	20,821	67,082	46,955.6	0.31	285	919	0.44	643	907	71%
1991	74	16,512	60,274	51,942.6	0.27	223	815	0.32	702	913	77%
1992	73	15,985	61,048	53,419.8	0.26	219	836	0.30	732	923	79%
1993	69	13,376	54,397	48,709.3	0.25	194	788	0.28	706	941	75%
1994	70	9,574	44,283	52,397.6	0.22	137	633	0.18	749	928	81%
1995	70	11,762	49,985	54,138.2	0.24	168	714	0.22	773	929	83%
1996	72	9,417	46,852	55,337.8	0.20	131	651	0.17	769	935	82%
1997	72	9,546	50,690	48,985.3	0.19	133	704	0.20	680	943	72%
1998	69	6,358	38,586	53,288.7	0.17	92	559	0.12	772	942	82%
1999	69	7,231	43,938	56,235.0	0.17	105	637	0.13	815	942	86%
2000	69	6,562	42,922	57,529.9	0.15	95	622	0.11	834	943	88%
2001	69	6,273	38,773	58,822.4	0.16	91	562	0.11	852	946	90%
2002	69	6,018	42,264	59,369.7	0.14	87	613	0.10	860	947	91%
2003	69	6,296	44,054	57,920.6	0.14	91	638	0.11	839	949	88%

* Includes only those reactors that had been in commercial operation for at least one full year as of December 31 of each of the indicated years.
** Figures are not adjusted for the multiple reporting of transient individuals. See Section 5.
*** Electricity Generated reflects the gross electricity generated for the years 1973 - 1996. Beginning in 1997, it reflects the net electricity generated.

TABLE 4.3
Summary of Information Reported by Commercial Light Water Reactors 1973 - 2003

Year	Number of Reactors Included*	Annual Collective Dose (person-rem)	No. of Workers With Measurable Dose**	Electricity Generated*** (MW-yrs)	Average Measurable Dose Per Worker (rem)**	Average Collective Dose Per Reactor (person-rem)	Average No. Personnel With Measurable Doses Per Reactor**	Average Collective Dose per MW-yr (person-rem/ MW-yr)	Average Electricity Generated Per Reactor (MW-yr)	Average Maximum Dependable capacity Net (MWe)	Percent of Maximum Dependable Capacity Achieved
1973	24	13,962	14,780	7,164.1	0.95	582	616	1.95	299	491	61%
1974	33	13,650	18,139	10,590.9	0.75	414	550	1.29	321	546	59%
1975	44	20,901	28,234	17,768.9	0.74	475	642	1.18	404	626	65%
1976	52	26,105	34,515	21,462.9	0.76	502	664	1.22	413	671	62%
1977	57	32,521	42,393	26,448.3	0.77	571	744	1.23	464	667	70%
1978	64	31,785	46,081	31,696.5	0.69	497	720	1.00	495	688	72%
1979	67	39,908	64,253	29,926.0	0.62	596	959	1.33	447	714	63%
1980	68	53,739	80,457	29,157.5	0.67	790	1,183	1.84	429	714	60%
1981	70	54,163	82,224	31,452.9	0.66	774	1,175	1.72	449	719	63%
1982	74	52,201	84,467	32,755.2	0.62	705	1,141	1.59	443	737	60%
1983	75	56,484	85,751	32,925.6	0.66	753	1,143	1.72	439	743	59%
1984	78	55,251	98,309	36,497.6	0.56	708	1,260	1.51	468	790	59%
1985	82	43,048	92,968	41,754.7	0.46	525	1,134	1.03	509	804	63%
1986	90	42,386	100,997	45,695.1	0.42	471	1,122	0.93	508	847	60%
1987	96	40,406	104,403	52,116.3	0.39	421	1,088	0.78	543	877	62%
1988	102	40,772	103,294	59,595.1	0.40	400	1,013	0.68	584	871	67%
1989	107	35,931	108,278	62,223.0	0.33	336	1,012	0.58	582	883	66%
1990	110	36,602	108,667	68,291.7	0.34	333	988	0.54	621	892	70%
1991	111	28,519	98,782	73,448.4	0.29	257	890	0.39	662	895	74%
1992	110	29,297	103,155	74,012.0	0.28	266	938	0.40	673	901	75%
1993	106	25,597	93,749	70,704.9	0.27	241	884	0.36	667	891	75%
1994	107	21,672	83,454	74,536.6	0.26	203	780	0.29	697	884	79%
1995	107	21,233	85,671	78,875.2	0.25	198	801	0.27	737	896	82%
1996	109	18,883	84,644	79,660.0	0.22	173	777	0.24	731	902	81%
1997	109	17,149	84,711	71,851.4	0.20	157	777	0.24	659	910	72%
1998	105	13,187	71,485	77,069.9	0.18	126	681	0.17	734	918	80%
1999	104	13,666	75,420	83,197.6	0.18	131	725	0.16	800	923	87%
2000	104	12,652	74,108	86,006.8	0.17	122	713	0.15	827	926	89%
2001	104	11,109	67,570	87,552.8	0.16	107	650	0.13	842	929	91%
2002	104	12,126	73,242	88,829.7	0.17	117	704	0.14	854	934	91%
2003	104	11,956	74,813	87,015.0	0.16	115	719	0.14	837	936	89%

* Includes only those reactors that had been in commercial operation for at least one full year as of December 31 of each of the indicated years.
** Figures are not adjusted for the multiple reporting of transient individuals. See Section 5.
*** Electricity Generated reflects the gross electricity generated for the years 1973 - 1996. Beginning in 1997, it reflects the net electricity generated.

number reflects the net electricity produced, which is the gross electricity minus the amount the plant uses for operations. This change is the result of a change in NRC power generation reporting requirements. The electricity generated (in MW-yrs) that is presented in Tables 4.1, 4.2, and 4.3 is the summation of electricity generated by the number of reactors included in each year. These sums are divided by the number of operating reactors included in each year to yield the average amount of electric energy generated per reactor, which is also shown in Tables 4.1, 4.2, and 4.3. The number of megawatt hours of electricity produced each year was obtained from Ref. 12.

As shown in Table 4.3, there was a 2% decrease in the net electricity generated at LWRs in 2003. Contributors to the decrease included Sequoyah, South Texas, and Surry, which all had decreases of over 300 MW-yrs from 2002 to 2003. BWRs decreased net electricity generated by 1%. PWRs decreased net electric output by 2%.

4.2.3 Collective Dose per Megawatt-Year

The number of MW-yrs of electricity generated was used in determining the ratio of the average value of the annual collective dose (TEDE) to the number of MW-yrs of electricity generated. The ratio was calculated by dividing the total collective dose in person-rem by the electric energy generated in MW-yrs and is a measure of the dose incurred by workers at power plants in relation to the electric energy produced. For the years 1973 to 1996, the electricity generated is the gross electricity output of the reactor. For 1997 to 2003, the number reflects the net electricity produced. This ratio, calculated by year for BWRs, PWRs, and LWRs, is presented in Tables 4.1, 4.2, and 4.3. This ratio was also calculated for each reactor site (see Appendix C). The average collective dose per MW-yr for LWRs remained at a value of 0.14 in 2003.

4.2.4 Average Maximum Dependable Capacity

Average maximum dependable capacity as shown in Tables 4.1, 4.2, and 4.3 was found by dividing the sum of the net maximum dependable capacities of the reactors in megawatts (net MWe) by the number of reactors included each year. The net maximum dependable capacity is defined as the gross electrical output as measured at the output terminals of the turbine generator during the most restrictive seasonal conditions, less the normal station service loads. This “capacity” of each plant was found in Ref. 12.

4.2.5 Percent of Maximum Dependable Capacity Achieved

The percent of maximum dependable capacity achieved is shown for all LWRs in Table 4.3. This parameter gives an indication of the overall power generation performance of LWRs as compared to the maximum dependable capacity that could be obtained in a given year. It is calculated by dividing the average electricity generated per reactor by the average maximum dependable capacity for each year.

From 1973 to 1978 this indicator exhibited an increasing trend as a number of new reactors began producing power at higher efficiencies. Following the accident at TMI, reactor operations personnel concentrated on improving safety systems and complying with the new regulations for these systems. During this time period, from 1979 to 1987, the percent of maximum dependable capacity remained around 61%. Following the completion of most of these mandated repairs, reactors have increased the percent of maximum dependable capacity from 62% in 1987 to 81% in 1996, a gain of nearly 20% in 10 years. The decrease in maximum dependable capacity from 1996 to 1997 was due to the change from measuring the gross electricity generated to the net electricity generated. The percent of maximum dependable capacity decreased from 91% in 2002 to 89% in 2003 due to the decrease in the net electricity generated.

4.3 ANNUAL TEDE DISTRIBUTIONS

Table 4.4 summarizes the distribution of the annual TEDE doses received by workers at all commercial LWRs during each of the years 1977 through 2003. This distribution is the sum of the annual dose distributions reported by each licensed LWR each year. As previously noted, the distribution reported by each LWR site for 2003 is shown in Appendix B. Table 4.4 shows the reported dose distributions corrected for the number of transient workers that were reported by more than one site (see Section 5). Table 4.4 includes only those reactors in operation for a full year for each year presented in the table. The total collective dose decreased by 1% to a value of 11,956 person-rem in 2003. A major contributor to this decrease was Quad Cities. Quad Cities 1,2 had the highest collective dose per reactor of any site in 2002, but the annual collective dose decreased by 75% in 2003. The high doses at Quad Cities Units 1 and 2 in 2002 were attributed to the large number of outages (two planned outages and six unplanned outages) that were performed at Quad Cities in 2002 in combination with higher than normal dose rates.

TABLE 4.4
Summary Distribution of Annual Whole Body Doses at Commercial Light Water Reactors*
1977 - 2003

Year	No Measurable Exposure	Measurable <0.10	Number of Individuals with Whole Body Doses in the Ranges (rem)															Total Number Monitored	Number with Measurable Exposure	Collective Dose ** (person-rem)
			0.10-0.25	0.25-0.5	0.50-0.75	0.75-1.0	1.0-2.0	2.0-3.0	3.0-4.0	4.0-5.0	5.0-6.0	6.0-7.0	7.0-8.0	8.0-9.0	9.0-10.0	10.0-12.0	>12			
1977	22,688	12,436	6,056	4,538	2,905	2,230	5,660	2,858	1,290	661	186	89	47	23	6	-	-	61,673	38,985	32,521
1978	26,360	15,165	6,349	5,010	3,094	2,255	5,984	3,050	1,194	517	110	37	9	-	1	-	2	69,137	42,777	31,785
1979	40,535	22,642	9,012	7,485	4,795	3,262	7,574	3,401	1,403	545	117	42	17	3	1	-	-	100,834	60,299	39,908
1980	44,716	26,990	10,697	8,913	5,573	4,139	10,672	4,607	1,816	831	235	119	29	7	1	-	-	119,345	74,629	53,739
1981	39,258	26,916	11,241	9,338	6,051	4,501	11,174	4,809	1,999	533	103	93	9	3	1	-	1	116,030	76,772	54,163
1982	41,704	29,278	11,734	9,907	6,235	4,422	10,220	4,716	2,066	596	97	31	5	-	1	1	-	121,013	79,309	52,201
1983	47,027	29,200	11,200	9,345	5,854	4,279	11,342	5,334	2,270	716	121	38	8	2	-	-	-	126,736	79,709	56,484
1984	54,637	36,488	13,438	10,277	6,338	4,804	11,284	5,208	2,122	487	52	22	-	-	-	-	-	145,157	90,520	55,251
1985	59,625	36,920	13,015	11,044	6,626	4,545	10,042	3,574	1,002	157	1	-	-	-	-	-	-	146,551	86,926	43,048
1986	67,677	41,536	14,574	11,842	7,017	4,693	10,241	3,062	868	146	-	-	-	-	-	-	-	161,656	93,979	42,386
1987	85,170	41,283	15,842	12,838	7,586	5,333	10,611	2,192	477	69	-	-	-	-	-	-	-	181,401	96,231	40,406
1988	87,281	40,290	15,915	13,152	7,905	5,461	10,310	2,442	511	26	-	1	-	-	-	-	-	183,294	96,013	40,772
1989	83,954	45,302	17,270	13,778	7,944	5,138	8,633	1,615	370	34	-	-	-	-	-	-	-	184,038	100,084	35,931
1990	83,875	42,612	17,526	14,199	8,226	5,261	8,594	1,791	337	21	-	-	-	-	-	-	-	182,442	98,567	36,602
1991	87,247	42,603	16,770	13,182	7,188	4,192	5,977	938	219	17	-	-	-	-	-	-	-	178,333	91,086	28,519
1992	87,717	41,943	17,821	14,779	8,135	4,521	6,076	808	85	4	-	-	-	-	-	-	-	181,889	94,172	29,297
1993	83,066	37,332	17,235	13,734	7,562	4,289	5,322	638	76	5	-	-	-	-	-	-	-	169,259	86,193	26,364
1994	67,777	30,185	15,010	11,823	6,185	3,620	4,242	508	40	-	-	-	-	-	-	-	-	139,390	71,613	21,704
1995	61,445	29,631	15,096	12,023	6,125	3,304	3,912	595	133	2	-	-	-	-	-	-	-	132,266	70,821	21,688
1996	58,097	30,204	14,831	11,343	5,423	2,833	3,196	408	67	-	-	-	-	-	-	-	-	126,402	68,305	18,883
1997	58,409	31,955	14,890	10,913	5,233	2,455	2,599	286	41	-	-	-	-	-	-	-	-	126,781	68,372	17,149
1998	56,901	27,998	12,849	8,816	3,940	1,841	1,827	179	15	1	-	-	-	-	-	-	-	114,367	57,466	13,187
1999	54,885	29,048	13,184	8,949	3,793	1,900	1,894	245	18	-	-	-	-	-	-	-	-	113,916	59,031	13,599
2000	53,324	28,480	12,921	8,679	3,571	1,644	1,734	186	18	-	-	-	-	-	-	-	-	110,557	57,233	12,652
2001	52,636	27,246	11,491	7,659	2,907	1,323	1,392	221	53	-	-	-	-	-	-	-	-	104,928	52,292	11,109
2002	53,440	28,523	11,610	7,668	3,004	1,479	1,820	320	35	1	-	-	-	-	-	-	-	107,900	54,460	12,126
2003	54,023	29,164	11,978	8,199	3,249	1,524	1,651	184	18	-	-	-	-	-	-	-	-	109,990	55,967	11,956

* Summary of reports submitted in accordance with 10 CFR 20.407 or 20.2206 by BWRs and PWRs that had been in commercial operation for at least 1 full year as of December 31 of each of the indicated years. Figures shown have been adjusted for the multiple reporting of transient individuals (see Section 5).

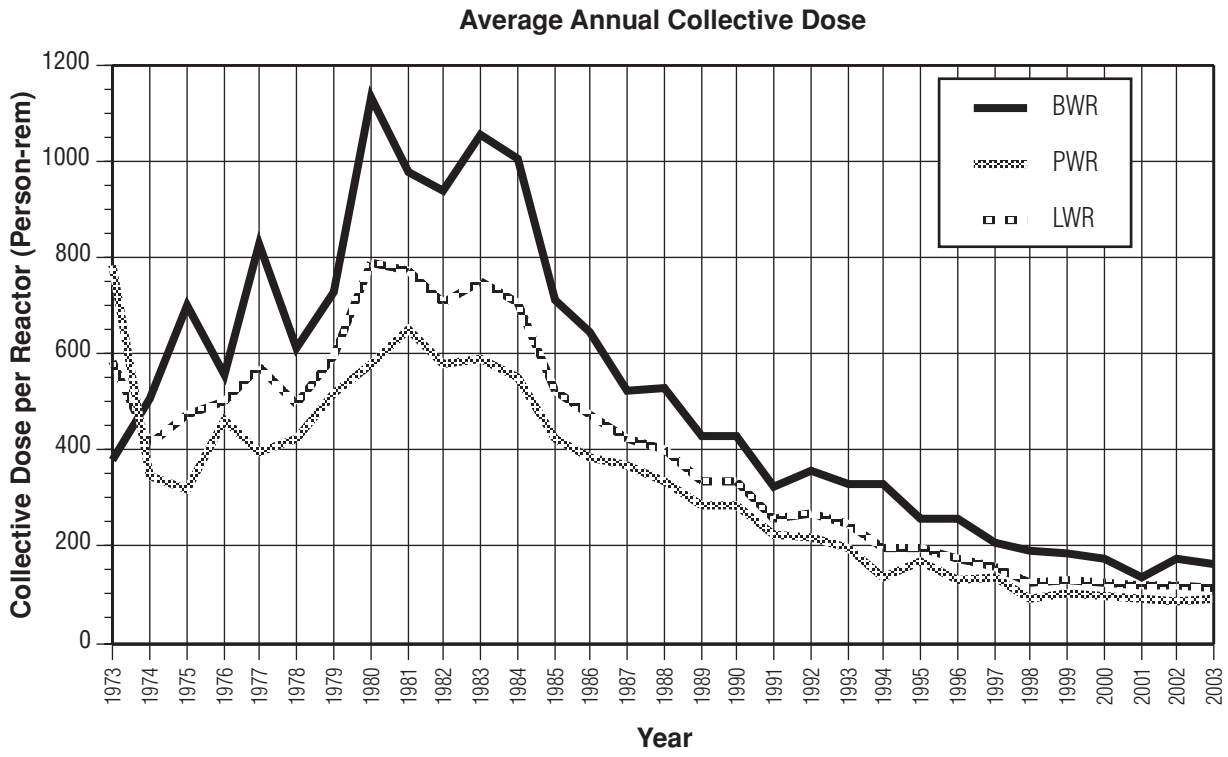
** The collective dose, when not reported by the licensee, was calculated by the NRC staff using methods described in Section 3.1.4.

4.4 AVERAGE ANNUAL TEDE DOSES

Some of the data presented in Tables 4.1, 4.2, and 4.3 are graphically displayed in Figure 4.1, where it can be seen that the average collective dose and average number of workers per BWR have been higher than those for PWRs since 1974 and that the values of both parameters, in general, continued to rise at both types of facilities until 1983. Between 1983 and 2003, the average collective dose per LWR dropped by 85%. Between 2002 and 2003, the collective dose per reactor for PWRs increased by 5% to 91 person-rem. The collective dose per reactor for BWRs decreased by 7% to 162 person-rem from 2002 to 2003. The overall collective dose per reactor for LWRs decreased by 2% to 115 person-rem in 2003. The number of workers with measurable dose per reactor decreased to 879 for BWRs and increased to 638 for PWRs in 2003. The overall decreasing trend in average reactor collective doses since 1983 indicates that licensees are continuing to successfully implement ALARA dose reduction features at their facilities.

Figures 4.2 and 4.3 are plots of most of the other information that is given in Tables 4.1, 4.2, and 4.3. Figure 4.2 shows that in 2003 the net electricity generated decreased to 87,015 MW-yr while the number of operating reactors has remained constant for the past 5 years. The value for the total collective dose for all LWRs decreased by 1% from a value of 12,126 person-rem in 2002 to 11,956 person-rem in 2003. Together with the increase in the number of workers with measurable dose, this resulted in the average measurable dose per worker decreasing from 0.17 rem in 2002 to 0.16 rem in 2003 (when not adjusted for transient workers).

The fluctuations in the parameters for the years following the accident at the TMI plant in 1979 may reflect some of the impact that this incident had on the nuclear power industry. The decrease seen in dose trends since 1983 may be attributable to several factors. Utilities have completed most of the tasks initiated as a result of the lessons learned from the TMI accident, and they are increasing efforts to avoid and reduce exposure. The importance of exposure control and the concept of keeping exposures to ALARA levels is continually being stressed, and most utilities have established programs to collect and share information relative to tasks, techniques, and exposures.



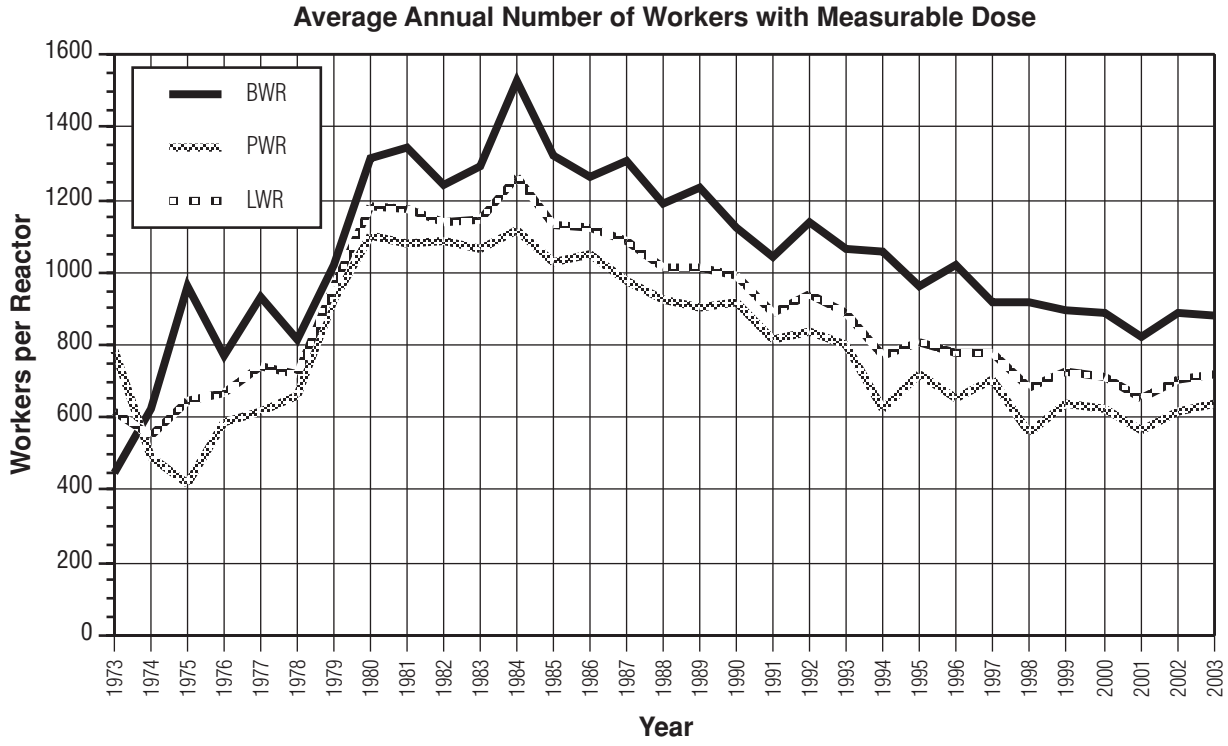
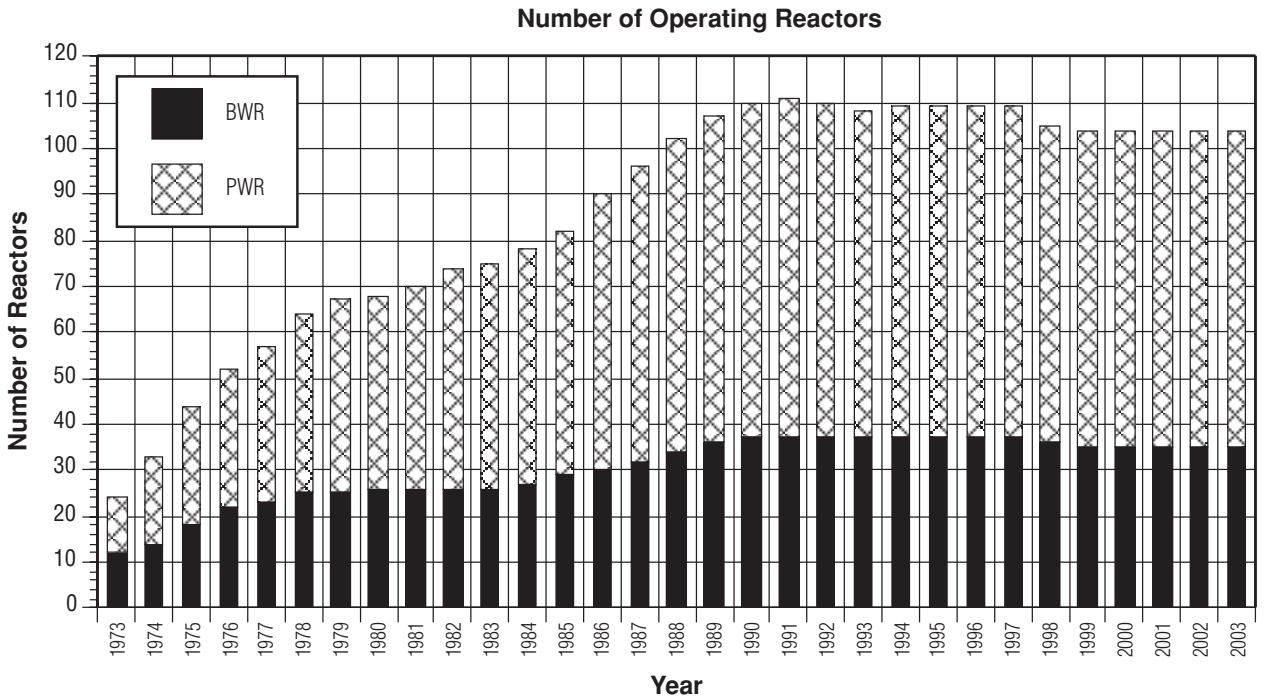
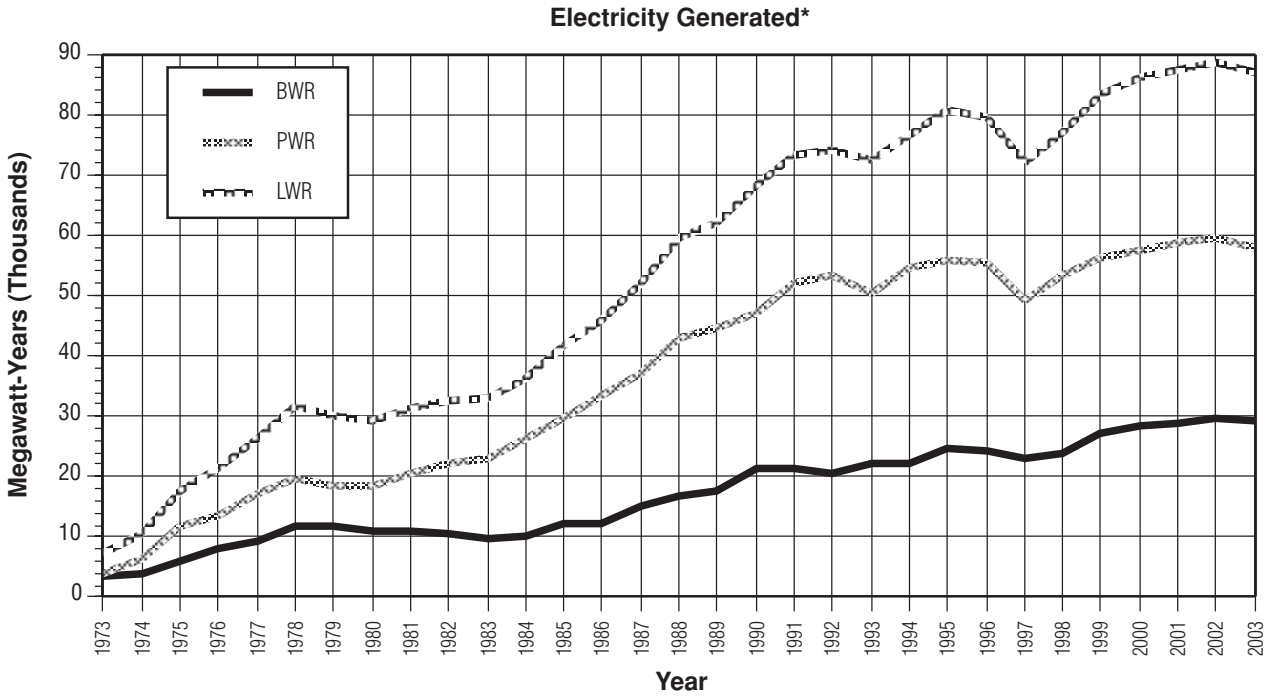


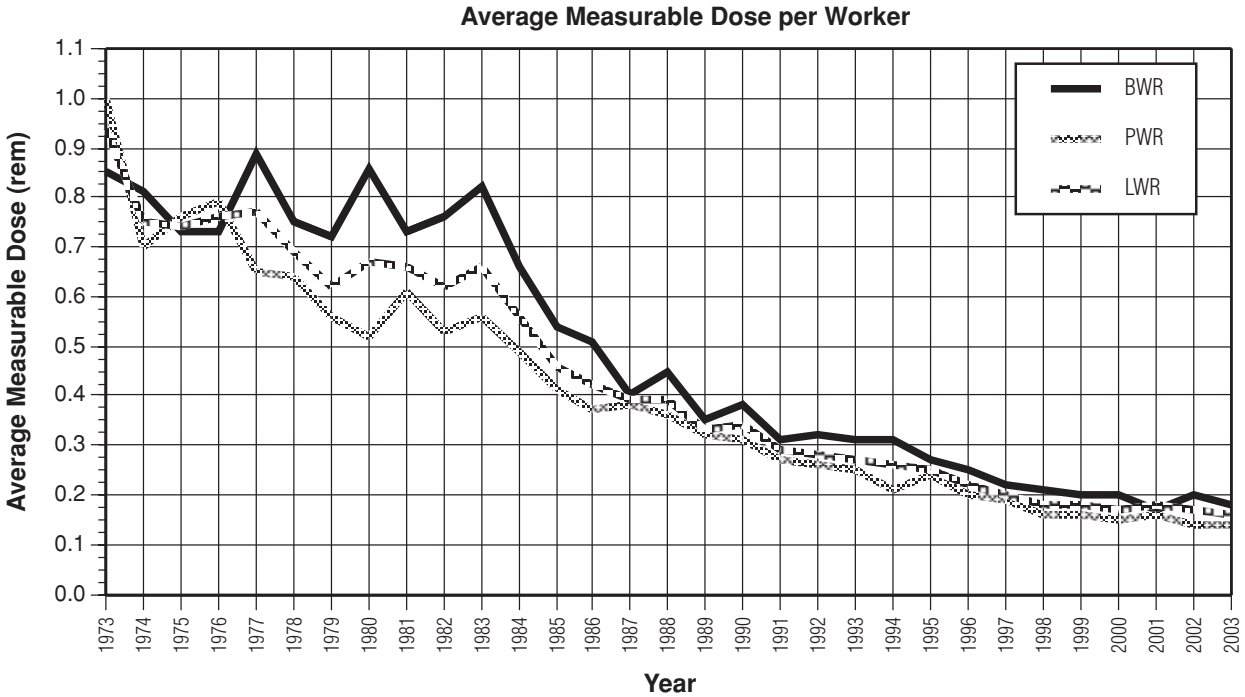
FIGURE 4.1. Average Collective Dose and Number of Workers with Measurable Dose per Reactor 1973 - 2003

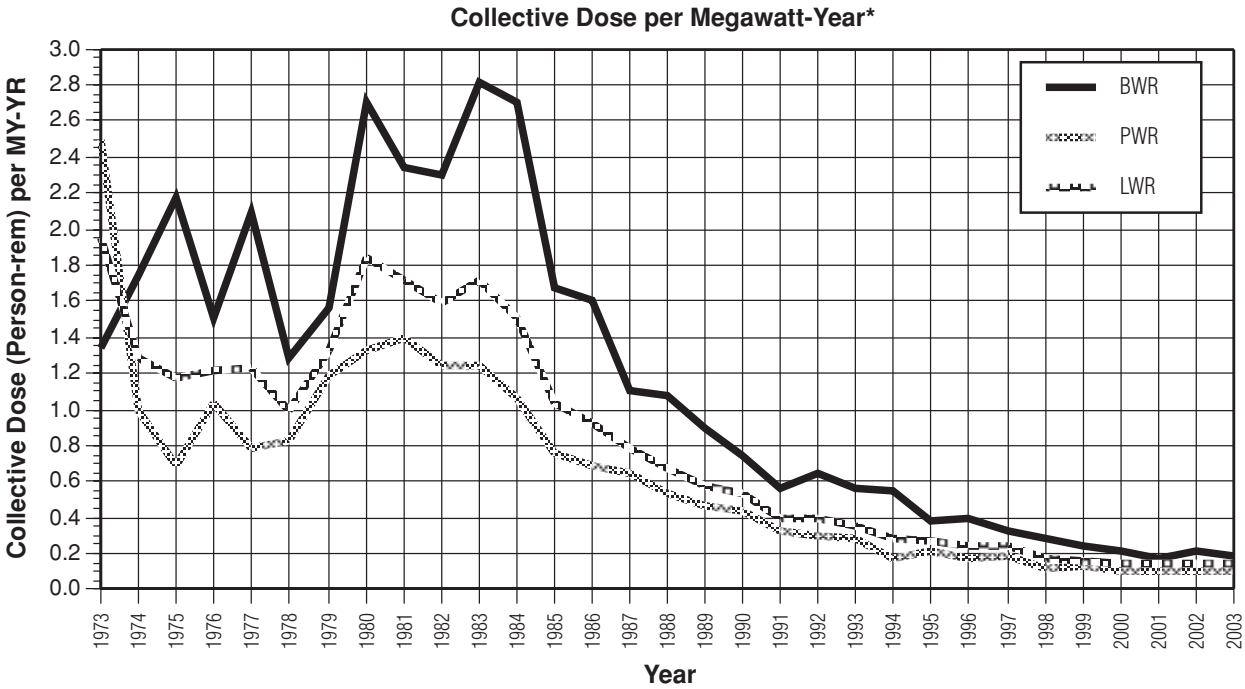




* Gross electricity 1973-1996, net electricity for 1997-2003

FIGURE 4.2. Number of Operating Reactors and Gross Electricity Generated 1973 - 2003





* Gross electricity 1973-1996, net electricity for 1997-2003

FIGURE 4.3. Average Measurable Dose per Worker and Collective Dose per Megawatt-Year 1973 - 2003

To further assist in the identification of any trends that might exist, Figures 4.4 and 4.5 together display the average and median[7] values of the collective dose per reactor for BWRs and for PWRs for the years 1973 through 2003. The ranges of the values reported each year are shown by the vertical lines with a small bar at each end marking the two extreme values. The rectangles indicate the range of values of the collective dose exhibited by those plants ranked in the 25th through the 75th percentiles. Because the median values usually are not as greatly affected by the extreme values of the collective doses, they do not normally fluctuate as much from year to year as do the average values. The median collective dose for PWRs remained unchanged at 75 person-rem in 2003. At BWRs, the median fluctuates more from year to year. The median collective dose increased from 130 person-rem in 2002 to 169 person-rem in 2003. Figure 4.5 also shows that, in 2003, 50% of the PWRs reported collective doses between 56 and 124 person-rem, while 50% of the BWRs reported collective doses between 124 and 201 person-rem. Nearly every year the median collective dose is less than the average, which indicates that the collective dose for most plants is less than the average collective dose per reactor (the value that is widely quoted).

4.5 THREE-YEAR AVERAGE COLLECTIVE TEDE PER REACTOR

The 3-year average collective dose per reactor is one of the metrics that the NRC uses in the Reactor Oversight Program to evaluate the effectiveness of the licensee's ALARA program. Tables 4.5 and 4.6 list the sites that had been in commercial operation for at least 3 years as of December 31, 2003, and show the values of several parameters for each of the sites. They also give averages for the two types of reactors. Based on the 105 reactor-years of operation accumulated by the 35 BWRs listed, the average 3-year collective TEDE per reactor was found to be 158 person-rem, the average measurable TEDE per worker was 0.18 rem, and the average collective TEDE per MW-yr was 0.19 person-rem per MW-yr. The average 3-year collective TEDE per reactor, the average measurable TEDE per worker, and the average collective TEDE per MW-yr decreased from 2002 to 2003.

Based on the 207 reactor-years of operation at the 69 PWRs listed, the average annual collective TEDE per reactor, average measurable TEDE per worker, and average collective TEDE per MW-yr were found to be 90 person-rem, 0.15 rem, and 0.11 person-rem per MW-yr, respectively. The collective TEDE per reactor decreased, while the other two values remained the same as the previous 3-year period.

[7] The value at which 50% of the reactors reported greater collective doses, and the other 50% reported smaller collective doses.

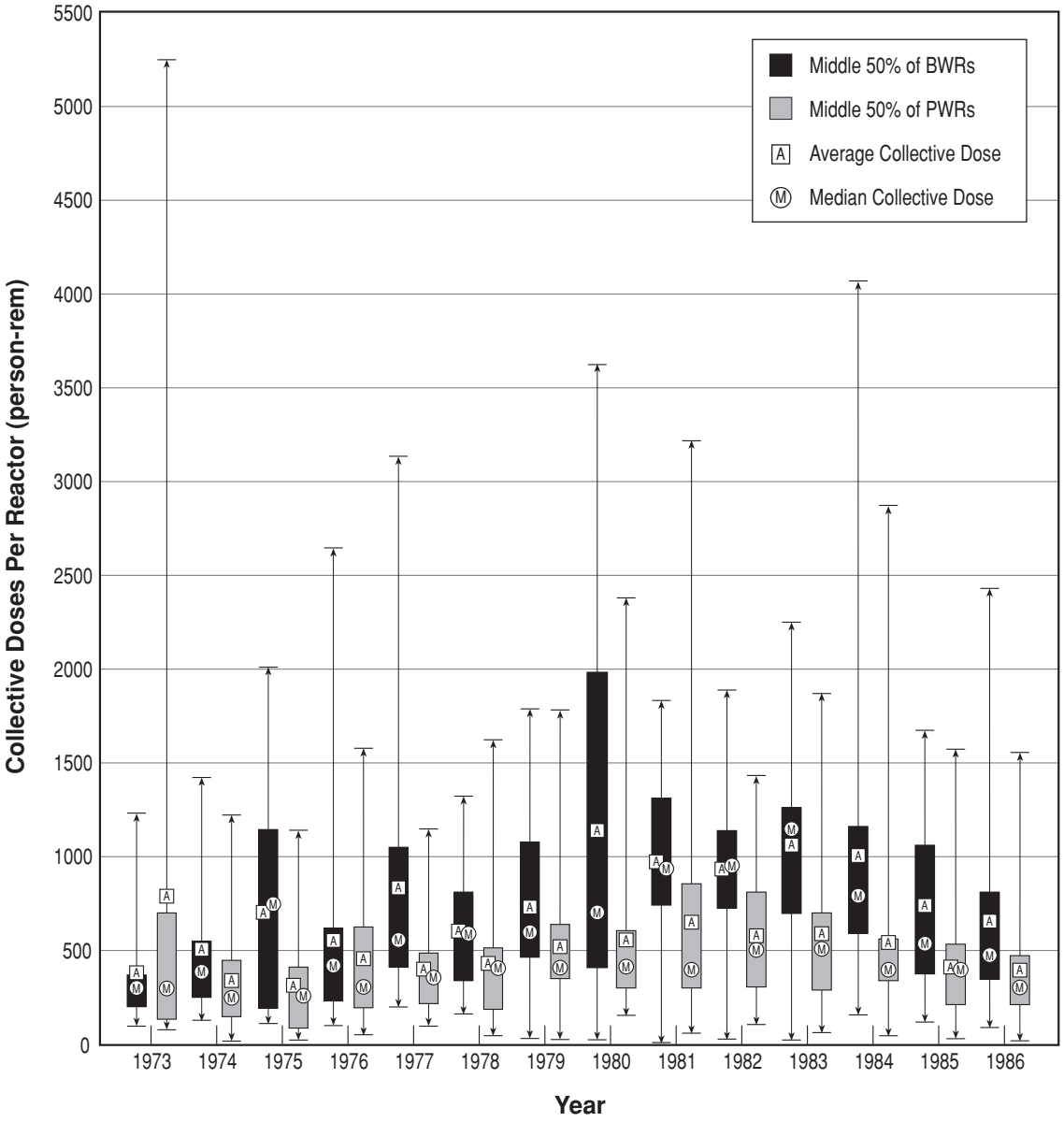


FIGURE 4.4. Average, Median, and Extreme Values of the Collective Dose per Reactor 1973 - 1986

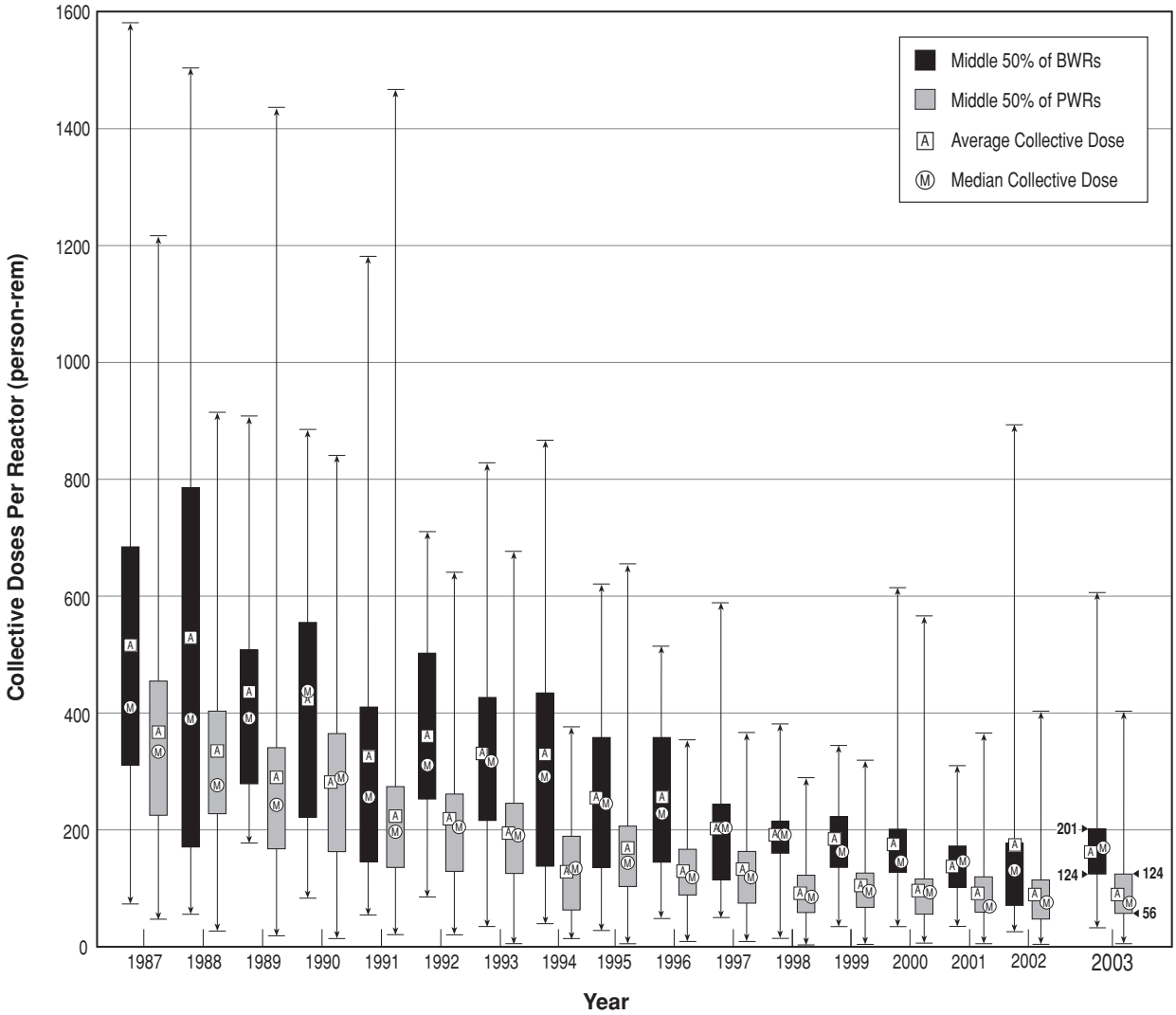


FIGURE 4.5. Average, Median, and Extreme Values of the Collective Dose per Reactor 1987 - 2003

TABLE 4.5
Three-Year Totals and Averages Listed in Ascending Order of Collective TEDE per BWR 2001-2003

Site Name*	Reactor Years	Collective TEDE per Reactor	Collective TEDE per Site	Number of Workers with Measurable TEDE	Average TEDE per Worker	Total MW-Years	Average TEDE per MW-Year
LIMERICK 1, 2	6	86	518	3,673	0.14	6,616.3	0.08
DUANE ARNOLD	3	99	297	2,046	0.15	1,416.2	0.21
CLINTON	3	100	299	2,119	0.14	2,759.1	0.11
HATCH 1, 2	6	102	613	4,001	0.15	4,808.8	0.13
HOPE CREEK 1	3	107	321	3,349	0.10	2,751.5	0.12
COOPER STATION	3	114	343	2,553	0.13	1,823.4	0.19
FITZPATRICK	3	115	345	2,197	0.16	2,351.0	0.15
VERMONT YANKEE	3	116	348	2,168	0.16	1,431.9	0.24
OYSTER CREEK	3	118	355	2,326	0.15	1,766.2	0.20
FERMI	3	125	375	2,872	0.13	2,959.4	0.13
GRAND GULF	3	131	393	2,459	0.16	3,516.2	0.11
SUSQUEHANNA 1, 2	6	133	798	5,631	0.14	6,051.6	0.13
BRUNSWICK 1, 2	6	138	827	5,160	0.16	4,821.2	0.17
BROWNS FERRY 1, 2, 3**	9	139	1,254	6,110	0.21	6,157.2	0.20
MONTICELLO	3	143	430	2,091	0.21	1,535.1	0.28
RIVER BEND 1	3	153	460	2,918	0.16	2,725.1	0.17
PILGRIM	3	156	468	3,013	0.16	1,809.0	0.26
COLUMBIA GENERATING	3	160	479	3,780	0.13	2,828.7	0.17
LASALLE 1, 2	6	166	997	4,800	0.21	6,364.4	0.16
PEACH BOTTOM 2, 3	6	172	1,033	5,001	0.21	6,214.0	0.17
DRESDEN 2, 3	6	185	1,112	7,686	0.14	4,530.2	0.25
NINE MILE POINT 1, 2	6	206	1,235	5,321	0.23	4,609.1	0.27
PERRY	3	312	936	3,708	0.25	2,995.2	0.31
QUAD CITIES 1, 2	6	395	2,368	5,552	0.43	4,444.0	0.53
Totals and Averages	**105**		**16,603**	**90,534**	**0.18**	**87,284.8**	**0.19**
Averages per Reactor-Yr		**158**		**862**		**831.3**	

* Sites where not all reactors had completed 3 full years of commercial operation as of 12/31/03 are not included.
** Browns Ferry 1 remains in the count of operating reactors, but was placed on Administrative Hold in June of 1985.

TABLE 4.6
Three-Year Totals and Averages Listed in Ascending Order of Collective TEDE per PWR 2001 - 2003

Site Name*	Reactor Years	Collective TEDE per Reactor	Collective TEDE per Site	Number of Workers with Measurable TEDE	Average TEDE per Worker	Total MW-Years	Average TEDE per MW-Year
SEABROOK	3	49	146	2,499	0.06	3,103.5	0.05
PRAIRIE ISLAND 1, 2	6	52	314	2,254	0.14	2,893.8	0.11
GINNA	3	55	165	1,185	0.14	1,365.9	0.12
BYRON 1, 2	6	57	342	2,830	0.12	6,800.9	0.05
PALO VERDE 1, 2, 3	9	59	533	4,647	0.11	10,048.0	0.05
WOLF CREEK 1	3	65	194	1,741	0.11	3,220.7	0.06
MCGUIRE 1, 2	6	65	389	2,971	0.13	6,320.3	0.06
POINT BEACH 1, 2	6	66	397	2,312	0.17	2,741.6	0.14
SUMMER 1	3	67	200	1,916	0.10	2,446.4	0.08
DIABLO CANYON 1, 2	6	67	402	3,094	0.13	5,897.9	0.07
COMANCHE PEAK 1, 2	6	68	407	2,598	0.16	5,993.9	0.07
CATAWBA 1, 2	6	68	408	3,253	0.13	6,341.2	0.06
WATERFORD 3	3	70	209	1,612	0.13	3,061.3	0.07
CALLAWAY 1	3	70	211	2,108	0.10	3,013.6	0.07
TURKEY POINT 3, 4	6	70	422	3,062	0.14	3,951.3	0.11
SAN ONOFRE 2, 3	6	72	432	3,498	0.12	5,867.4	0.07
BRAIDWOOD 1, 2	6	73	436	3,428	0.13	6,750.2	0.06
INDIAN POINT 3	3	74	221	2,072	0.11	2,730.1	0.08
VOGTLE 1, 2	6	76	458	2,828	0.16	6,353.3	0.07
ARKANSAS 1, 2	6	78	470	3,636	0.13	5,018.6	0.09
ROBINSON 2	3	80	240	1,766	0.14	1,999.2	0.12
COOK 1, 2	6	86	515	3,455	0.15	5,108.3	0.10
ST. LUCIE 1, 2	6	88	526	3,304	0.16	4,685.2	0.11
FARLEY 1, 2	6	88	528	3,370	0.16	4,534.9	0.12
WATTS BAR 1	3	88	265	2,498	0.11	3,102.8	0.09
BEAVER VALLEY 1, 2	6	92	552	3,873	0.14	4,485.4	0.12
KEWAUNEE	3	93	278	1,651	0.17	1,376.3	0.20
CRYSTAL RIVER 3	3	93	280	1,991	0.14	2,321.7	0.12
INDIAN POINT 2	3	94	282	2,001	0.14	2,700.5	0.10
SALEM 1, 2	6	95	570	5,035	0.11	5,852.4	0.10
NORTH ANNA 1, 2	6	107	639	3,186	0.20	4,616.8	0.14
HARRIS	3	109	327	2,517	0.13	2,327.1	0.14
CALVERT CLIFFS 1, 2	6	113	677	4,148	0.16	4,493.5	0.15
SEQUOYAH 1, 2	6	114	684	5,033	0.14	6,040.3	0.11
OCONEE 1, 2, 3	9	117	1,049	5,905	0.18	6,700.0	0.16
SOUTH TEXAS 1, 2	6	118	710	3,744	0.19	6,232.0	0.11
THREE MILE ISLAND 1	3	119	358	2,598	0.14	2,155.7	0.17
SURRY 1, 2	6	124	742	3,670	0.20	4,254.0	0.17
MILLSTONE 2, 3	6	132	789	4,149	0.19	5,296.5	0.15
PALISADES	3	197	590	2,078	0.28	1,694.4	0.35
FORT CALHOUN	3	201	602	2,426	0.25	1,234.4	0.49
DAVIS-BESSE	3	209	628	3,149	0.20	981.4	0.64
Totals and Averages	**207**		**18,588**	**125,091**	**0.15**	**176,112.7**	**0.11**
Averages per Reactor-Yr		**90**		**604**		**850.8**	

* Sites where not all reactors had completed 3 full years of commercial operation as of 12/31/03 are not included.

The average 3-year collective TEDE per BWR for 2001 - 2003 is 2% less than the average for 2000 - 2002. The average 3-year collective TEDE per PWR for 2001 - 2003 is 1% less than the average for 2000 - 2002.

4.6 GRAPHICAL REPRESENTATION OF DOSE TRENDS IN APPENDIX D

Each page of Appendix D presents a graph of selected dose performance indicators from 1973 through 2003. The dose and performance indicators illustrate the history of the collective dose per reactor for the site, the rolling 3-year average collective dose per reactor, and the electricity generated at the site. These data are plotted, beginning with the plant's first full year of commercial operation, and continuing through 2003. Data for years when the plant was not in commercial operation have been included when available. However, any data reported prior to 1973 are not included. The 3-year average collective dose per reactor data are included because they provide an overall indication of the plant's general trend in collective dose. The 3-year average collective dose per reactor is also one of the metrics used by the NRC in the Reactor Oversight Program to evaluate a plant's ALARA program. This average is determined by summing the collective dose for the current year and the previous 2 years and then dividing this sum by the number of reactors reporting during those years. Depicting dose trends using a 3-year average reduces the sporadic effects on annual doses of refueling operations (usually an 18 to 24 month cycle) and occasional high dose maintenance activities, and gives a better idea of collective dose trends over the life of the plant. The annual average collective dose per reactor for all reactors of the same type is also shown on the graph.

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Section 5

TRANSIENT WORKERS AND CAREER DOSES AT NRC-LICENSED FACILITIES

5.1 TERMINATION REPORTS

Under 10 CFR 20, licensees are required to submit NRC Form 5s to the Commission for each individual who is required to be monitored at the end of the monitoring year or upon the individual's termination of employment at the facility. The requirement for submitting "termination reports" in accordance with the old § 20.408, which listed the individual's completed dose history during employment at the facility, was eliminated in 1994.

However, the Form 5s submitted to the NRC upon an individual's termination of employment serve the same function as the previous requirements with regard to the analysis of transient workers at NRC-licensed facilities. The following analysis examines the workers who had more than one Form 5 dose record at more than one NRC-licensed facility during the monitoring year. These workers are defined as "transient" because they worked at more than one facility during the monitoring year.

The term "monitoring year" is used here in accordance with the definition of a year given in § 20.1003, which defines a year as "the period of time beginning in January used to determine compliance with the provisions of this part. The licensee may change the start date of the monitoring year used to determine compliance provided that the change is made at the beginning of the monitoring/calendar year and that no day is omitted or duplicated in consecutive years."

5.2 TRANSIENT WORKERS AT NRC FACILITIES

Examination of the data reported for workers who began and terminated two or more periods of employment with two or more different facilities within one monitoring year is useful in many ways. For example, the number of and individual dose received by these "annual transients" can be determined from examining these data.

Additionally, the distribution of the doses received by transient workers can be useful in determining the impact that the inclusion of these individuals in each of two or more licensees' annual reports has on the annual summary (as reported in Appendix B) for all nuclear power facilities, and all NRC licensees combined (one of the problems mentioned in Section 2). Table 5.1 shows the "actual distribution" of transient worker doses as determined from the NRC Form 5 termination reports and compares it with the "reported distribution" of the doses of these workers as they would have appeared in a summation of the annual reports submitted by each of the licensees.

In 2003, over 99% of the transient individuals were reported by nuclear power facilities. For this reason, these data are shown separately in Table 5.1.

TABLE 5.1
Effects of Transient Workers on Annual Statistical Compilations
2003

License Category	Number of Individuals with TEDE in the Ranges (rem)												Total Number Monitored	Number with Measurable Exposure	Collective TEDE (person-rem)	Average Meas. TEDE (rem)
	No Measurable Exposure	Measurable <0.10	0.10-0.25	0.25-0.50	0.50-0.75	0.75-1.0	1.0-2.0	2.0-3.0	3.0-4.0	4.0-5.0	5.0-6.0	>6				
POWER REACTORS																
1) Form 5 Summation	77,889	42,720	17,231	9,589	3,139	1,233	864	37					152,702	74,813	11,956	0.16
2) Transients - As Reported	30,902	20,235	9,457	5,129	1,752	715	452	19					68,661	37,759	6,428	0.17
3) Transients - Actual	7,036	6,679	4,204	3,739	1,862	1,006	1,239	166	18				25,949	18,913	6,428	0.34
Corrected Distribution (1-(2-3))	**54,023**	**29,164**	**11,978**	**8,199**	**3,249**	**1,524**	**1,651**	**184**	**18**				**109,990**	**55,967**	**11,956**	**0.21**
ALL LICENSEES																
1) Form 5 Summation	82,723	46,434	18,637	10,440	3,632	1,557	1,328	184	46	11		1	164,993	82,270	14,413	0.18
2) Transients - As Reported	31,565	20,468	9,544	5,207	1,796	738	485	26	1				69,830	38,265	6,590	0.17
3) Transients - Actual	7,027	6,666	4,228	3,775	1,893	1,025	1,289	179	19	1			26,102	19,075	6,590	0.35
Corrected Distribution (1-(2-3))	**58,185**	**32,632**	**13,321**	**9,008**	**3,729**	**1,844**	**2,132**	**337**	**64**	**12**		**1**	**121,265**	**63,080**	**14,413**	**0.23**

Table 5.1 illustrates the impact that the multiple reporting of these transient individuals had on the summation of the exposure reports for 2003. Because each licensee reports the doses received by workers while monitored by the particular licensee during the year, one would expect that a summation of these reports would result in individuals being counted several times in dose ranges lower than the range in which their total accumulated dose (the sum of the personnel monitoring results incurred at each facility during the year) would actually place them. Thus, while the total collective dose would remain the same, the number of workers, their dose distribution, and average dose would be affected by this multiple reporting. This was found to be true because too few workers were reported in the higher dose ranges. For example, in 2003, Table 5.1 shows that the summation of annual reports for reactor licensees indicated that 37 individuals received doses greater than 2 rem. After accounting for those individuals who were reported more than once, the corrected distribution indicated that there were really 202 transient workers who received doses greater than 2 rem. Correcting for the multiple counting of individuals also has a significant effect on the average measurable dose for these workers. The corrected average measurable dose for transient workers is twice as high as the value calculated for transient workers by the summation of licensee records.

The transient workers represent 30% of the workforce that receives measurable dose (for those licensees listed in Table 3.1). The correction for the transient workers increases the average measurable dose by a factor of 2 from 0.17 rem to 0.35 rem for the transient workforce for all licensees. It should be noted that this analysis of transient workers does not include workers who may have been exposed at facilities that are not required to report to the NRC REIRS database (see Section 1), such as Agreement State licensees, or DOE facilities.

One purpose of the REIRS database, which tracks occupational radiation exposures at NRC-licensed facilities, is to identify individuals who may have exceeded the occupational radiation exposure limits because of multiple exposures at different facilities throughout the year. The REIRS database stores the radiation exposure information for an individual by their unique identification number and identification type [Ref. 10, Section 1.5] and sums the exposure for all facilities during the monitoring year. An individual exceeding the TEDE 5 rem per year regulatory limit would be identified in Table 5.1 in one of the dose ranges >5 rem. In 2003, one individual exceeded the 5 rem annual TEDE limit, but the individual received this dose at one radiography licensee and was therefore not a transient (see Section 6). So the individual is included in the distribution of all licensees as determined by the summation of Form 5 records.

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Section 6

EXPOSURES TO PERSONNEL IN EXCESS OF REGULATORY LIMITS

6.1 CONTROL LEVELS

Exposures in excess of regulatory limits are sometimes referred to as "overexposures." The phrase "exposures in excess of regulatory limits" is preferred to "overexposures" because the latter suggests that a worker has been subjected to an unacceptable biological risk, which may, or may not, be the case.

The implementation date for the revised 10 CFR 20 was January 1, 1994. 10 CFR 20 includes requirements for summing internal and external dose equivalents to yield TEDE and to implement a similar limitation system for organs and tissues (such as the gonads, red bone marrow, bone surfaces, lung, thyroid, and breast). 10 CFR 20.1201 limits the TEDE of workers to ionizing radiation from licensed material and other sources of radiation within the licensee's control. 10 CFR 20 no longer contains quarterly exposure limits but has reporting requirements for planned special exposures (PSEs)[8]. The annual TEDE limit for adult workers is 5 rem.

10 CFR 20.2202 and 10 CFR 20.2203 require that all licensees submit reports of all occurrences involving personnel radiation exposures that exceed certain control levels, thus providing for investigations and corrective actions as necessary. Based on the magnitude of the exposure, the occurrence may be placed into one of three categories:

(1) Category A
10 CFR 20.2202(a)(1) - a TEDE to any individual of 25 rem or more; an eye dose equivalent of 75 rem or more; or a shallow-dose equivalent to the skin or extremities of 250 rad or more. The Commission must be notified immediately of these events.

(2) Category B
10 CFR 20.2202(b)(1) - a TEDE to any individual of 5 rem or more; an eye dose equivalent of 15 rem or more; or a shallow-dose equivalent to the skin or extremities of 50 rem or more in a 24-hour period. The Commission must be notified within 24 hours of these events.

[8] See 10 CFR 20.1206, 20.2204, and Regulatory Guide 8.35 for more information on PSEs and their reporting requirements.

(3) Category C
10 CFR 20.2203 - In addition to the notification required by § 20.2202 (category A and B occurrences), each licensee must submit a written report within 30 days after learning of any of the following occurrences:

(1) Any incident for which notification is required by § 20.2202; or

(2) Doses that exceed the limits in § 20.1201, § 20.1207, § 20.1208, § 20.1301 (for adults, minors, the embryo/fetus of a declared pregnant worker, and the public, respectively), or any applicable limit in the license; or

(3) Levels of radiation or concentrations of radioactive material that exceed any applicable license limit for restricted areas or that, for unrestricted areas, are in excess of 10 times any applicable limit set forth in this part or in the license (whether or not involving exposure of any individual in excess of the limits in § 20.1301); or

(4) For licensees subject to the provisions of the Environmental Protection Agency's generally applicable environmental radiation standards in 40 CFR 190, levels of radiation or releases of radioactive material in excess of those standards, or of license conditions related to those standards.

6.2 LIMITATIONS OF THE DATA

It is important to note that this summary of events includes **only**:

- Occupational radiation exposures in excess of regulatory limits
- Events at NRC-licensed facilities
- Final dose of record assigned to an individual

It **does not** include:

- Medical misadministrations to medical patients
- Exposures in excess of regulatory limits to the general public
- Agreement State-licensed activities or DOE facilities
- Other radiation-related violations, such as high dose rate areas or effluent limits
- Exposures to dosimeters that, upon evaluation, have been determined to be high dosimeter readings only and are not assigned to an individual as the dose of record by the NRC

Care should be taken when comparing the summary information presented here with other reports and analyses published by the NRC or other agencies. Various reports may include other types of "overexposure" events; therefore, the distinctions should be noted.

The analysis and summary of incidents presented here involving exposures in excess of regulatory limits represent the status of events as of the publication of this report. Exposure events of this type typically undergo a long review and evaluation process by the licensee, the NRC inspector for the regional office, and NRC Headquarters. Preliminary dose estimates submitted by licensees are often conservatively high and do not represent the final (record) dose assigned for the event. It is, therefore, not uncommon for an "overexposure" event to be reassessed and the final assigned dose to be categorized as not having been in excess of the regulatory limits. In other cases, the exposure may not be identified until a later date, such as during the next scheduled audit or inspection of the licensee's exposure records.

For these reasons, an attempt is made to keep the exposure events summary presented here current. An event that has been reassessed and determined not to be an exposure in excess of the limits is not included in this report. In addition, events that occurred in prior years are added to the summary in the appropriate year of occurrence. The reader should note that the summary presented here represents a "snapshot" of the status of events as of the publication date of this report. Previous or future reports may not correlate in the exact number of events because of the review cycle and reassessment of the events.

6.3 SUMMARY OF EXPOSURES IN EXCESS OF REGULATORY LIMITS

Table 6.1 summarizes the occupational exposures in excess of regulatory limits as reported by Commission licensees pursuant to 10 CFR 20.2202 and 10 CFR 20.2203 from 1994 to 2003. Table 6.2 shows the data reported under 10 CFR 20.403 and 10 CFR 20.405 for the period 1985-1993. Note that the categorization criteria changed effective with the revision of 10 CFR 20 in 1994.

For the period 1990-1993, Table 6.2 shows the number of individuals who exceeded various limits while employed by one of several types of licensees. For the period 1985-1989, only the exposures in excess of regulatory limits reported by licensed industrial radiography firms are shown separately. Most of the occurrences included in the "All Other" category come from research facilities, universities, and measuring and well-logging activities.

In 2003, there were no Category A occurrences, one Category B occurrence, and no Category C occurrences.

TABLE 6.1
Occupational Exposures in Excess of Regulatory Limits
1994 - 2003

Year	License Category	Persons and Doses (rem)	Types Of Exposures And Doses					
			TEDE (rem)		Lens of the Eye (rem)		Skin/Extremity (rem)	
			5 - 25	>25	15 - 75	>75	50 - 250	>250 rad
2003	INDUSTRIAL RADIOGRAPHY	NO. OF PERSONS SUM OF DOSES	1[g] 15.678		1[g] 15.667			
	POWER REACTORS	NO. OF PERSONS SUM OF DOSES						
	MEDICAL FACILITIES	NO. OF PERSONS SUM OF DOSES						
	MARKETING & MANUFACT.	NO. OF PERSONS SUM OF DOSES						
	OTHER	NO. OF PERSONS SUM OF DOSES						
2002	INDUSTRIAL RADIOGRAPHY	NO. OF PERSONS SUM OF DOSES	1 5.860					
	POWER REACTORS	NO. OF PERSONS SUM OF DOSES						
	MEDICAL FACILITIES	NO. OF PERSONS SUM OF DOSES						
	MARKETING & MANUFACT.	NO. OF PERSONS SUM OF DOSES						
	OTHER	NO. OF PERSONS SUM OF DOSES						
2001	INDUSTRIAL RADIOGRAPHY	NO. OF PERSONS SUM OF DOSES	1 5.606				1 80	
	POWER REACTORS	NO. OF PERSONS SUM OF DOSES						
	MEDICAL FACILITIES	NO. OF PERSONS SUM OF DOSES						
	MARKETING & MANUFACT.	NO. OF PERSONS SUM OF DOSES					1 127	3 1260
	OTHER	NO. OF PERSONS SUM OF DOSES						
2000	INDUSTRIAL RADIOGRAPHY	NO. OF PERSONS SUM OF DOSES	2 11.373					
	POWER REACTORS	NO. OF PERSONS SUM OF DOSES						
	MEDICAL FACILITIES	NO. OF PERSONS SUM OF DOSES	2 10.636					
	MARKETING & MANUFACT.	NO. OF PERSONS SUM OF DOSES						2 2,562
	OTHER	NO. OF PERSONS SUM OF DOSES						1 115
1999	INDUSTRIAL RADIOGRAPHY	NO. OF PERSONS SUM OF DOSES	1 5.67					
	POWER REACTORS	NO. OF PERSONS SUM OF DOSES						
	MEDICAL FACILITIES	NO. OF PERSONS SUM OF DOSES					1 143	
	MARKETING & MANUFACT.	NO. OF PERSONS SUM OF DOSES					4[f] 423	2[f] 1,080
	OTHER	NO. OF PERSONS SUM OF DOSES						
1998	INDUSTRIAL RADIOGRAPHY	NO.OF PERSONS SUM OF DOSES	4[a] 34.8				1 50-200	
	OTHER	NO.OF PERSONS SUM OF DOSES					5[f] 675	3[f] 1,115
1997	INDUSTRIAL RADIOGRAPHY	NO. OF PERSONS SUM OF DOSES					1[b] 51.1	
	OTHER	NO.OFPERSONS SUM OF DOSES					5[f] 431	3[f] 1,199
1996	INDUSTRIAL RADIOGRAPHY	NO.OF PERSONS SUM OF DOSES	1 8.3					
	OTHER	NO. OF PERSONS SUM OF DOSES					7[c, f] 810.6	
1995	INDUSTRIAL RADIOGRAPHY	NO.OF PERSONS SUM OF DOSES	1 5.1					
	OTHER	NO. OF PERSONS SUM OF DOSES					4[d, f] 782	1[f] 255
1994	INDUSTRIAL RADIOGRAPHY	NO.OF PERSONS SUM OF DOSES	2 12.2					
	OTHER	NO. OF PERSONS SUM OF DOSES					1[e] 180	

[a] One of these individuals also received the extremity exposure as shown.
[b] This exposure was from a hot particle to a localized area of the skin.
[c] This exposure was from a hot particle to a localized area of the skin.
[d] Two of these exposures (230 rem and 342 rem) were the result of hot particles.
[e] This exposure was from a hot particle to a localized area of the skin.
[f] These exposures have been added due to a reassessment of extremity dose from the direct handling of vials containing Indium at a radiopharmaceutical manufacturing licensee.
[g] These exposures were received by the same individual.

TABLE 6.2
Occupational Exposures in Excess of Regulatory Limits
1985 - 1993

Year	License Category	Persons and Doses (rem)	Types Of Exposures And Doses								
			Whole Body (rem)			Skin (rem)			Extremity (rem)		
			<5	5 - 25	>25	<7.5<30	30 - 50	>150	>18.75>75	75 - 375	>375
1993	INDUSTRIAL RADIOGRAPHY	NO. OF PERSONS SUM OF DOSES		1 6							
	POWER REACTORS	NO. OF PERSONS SUM OF DOSES									
	MEDICAL FACILITIES	NO. OF PERSONS SUM OF DOSES	1 1.3							3[f] 187.3	
	MARKETING & MANUFACT.	NO. OF PERSONS SUM OF DOSES	5 10.6								
	OTHER	NO. OF PERSONS SUM OF DOSES	2[a] 4.0	1[a] 5.4						1 275	
1992	INDUSTRIAL RADIOGRAPHY	NO. OF PERSONS SUM OF DOSES									1 300-1000
	POWER REACTORS	NO. OF PERSONS SUM OF DOSES	1 1.9			4 57.7					
	MEDICAL FACILITIES	NO. OF PERSONS SUM OF DOSES							4 143.6	1 272	
	MARKETING & MANUFACT.	NO. OF PERSONS SUM OF DOSES									
	OTHER	NO. OF PERSONS SUM OF DOSES	1[b] 1.9			1 24.1			1 40.5		
1991	INDUSTRIAL RADIOGRAPHY	NO. OF PERSONS SUM OF DOSES	2 5.6								
	POWER REACTORS	NO. OF PERSONS SUM OF DOSES									
	MEDICAL FACILITIES	NO. OF PERSONS SUM OF DOSES	2 3.8								
	MARKETING & MANUFACT.	NO. OF PERSONS SUM OF DOSES							1 22.3		
	OTHER	NO. OF PERSONS SUM OF DOSES	1 2.4								
1990	INDUSTRIAL RADIOGRAPHY	NO. OF PERSONS SUM OF DOSES	3 7.2	3[c, d] 49.9				1[c] 6000		1 111	2[d] 3962
	POWER REACTORS	NO. OF PERSONS SUM OF DOSES							1 48.8		
	MEDICAL FACILITIES	NO. OF PERSONS SUM OF DOSES	3[e] 8.9								
	MARKETING & MANUFACT.	NO. OF PERSONS SUM OF DOSES									
	OTHER	NO. OF PERSONS SUM OF DOSES	1 2.3								
1989	INDUSTRIAL RADIOGRAPHY	NO. OF PERSONS SUM OF DOSES	3 8.1		1 93				1 72		
	ALL OTHER	NO. OF PERSONS SUM OF DOSES	4 6.6			1 9.2			2 105	1 178	
1988	INDUSTRIAL RADIOGRAPHY	NO. OF PERSONS SUM OF DOSES	3 8.1	1 6.1						1 118	
	ALL OTHER	NO. OF PERSONS SUM OF DOSES	7 19.34			4 66.8	1 61	1 278	1 58	1 127	
1987	INDUSTRIAL RADIOGRAPHY	NO. OF PERSONS SUM OF DOSES	1 3.1							1 180	
	ALL OTHER	NO. OF PERSONS SUM OF DOSES	2 2.8	1 7.5		5 128.4			3 72.0		1 650
1986	INDUSTRIAL RADIOGRAPHY	NO. OF PERSONS SUM OF DOSES	2 4.4								
	ALL OTHER	NO. OF PERSONS SUM OF DOSES	3 9.6						1 41.2	1 115	2 930
1985	INDUSTRIAL RADIOGRAPHY	NO. OF PERSONS SUM OF DOSES	6 16.7	3 32.6	1 27.0					1 288	
	ALL OTHER	NO. OF PERSONS SUM OF DOSES	7 11.8						3 60.2	1 93	

[a] Same individual exceeded 1.25 rem/qtr limit twice during 1993.

[b] This 1992 exposure was reported in 1994.

[c] This individual received a whole-body dose of 24 rem in addition to a 6000 rem skin dose.

[d] One of these individuals received a 9 rem whole-body dose in addition to a 1070 rem extremity dose.

[e] One of these individuals exceeded the quarterly whole-body dose limits three times in one calendar year.

[f] An additional 1993 exposure was reported in 1994.

In September of 2003, a multi-location radiography licensee reported that a radiographer received an overexposure at a pipe fabrication facility in Charleston, West Virginia. Two radiographers were using an AEA Technology exposure device with a 762.2 GBq (20.6 Ci) Ir-192 source. Following a radiography shot of a pipe weld, the equipment was set up for a shot of the next weld. Upon completion of the shot, the radiographer attempted to retract the source but nothing happened. The radiographer realized that the source had been exposed during setup for the shot and that he had retracted the source into the camera when he thought he was extending it for the shot. Both radiographers were wearing pocket dosimeters, which were off scale. The radiographers were also wearing alarming ratemeters set at 5 mSv/hour (500 mrem/hour), which they said did not alarm. An investigation determined that the source was extended approximately 16 inches during the 10-minute setup for the second shot. One of these individuals exceeded the 5 rem TEDE annual limit. The TEDE reported to REIRS for the individual was 15.68 rem. This incident was caused by the failure to perform an adequate radiation survey of the exposure device, the failure to properly lock the exposure device prior to moving it for the second shot, the failure to remove faulty equipment from service (the source crank assembly was missing two screws in the gear housing, allowing the cable to slip), and inadequate management oversight. The licensee returned the exposure device to the manufacturer for evaluation, where it was determined that the posilock was sluggish and the lock mechanism was operational but had significant friction due to dirt and grease. The alarming ratemeters were sent to the corporate office, where they were found to operate correctly. To prevent recurrence, the licensee held training meetings with all radiographic personnel, performed a maintenance inspection on all exposure devices and their associated equipment, reassigned the RSO duties, and contracted with an independent auditor to review their radiation safety program.

No individuals were reported to have exceeded the annual extremity, skin dose, or organ dose limits.

6.4 MAXIMUM EXPOSURES BELOW THE NRC LIMITS

Because few exposures exceed the NRC occupational exposure limits, certain researchers have expressed an interest in a listing of the maximum exposures received at NRC licensees that do not exceed the limits. This would allow an examination of exposures that approach, but do not exceed the limits. Table 6.3 shows the maximum exposures for each dose category required to be reported to the NRC. In addition, the number of exposures in certain dose ranges is shown to reflect the number of exposures that approaches the NRC limits.

As shown in Table 6.3, few exposures exceed half of the NRC occupational annual limits. In 2003, only 31 individuals exceeded 75% of the occupational dose limits. One individual exceeded both the 5 rem TEDE annual limit and the LDE annual limit at a multi-location radiographer as described above. The exposure in excess of the TEDE limit (15.68 rem) is the highest TEDE recorded within the past 10 years.

TABLE 6.3
Maximum Occupational Exposures for Each Exposure Category*
2003

Exposure Category**	Annual Dose Limit 10CFR20***	Maximum Exposure Reported (rem)	Max Dose Percent of the Limit	Number of Individuals with Measurable Dose	Number of Individuals ≥ 25% of the Limit	Number of Individuals ≥ 50% of the Limit	Number of Individuals ≥ 75% of the Limit	Number of Individuals ≥ 95% of the Limit	Number of Individuals > Limit
SDE-ME	50 rem	46.210	92%	73,752	182	40	8	0	0
SDE-WB	50 rem	14.936	30%	85,641	2	0	0	0	0
LDE	15 rem	15.667	104%	83,848	19	1	1	1	1
CEDE		1.546		3,893					
CDE		8.729		2,595					
DDE		15.678		84,704					
TEDE	5 rem	15.678	314%	85,599	934	124	21	2	1
TODE	50 rem	15.678	31%	73,270	1	0	0	0	0

* Only records reported by licensees required to report under 10 CFR 20.2206 are included. Numbers have been adjusted for the multiple reporting of transient individuals.

** SDE-ME = shallow dose equivalent – maximally exposed extremity
SDE-WB = shallow dose equivalent – whole body
LDE = eye dose equivalent to the lens of the eye
CEDE = committed effective dose equivalent
CDE = committed dose equivalent
DDE = deep dose equivalent
TEDE = total effective dose equivalent
TODE = total organ dose equivalent

*** Shaded boxes represent dose categories that do not have specific dose limits defined in 10 CFR 20.

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Section 7

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10. *Instructions for Recording and Reporting Occupational Radiation Exposure Data,* USNRC Regulatory Guide 8.7, Rev. 1, June 1992.

11. United Nations, *Sources and Effects of Ionizing Radiation, United Nations Scientific Committee on the Effects of Atomic Radiation UNSCEAR 2000 Report to the General Assembly, with scientific annexes, Volume I,* General Assembly of Official Records, United Nations, New York, 2000.

12. *Licensed Operating Reactors, Status Summary Report,* compiled from reactor monthly operating reports submitted to the NRC. Data provided electronically from the Idaho National Engineering and Environmental Laboratory (INEEL) Risk, Reliability and Regulatory Support Department under contract to the NRC in support of the NRC's Performance Indicator Project.

* Report is available for purchase from the National Technical Information Service, Springfield, Virginia, 22161, and/or the Superintendent of Documents, U.S. Government Printing Office, P.O. Box 37082, Washington, DC 20402-9328.

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Appendix A

ANNUAL TEDE FOR NON-REACTOR NRC LICENSEES

2003

APPENDIX A
Annual TEDE for Non-Reactor NRC Licensees
CY 2003

PROGRAM CODE - LICENSEE NAME	LICENSE#	Number of Individuals with Whole Body Doses in the Ranges (rems)													Total Number Monitored	Number With Meas. Dose	Total Collective TEDE (Person-Rem)	Average Meas. TEDE (Rems)
		No Meas. Exposure	Meas. <0.10	0.10-0.25	0.25-0.50	0.50-0.75	0.75-1.00	1.00-2.00	2.00-3.00	3.00-4.00	4.00-5.00	5.00-6.00	6.00-12.00	>12.0				
INDUSTRIAL RADIOGRAPHY - SINGLE LOCATION - 03310																		
AMERICAN CASTINGS, LLC	35-18099-01	-	2	-	-	-	-	-	-	-	-	-	-	-	2	2	0.005	0.003
ARMY, DEPARTMENT OF THE	29-00047-06	2	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-
ARROW TANK & ENGINEERING CO.	22-13253-01	-	2	1	1	1	-	-	-	-	-	-	-	-	5	5	**1.189**	**0.238**
CARONDELET CORPORATION	24-26136-01	3	6	-	-	-	-	-	-	-	-	-	-	-	9	6	0.272	0.045
CHART INDUSTRIES, INC.	22-24393-01	1	4	-	-	-	-	-	-	-	-	-	-	-	5	4	0.048	0.012
DURALOY TECHNOLOGIES, INC.	37-02279-02	-	2	2	-	-	-	-	-	-	-	-	-	-	4	4	0.330	0.083
HARRISON STEEL CASTINGS CO.	13-02141-01	4	1	-	-	-	-	-	-	-	-	-	-	-	5	1	0.005	0.005
HUTCHINSON TECHNICAL COLLEGE	22-15554-01	28	11	-	-	-	-	-	-	-	-	-	-	-	**39**	**11**	0.098	0.009
INTERMET-ARCHER CREEK	45-17464-01	3	3	1	-	-	-	-	-	-	-	-	-	-	7	4	0.189	0.047
NILES STEEL TANK CO.	21-04741-01	1	1	-	-	-	-	-	-	-	-	-	-	-	2	1	0.025	0.025
TESTWELL LABORATORIES, INC.	31-30653-02	5	3	2	2	-	-	-	-	-	-	-	-	-	12	7	0.905	0.129
WAUKESHA FOUNDRY, INC.	48-13776-01	5	-	-	-	-	-	-	-	-	-	-	-	-	5	-	-	-
Total	**12**	**52**	**35**	**6**	**3**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**97**	**45**	**3.066**	**0.068**

NOTE: The data values shown bolded and in boxes represent the highest value in each category.

APPENDIX A
Annual TEDE for Non-Reactor NRC Licensees
CY 2003 (continued)

PROGRAM CODE - LICENSEE NAME	LICENSE#	Number of Individuals with Whole Body Doses in the Ranges (rems)													Total Number Monitored	Number With Meas. Dose	Total Collective TEDE (Person-Rem)	Average Meas. TEDE (Rems)
		No Meas. Exposure	Meas. <0.10	0.10-0.25	0.25-0.50	0.50-0.75	0.75-1.00	1.00-2.00	2.00-3.00	3.00-4.00	4.00-5.00	5.00-6.00	6.00-12.00	>12.0				
INDUSTRIAL RADIOGRAPHY - MULTIPLE LOCATION - 03320																		
ADVEX CORPORATION	45-16452-01	2	4	-	-	-	-	-	-	-	-	-	-	-	6	4	0.128	0.032
ALASKA INDUSTRIAL X-RAY, INC.	50-16084-01	1	4	2	3	3	1	1	-	-	1	-	-	-	16	15	10.229	0.682
ALLIED INSPECTION SERVICES, INC.	21-18428-01	-	-	2	-	1	2	-	-	-	-	-	-	-	5	5	2.537	0.507
AMERICAN ENGRG. TESTING, INC.	22-20271-02	2	7	3	5	-	2	9	2	2	-	-	-	-	32	30	28.982	0.966
ANVIL CORPORATION	46-23236-03	3	19	10	14	9	3	14	2	-	-	-	-	-	74	71	40.148	0.565
APPLIED TECHNICAL SERVICES, INC.	45-25477-01	1	6	1	-	-	-	-	-	-	-	-	-	-	8	7	0.369	0.053
ASRC ENERGY SERVICES INSP., INC.	50-27740-01	1	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
BARNETT INDUSTRIAL X-RAY	35-26953-01	1	-	1	4	3	1	4	-	-	-	-	-	-	14	13	10.685	0.822
BILL MILLER, INC.	35-19048-01	1	2	3	1	2	4	3	1	-	-	-	-	-	17	16	11.670	0.729
BRANCH RADIOGRAPHIC LABS., INC.	29-03405-02	8	3	3	2	5	1	1	-	-	-	-	-	-	23	15	6.110	0.407
BRAUN INTERTEC CORPORATION	22-16537-02	8	3	3	4	4	1	3	-	-	-	-	-	-	26	18	8.602	0.478
CALUMET TESTING SERVICES, INC.	13-16347-01	1	3	3	4	-	1	3	3	-	-	-	-	-	18	17	14.655	0.862
CANSPEC (USA), INC.	42-32443-01	1	10	6	13	8	8	5	-	-	-	-	-	-	51	50	24.252	0.485
CAPITAL X-RAY SERVICES, INC.	35-11114-01	-	19	1	2	1	-	6	5	1	-	-	-	-	35	35	26.700	0.763
CENTURY INSPECTION, INC.	42-08456-02	12	9	11	10	2	5	7	2	1	-	-	-	-	59	47	29.077	0.619
CERTIFIED TESTING LABS, INC.	29-14150-01	4	20	6	2	2	1	1	-	-	-	-	-	-	36	32	5.357	0.167
COLBY & THIELMEIER TESTING CO.	24-13737-01	-	4	-	1	-	2	2	1	-	-	-	-	-	10	10	6.765	0.677
COMO TECH INSPECTION	15-26978-01	-	-	-	1	-	1	1	-	-	-	-	-	-	3	3	2.545	0.848
CONAM INSPECTION	12-16559-02	8	15	8	3	6	2	3	1	-	-	-	-	-	46	38	14.920	0.393
CONSUMERS ENERGY LAB. SERVICES	21-08606-03	7	4	5	3	4	2	-	-	-	-	-	-	-	25	18	6.100	0.339
COOPER HEAT-MQS	42-32219-01	15	47	24	28	13	15	14	2	1	-	-	-	-	159	144	67.606	0.469
CTI CORE DRILLING SERVICES, INC.	45-25383-01	-	1	-	1	2	-	1	-	-	-	-	-	-	5	5	3.891	0.778
CURTISS-WRIGHT ELECTRO-MECH. CORP.	37-05809-02	-	3	-	-	-	-	-	-	-	-	-	-	-	3	3	0.027	0.009
ELECTRIC BOAT CORPORATION	06-01781-08	11	27	4	-	-	-	-	-	-	-	-	-	-	42	31	0.904	0.029
ELITE INSPECTION, INC.	13-26712-01	3	2	8	2	6	2	5	2	-	-	-	-	-	30	27	18.665	0.691

NOTE: The data values shown bolded and in boxes represent the highest value in each category.

APPENDIX A
Annual TEDE for Non-Reactor NRC Licensees
CY 2003 (continued)

PROGRAM CODE - LICENSEE NAME	LICENSE#	Number of Individuals with Whole Body Doses in the Ranges (rems)													Total Number Monitored	Number With Meas. Dose	Total Collective TEDE (Person-Rem)	Average Meas. TEDE (Rems)
		No Meas. Exposure	Meas. <0.10	0.10-0.25	0.25-0.50	0.50-0.75	0.75-1.00	1.00-2.00	2.00-3.00	3.00-4.00	4.00-5.00	5.00-6.00	6.00-12.00	>12.0				
INDUSTRIAL RADIOGRAPHY - MULTIPLE LOCATION - 03320 Continued																		
ENGINEERING & INSPECTIONS, HAWAII	53-27731-01	1	3	3	2	-	-	1	-	-	-	-	-	-	10	9	2.656	0.295
FROEHLING & ROBERTSON, INC.	45-08890-01	9	-	1	1	-	-	-	-	-	-	-	-	-	11	2	0.440	0.220
GLOBE X-RAY SERVICES, INC.	35-15194-01	-	5	2	2	7	2	8	4	4	-	-	-	-	34	34	41.400	1.218
H & G INSPECTION COMPANY, INC.	42-26838-01	-	6	8	7	2	4	11	2	-	-	-	-	-	40	40	28.653	0.716
H & H X-RAY SERVICES, INC.	17-19236-01	3	4	5	13	13	9	29	8	1	-	-	-	-	85	82	82.681	1.008
HIGH MOUNTAIN INSPECTION SERVICES	49-26808-02	-	8	7	12	5	7	22	10	4	2	-	-	-	77	77	95.432	1.239
INDUSTRIAL NDT CO., INC.	39-24888-01	2	3	2	6	-	-	2	-	-	-	-	-	-	15	13	5.182	0.399
INSPECTION SERVICES ORG.	41-06832-06	15	4	4	-	-	-	-	-	-	-	-	-	-	23	8	0.827	0.103
INTEGRATED TECHNOLOGIES, INC.	06-30317-01	2	10	6	2	3	-	-	-	-	-	-	-	-	23	21	3.648	0.174
INT'L RADIOGRAPHY & INSPEC. SERVICES	35-30246-01	-	8	8	5	1	4	14	14	4	-	-	-	-	58	58	78.299	1.350
JAN X-RAY SERVICES, INC	21-16560-01	33	22	33	56	31	32	24	4	1	-	-	-	-	**236**	**203**	**120.934**	0.596
KAKIVIK ASSET MANAGEMENT	50-27667-01	12	11	13	9	11	3	1	-	-	-	-	-	-	60	48	16.573	0.345
LONGVIEW INSPECTION, INC.	42-27593-01	15	51	30	23	14	12	26	11	1	-	-	-	-	183	168	99.679	0.593
MARYLAND Q.C. LABORATORIES, INC.	19-28683-01	4	13	-	4	1	-	2	-	-	-	-	-	-	24	20	5.549	0.277
MASSACHUSETTS MATERIALS RESEARCH	07-01173-03	-	2	2	-	-	-	-	-	-	-	-	-	-	4	4	0.436	0.109
MET-CHEM TESTING LABS OF UTAH, INC.	43-27362-01	7	8	1	1	-	-	-	-	-	-	-	-	-	17	10	0.825	0.083
MID AMERICAN INSPECTION SVCS., INC.	21-26060-01	1	2	1	3	-	2	2	3	-	-	-	-	-	14	13	12.719	0.978
MIDWEST INDUSTRIAL X-RAY, INC.	33-27427-01	-	-	3	3	3	1	2	3	6	1	-	-	-	22	22	41.564	1.889
NEWPORT NEWS SHIP BLDG. & DRY DOCK CO.	45-09428-02	2	23	15	1		-	-	-	-	-	-	-	-	41	39	3.227	0.083
NON-DESTRUCTIVE TESTING GROUP	21-32340-01	3	4	7	3	5	-	1	-	-	-	-	-	-	23	20	6.639	0.332
NOVA DATA TESTING LABS, INC.	45-24872-01	2	5		-	-	-		-	-	-	-	-	-	7	5	0.014	0.003
PACIFIC TESTING, INC.	53-29118-01	-	5	2	1	-	-	3	-	-	-	-	-	-	11	11	5.587	0.508
PRECISION CALIBRATION & TESTING CO.	37-30546-01	3	4	2	-	-	-	-	-	-	-	-	-	-	9	6	0.344	0.057
PRECISION COMPONENTS CORP.	37-16280-01	7	12		-	-	-	-	-	-	-	-	-	-	19	12	0.042	0.004
PRIME NDT SERVICES, INC.	37-23370-01	1	2	6	1	-	3	6	2	-	-	-	-	-	21	20	16.428	0.821

NOTE: The data values shown bolded and in boxes represent the highest value in each category.

APPENDIX A
Annual TEDE for Non-Reactor NRC Licensees
CY 2003 (continued)

PROGRAM CODE - LICENSEE NAME	LICENSE#	Number of Individuals with Whole Body Doses in the Ranges (rems)													Total Number Monitored	Number With Meas. Dose	Total Collective TEDE (Person-Rem)	Average Meas. TEDE (Rems)
		No Meas. Exposure	Meas. <0.10	0.10-0.25	0.25-0.50	0.50-0.75	0.75-1.00	1.00-2.00	2.00-3.00	3.00-4.00	4.00-5.00	5.00-6.00	6.00-12.00	>12.0				
INDUSTRIAL RADIOGRAPHY - MULTIPLE LOCATION - 03320 Continued																		
PROFESSIONAL NDE & WELDING SERVICES	52-25538-01	1	2	1	5	1	-	-	-	-	-	-	-	-	10	9	2.815	0.313
PROFESSIONAL WELDING ASSOC., INC.	48-25806-01	1	4	2	-	-	-	-	-	-	-	-	-	-	7	6	0.453	0.076
Q.C. LABORATORIES, INC.	09-11579-03	-	7	2	4	2	-	-	-	-	-	-	-	-	15	15	3.207	0.214
QSL PLUS, INC.	37-28085-01	7	9	7	11	5	4	7	9	2	1	-	-	-	62	55	56.420	1.026
QUALITY INSPECTION SERVICES, INC.	31-30187-01	-	2	-	-	1	3	-	-	-	-	-	-	-	6	6	3.342	0.557
QUALITY TESTING SERVICE, INC.	24-32292-01	-	4	1	1	-	-	-	-	-	-	-	-	-	6	6	0.648	0.108
SCIENTIFIC TECHNICAL, INC.	45-24882-01	7	5	-	-	-	-	-	-	-	-	-	-	-	12	5	0.198	0.040
SHAW PIPELINE SERVICES, INC.	35-23193-01	3	12	15	25	18	13	8	1	-	-	-	-	-	95	92	47.373	0.515
S.K. MCBRYDE, INC.	32-25137-01	-	1	4	3	1	-	-	-	-	-	-	-	-	9	9	2.207	0.245
SOUTHWEST X-RAY CORPORATION	49-27434-01	-	2	-	4	1	1	1	1	-	-	-	-	-	10	10	7.623	0.762
ST. LOUIS TESTING LABS, INC.	24-00188-02	1	6	1	1	1	2	3	-	-	-	-	-	-	15	14	7.233	0.517
T & K INSPECTION, INC.	33-27678-01	-	-	-	1	-	-	4	2	2	-	-	-	-	9	9	18.690	**2.077**
TEI ANALYTICAL SERVICES, INC.	37-28004-01	1	11	6	10	6	2	6	1	-	-	-	-	-	43	42	20.933	0.498
TESTING TECHNOLOGIES, INC.	45-25007-01	-	5	6	6	3	4	2	-	-	-	-	-	-	26	26	10.740	0.413
TEST MASTER INSPECTION CO., INC.	34-24872-02	-	1	-	2	2	1	1	-	-	-	-	-	-	7	7	5.090	0.727
THERMAL ENGINEERING INT'L	24-19500-01	6	-	-	-	-	-	-	-	-	-	-	-	-	6	-	-	-
THREE RIVERS GAMMA	37-28367-01	-	-	-	-	-	-	2	-	-	-	-	-	-	2	2	2.840	1.420
TMP WORLDWIDE, INC.	37-27891-01	2	6	7	-	2	1	5	-	-	-	-	-	-	23	21	10.142	0.483
TULSA GAMMA RAY, INC.	35-17178-01	2	7	3	11	12	10	24	8	7	4	-	-	-	88	86	115.864	1.347
U.S. INSPECTION SERVICES	34-06943-02	7	58	23	19	17	16	21	9	1	-	-	-	1	172	165	107.871	0.654
VALLEY INDUSTRIAL X-RAY	04-29076-01	25	11	11	6	13	5	12	-	-	-	-	-	-	83	58	33.956	0.585
VALLEY INSPECTION SERVICE, INC.	37-28385-01	2	2	1	1	2	1	1	1	-	-	-	-	-	11	9	6.864	0.763
WESTERN X-RAY COMPANY	35-19993-01	-	2	3	-	2	-	9	1	2	-	-	-	-	19	19	23.765	1.251
WOS TESTING COMPANY, INC.	48-26385-01	1	2	-	1	-	-	1	-	-	-	-	-	-	5	4	1.909	0.477
Total	**74**	**278**	**586**	**358**	**369**	**256**	**196**	**344**	**115**	**40**	**9**	**-**	**-**	**1**	**2,552**	**2,274**	**1500.885**	**0.660**

NOTE: The data values shown bolded and in boxes represent the highest value in each category.

APPENDIX A
Annual TEDE for Non-Reactor NRC Licensees
CY 2003 (continued)

PROGRAM CODE - LICENSEE NAME	LICENSE#	Number of Individuals with Whole Body Doses in the Ranges (rems)													Total Number Monitored	Number With Meas. Dose	Total Collective TEDE (Person-Rem)	Average Meas. TEDE (Rems)
		No Meas. Exposure	Meas. <0.10	0.10-0.25	0.25-0.50	0.50-0.75	0.75-1.00	1.00-2.00	2.00-3.00	3.00-4.00	4.00-5.00	5.00-6.00	6.00-12.00	>12.0				
MANUFACTURING AND DISTRIBUTION - LIMITED NUCLEAR PHARMACIES - 02500																		
CAPITAL PHARMACY, INC.	21-26597-01MD	4	11	3	1	-	-	-	-	-	-	-	-	-	19	15	1.038	0.069
CARDINAL HEALTH	04-26507-01MD	114	534	128	42	7	3	2	-	-	1	-	-	-	**831**	**717**	61.810	0.086
EASTERN ISOTOPES, INC.	45-25221-01MD	30	78	19	9	5	9	17	7	5	1	-	-	-	180	150	**82.070**	**0.547**
MALLINCKRODT, INC.	24-04206-08MD	4	11	5	-	-	-	-	-	-	-	-	-	-	20	16	1.044	0.065
MALLINCKRODT, INC.	24-04206-22MD	12	1	1	-	-	-	-	-	-	-	-	-	-	14	2	0.169	0.085
MALLINCKRODT MEDICAL, INC.	24-04206-01MD	13	8	1	-	-	-	-	-	-	-	-	-	-	22	9	0.449	0.050
MALLINCKRODT MEDICAL, INC.	24-04206-14MD	5	11	9	1	-	-	-	-	-	-	-	-	-	26	21	2.268	0.108
MALLINCKRODT MEDICAL, INC.	24-04206-16MD	11	3	3	1	-	-	-	-	-	-	-	-	-	18	7	1.065	0.152
MALLINCKRODT MEDICAL, INC.	24-04206-19MD	14	5	6	2	1	-	-	-	-	-	-	-	-	28	14	2.869	0.205
MALLINCKRODT MEDICAL, INC.	24-17450-02MD	10	8	2	1	-	-	-	-	-	-	-	-	-	21	11	0.980	0.089
MID-AMERICA ISOTOPES, INC.	24-26241-01MD	16	7	2	-	1	1	-	-	-	-	-	-	-	27	11	1.987	0.181
OKLAHOMA, UNIVERSITY OF	35-03176-04MD	10	15	7	-	-	-	-	-	-	-	-	-	-	32	22	1.427	0.065
PHARMALOGIC OF PENN LTD.	37-30219-01MD	1	5	6	1	-	-	-	-	-	-	-	-	-	13	12	1.490	0.124
RADIOPHARMACY, INC.	13-26246-01MD	4	15	3	2	-	-	-	-	-	-	-	-	-	24	20	1.435	0.072
SPECTRUM PHARMACY, INC.	13-26367-01MD	6	31	4	3	-	-	-	-	-	-	-	-	-	44	38	2.495	0.066
SPECTRUM PHARMACY, INC.- FT. WAYNE	13-32053-01MD	12	15	1	-	-	-	-	-	-	-	-	-	-	28	16	0.461	0.029
Total	**16**	**266**	**758**	**200**	**63**	**14**	**13**	**19**	**7**	**5**	**2**	**-**	**-**	**-**	**1,347**	**1,081**	**163.057**	**0.151**

NOTE: The data values shown bolded and in boxes represent the highest value in each category.

APPENDIX A
Annual TEDE for Non-Reactor NRC Licensees
CY 2003 (continued)

PROGRAM CODE - LICENSEE NAME	LICENSE#	Number of Individuals with Whole Body Doses in the Ranges (rems)													Total Number Monitored	Number With Meas. Dose	Total Collective TEDE (Person-Rem)	Average Meas. TEDE (Rems)
		No Meas. Exposure	Meas. <0.10	0.10-0.25	0.25-0.50	0.50-0.75	0.75-1.00	1.00-2.00	2.00-3.00	3.00-4.00	4.00-5.00	5.00-6.00	6.00-12.00	>12.0				
MANUFACTURING AND DISTRIBUTION - TYPE A BROAD - 03211																		
INTERNATIONAL ISOTOPES IDAHO, INC.	11-27680-01	7	2	1	4	-	-	1	-	-	-	-	-	-	15	8	3.298	0.412
MALLINCKRODT, INC.	24-04206-01	76	54	46	56	40	37	54	25	1	-	-	-	-	**389**	**313**	**224.897**	**0.719**
NUCLEAR RESEARCH CORPORATION	29-04236-01	6	27	1	-	-	-	-	-	-	-	-	-	-	34	28	0.727	0.026
Total	**3**	**89**	**83**	**48**	**60**	**40**	**37**	**55**	**25**	**1**	**-**	**-**	**-**	**-**	**438**	**349**	**228.922**	**0.656**
MANUFACTURING AND DISTRIBUTION - LIMITED TYPE B BROAD - 03212																		
OHMART/VEGA CORP.	34-00639-04	33	17	1	1	1	-	-	-	-	-	-	-	-	**53**	**20**	**1.867**	**0.093**
Total	**1**	**33**	**17**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**53**	**20**	**1.867**	**0.093**
MANUFACTURING AND DISTRIBUTION - LIMITED OTHER - 03214																		
BMS-MEDICAL IMAGING	20-00320-19	-	1	1	-	-	-	-	-	-	-	-	-	-	2	2	0.160	**0.080**
MDS NORDION, INC.	54-28275-01	2	2	1	-	-	-	-	-	-	-	-	-	-	**5**	3	**0.217**	0.072
PHARMASAN LABS, INC.	48-26355-01	-	4	-	-	-	-	-	-	-	-	-	-	-	4	**4**	0.014	0.004
Total	**3**	**2**	**7**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**11**	**9**	**0.391**	**0.043**

NOTE: The data values shown bolded and in boxes represent the highest value in each category.

APPENDIX A
Annual TEDE for Non-Reactor NRC Licensees
CY 2003 (continued)

PROGRAM CODE - LICENSEE NAME	LICENSE#	Number of Individuals with Whole Body Doses in the Ranges (rems)													Total Number Monitored	Number With Meas. Dose	Total Collective TEDE (Person-Rem)	Average Meas. TEDE (Rems)
		No Meas. Exposure	Meas. <0.10	0.10-0.25	0.25-0.50	0.50-0.75	0.75-1.00	1.00-2.00	2.00-3.00	3.00-4.00	4.00-5.00	5.00-6.00	6.00-12.00	>12.0				
INDEPENDENT SPENT FUEL STORAGE INSTALLATION - 23200																		
DEPARTMENT OF ENERGY (TMI)	SNM-2508	1	9	5	2	-	-	-	-	-	-	-	-	-	17	16	**1.583**	**0.099**
GENERAL ELECTRIC COMPANY	SNM-2500	8	25	5	-	-	-	-	-	-	-	-	-	-	**38**	**30**	1.208	0.040
Total	**2**	**9**	**34**	**10**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**55**	**46**	**2.791**	**0.061**
FUEL CYCLE URANIUM ENRICHMENT PLANTS - 21200																		
USEC-PADUCAH	GDP-1	2,027	251	26	1	-	-	-	-	-	-	-	-	-	**2,305**	278	11.209	0.040
USEC-PORTSMOUTH	GDP-2	1,091	249	23	18	-	-	-	-	-	-	-	-	-	1,381	**290**	**17.595**	**0.061**
Total	**2**	**3,118**	**500**	**49**	**19**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3,686**	**568**	**28.804**	**0.051**
FUEL CYCLE FUEL FABRICATION FACILITIES - 21210																		
BWX TECHNOLOGIES, INC. (NPD)	SNM-0042	20	137	120	21	3	1	2	-	-	-	-	-	-	304	284	38.077	0.134
FRAMATOME ANP, INC.	SNM-1168	586	159	30	6	3	-	-	-	-	-	-	-	-	784	198	12.543	0.063
FRAMATOME ANP, INC.	SNM-1227	68	180	91	77	39	20	4	-	-	-	-	-	-	479	411	95.123	0.231
GLOBAL NUCLEAR FUEL-WILMINGTON, NC	SNM-1097	255	338	182	46	3	-	-	-	-	-	-	-	-	824	569	57.263	0.101
NUCLEAR FUEL SERVICES, INC.	SNM-0124	49	720	156	64	8	3	3	-	-	-	-	-	-	**1,003**	**954**	78.995	0.083
WESTINGHOUSE ELECTRIC COMPANY	SNM-1107	9	160	153	120	125	54	37	-	-	-	-	-	-	658	649	**245.492**	**0.378**
Total	**6**	**987**	**1,694**	**732**	**334**	**181**	**78**	**46**	**-**	**-**	**-**	**-**	**-**	**-**	**4,052**	**3,065**	**527.493**	**0.172**

NOTE: The data values shown bolded and in boxes represent the highest value in each category.

Appendix B

ANNUAL WHOLE BODY DOSES AT LICENSED NUCLEAR POWER FACILITIES

2003

APPENDIX B

Annual Whole Body Doses at Licensed Nuclear Power Facilities
CY 2003

PLANT NAME	TYPE	Number of Individuals with Whole Body Doses in the Ranges (rems)														Total Number Monitored	Number With Meas. Dose	Total Collective TEDE (Person-Rem)
		No Meas. Exposure	Meas. <0.10	0.10-0.25	0.25-0.50	0.50-0.75	0.75-1.00	1.00-2.00	2.00-3.00	3.00-4.00	4.00-5.00	5.00-6.00	6.00-7.00	7.00-12.00	>12.0			
ARKANSAS 1, 2	PWR	1,169	688	187	68	20	7	3	-	-	-	-	-	-	-	2,142	973	99.003
BEAVER VALLEY 1, 2	PWR	1,533	825	420	267	68	27	16	-	-	-	-	-	-	-	3,156	1,623	277.168
BRAIDWOOD 1, 2	PWR	1,609	844	397	228	78	19	6	-	-	-	-	-	-	-	3,181	1,572	244.860
BROWNS FERRY 1, 2, 3	BWR	2,168	1,163	548	514	257	86	39	1	-	-	-	-	-	-	4,776	2,608	602.535
BRUNSWICK 1, 2	BWR	1,355	1,183	294	193	86	27	11	-	-	-	-	-	-	-	3,149	1,794	248.622
BYRON 1, 2	PWR	1,109	516	219	79	9	1	-	-	-	-	-	-	-	-	1,933	824	87.129
CALLAWAY 1	PWR	1,056	235	16	1	-	-	-	-	-	-	-	-	-	-	1,308	252	8.297
CALVERT CLIFFS 1, 2	PWR	1,333	811	518	254	73	14	1	-	-	-	-	-	-	-	3,004	1,671	265.164
CATAWBA 1, 2	PWR	1,724	672	489	200	32	12	4	-	-	-	-	-	-	-	3,133	1,409	210.617
CLINTON	BWR	736	203	100	42	16	11	-	-	-	-	-	-	-	-	1,108	372	57.118
COLUMBIA GENERATING	BWR	736	1,040	295	203	63	13	4	-	-	-	-	-	-	-	2,354	1,618	205.225
COMANCHE PEAK 1, 2	PWR	1,317	416	163	51	8	1	-	-	-	-	-	-	-	-	1,956	639	66.313
COOK 1, 2	PWR	2,082	822	340	162	51	17	16	-	-	-	-	-	-	-	3,490	1,408	209.526
COOPER STATION	BWR	944	473	237	116	42	14	-	-	-	-	-	-	-	-	1,826	882	135.249
CRYSTAL RIVER 3	PWR	794	570	252	107	15	12	5	-	-	-	-	-	-	-	1,755	961	126.554
DAVIS-BESSE	PWR	1,113	539	235	140	70	35	28	-	-	-	-	-	-	-	2,160	1,047	219.696
DIABLO CANYON 1, 2	PWR	1,217	590	244	128	33	8	1	-	-	-	-	-	-	-	2,221	1,004	135.482
DRESDEN 2, 3	BWR	1,073	1,211	444	266	108	33	35	1	-	-	-	-	-	-	3,171	2,098	356.572
DUANE ARNOLD	BWR	1,122	465	191	125	42	6	-	-	-	-	-	-	-	-	1,951	829	124.402
FARLEY 1, 2	PWR	1,062	479	195	83	12	3	16	-	-	-	-	-	-	-	1,850	788	111.016
FERMI 2	BWR	1,382	692	279	181	46	9	-	-	-	-	-	-	-	-	2,589	1,207	168.138
FITZPATRICK	BWR	725	146	76	54	16	3	3	-	-	-	-	-	-	-	1,023	298	51.156
FORT CALHOUN	PWR	578	402	213	169	76	41	13	-	-	-	-	-	-	-	1,492	914	212.422
GINNA	PWR	889	267	150	79	10	2	2	-	-	-	-	-	-	-	1,399	510	74.533
GRAND GULF	BWR	778	181	81	27	-	1	-	-	-	-	-	-	-	-	1,068	290	31.250
HARRIS	PWR	1,002	540	185	56	5	-	-	-	-	-	-	-	-	-	1,788	786	68.463
HATCH 1, 2	BWR	1,180	716	367	188	23	1	-	-	-	-	-	-	-	-	2,475	1,295	168.281
HOPE CREEK 1	BWR	433	1,184	226	137	30	14	6	-	-	-	-	-	-	-	2,030	1,597	139.295
INDIAN POINT 2	PWR	1,504	214	22	4	1	-	-	-	-	-	-	-	-	-	1,745	241	11.778
INDIAN POINT 3	PWR	1,477	567	239	84	11	1	-	-	-	-	-	-	-	-	2,379	902	96.059
KEWAUNEE	PWR	604	217	116	75	26	4	1	-	-	-	-	-	-	-	1,043	439	73.108
LASALLE 1, 2	BWR	1,498	1,255	387	311	161	90	47	2	-	-	-	-	-	-	3,751	2,253	464.427
LIMERICK 1, 2	BWR	1,737	870	270	111	34	9	4	-	-	-	-	-	-	-	3,035	1,298	147.047
MCGUIRE 1, 2	PWR	1,660	620	170	44	7	-	-	-	-	-	-	-	-	-	2,501	841	71.323
MILLSTONE 2, 3	PWR	1,007	686	263	160	62	33	66	4	-	-	-	-	-	-	2,281	1,274	322.923
MONTICELLO	BWR	701	402	209	158	60	21	8	-	-	-	-	-	-	-	1,559	858	168.896
NINE MILE POINT 1, 2	BWR	1,217	727	277	248	120	59	70	-	-	-	-	-	-	-	2,718	1,501	374.775
NORTH ANNA 1, 2	PWR	2,172	588	230	131	45	24	21	2	-	-	-	-	-	-	3,213	1,041	187.014

APPENDIX B

Annual Whole Body Doses at Licensed Nuclear Power Facilities
CY 2003 (continued)

PLANT NAME	TYPE	Number of Individuals with Whole Body Doses in the Ranges (rems)														Total Number Monitored	Number With Meas. Dose	Total Collective TEDE (Person-Rem)
		No Meas. Exposure	Meas. <0.10	0.10-0.25	0.25-0.50	0.50-0.75	0.75-1.00	1.00-2.00	2.00-3.00	3.00-4.00	4.00-5.00	5.00-6.00	6.00-7.00	7.00-12.00	>12.0			
OCONEE 1, 2, 3	PWR	2,226	1,235	729	205	10	1	-	-	-	-	-	-	-	-	4,406	2,180	245.349
OYSTER CREEK	BWR	859	273	105	30	6	1	1	-	-	-	-	-	-	-	1,275	416	43.363
PALISADES	PWR	792	329	219	161	53	34	26	-	-	-	-	-	-	-	1,614	822	202.571
PALO VERDE 1, 2, 3	PWR	1,907	1,331	408	140	38	15	11	-	-	-	-	-	-	-	3,850	1,943	210.842
PEACH BOTTOM 2, 3	BWR	1,370	819	381	231	91	68	51	-	-	-	-	-	-	-	3,011	1,641	355.969
PERRY	BWR	780	733	333	371	196	109	136	2	-	-	-	-	-	-	2,660	1,880	607.384
PILGRIM	BWR	597	821	288	202	68	37	21	-	-	-	-	-	-	-	2,034	1,437	250.192
POINT BEACH 1, 2	PWR	827	327	204	80	16	-	-	-	-	-	-	-	-	-	1,454	627	84.965
PRAIRIE ISLAND 1, 2	PWR	882	374	161	51	8	-	-	-	-	-	-	-	-	-	1,476	594	61.137
QUAD CITIES 1, 2	BWR	772	373	171	132	107	83	110	22	-	-	-	-	-	-	1,770	998	438.144
RIVER BEND 1	BWR	777	674	312	221	63	20	6	-	-	-	-	-	-	-	2,073	1,296	216.950
ROBINSON 2	PWR	746	98	11	-	-	-	-	-	-	-	-	-	-	-	855	109	4.838
SALEM 1, 2	PWR	353	965	184	111	24	12	5	-	-	-	-	-	-	-	1,654	1,301	124.042
SAN ONOFRE 2, 3	PWR	1,854	769	292	168	41	5	-	-	-	-	-	-	-	-	3,129	1,275	163.804
SEABROOK	PWR	708	775	130	55	20	1	-	-	-	-	-	-	-	-	1,689	981	70.953
SEQUOYAH 1, 2	PWR	1,598	1,177	714	441	107	31	14	-	-	-	-	-	-	-	4,082	2,484	430.889
SOUTH TEXAS 1, 2	PWR	1,228	509	210	121	46	19	4	-	-	-	-	-	-	-	2,137	909	143.495
ST. LUCIE 1, 2	PWR	1,239	537	236	99	37	24	4	-	-	-	-	-	-	-	2,176	937	141.734
SUMMER 1	PWR	1,007	527	148	58	11	1	-	-	-	-	-	-	-	-	1,752	745	70.828
SURRY 1, 2	PWR	2,647	839	338	272	115	35	26	3	-	-	-	-	-	-	4,275	1,628	325.729
SUSQUEHANNA 1, 2	BWR	1,296	1,219	411	209	68	24	3	-	-	-	-	-	-	-	3,230	1,934	250.096
THREE MILE ISLAND 1	PWR	1,272	744	313	117	42	10	4	-	-	-	-	-	-	-	2,502	1,230	155.101
TURKEY POINT 3, 4	PWR	1,184	696	421	224	70	21	10	-	-	-	-	-	-	-	2,626	1,442	247.053
VERMONT YANKEE	BWR	698	219	62	56	11	10	1	-	-	-	-	-	-	-	1,057	359	54.348
VOGTLE 1, 2	PWR	1,107	500	229	71	5	1	-	-	-	-	-	-	-	-	1,913	806	84.344
WATERFORD 3	PWR	1,079	446	144	85	28	5	2	-	-	-	-	-	-	-	1,789	710	95.332
WATTS BAR 1	PWR	1,281	854	354	142	35	5	2	-	-	-	-	-	-	-	2,673	1,392	165.741
WOLF CREEK 1	PWR	1,007	538	179	92	7	3	1	-	-	-	-	-	-	-	1,827	820	88.941
TOTALS	**BWRS**	**24,934**	**17,042**	**6,344**	**4,326**	**1,714**	**749**	**556**	**28**	**-**	**-**	**-**	**-**	**-**	**-**	**55,693**	**30,759**	**5,659.434**
TOTALS	**PWRS**	**52,955**	**25,678**	**10,887**	**5,263**	**1,426**	**484**	**308**	**9**	**-**	**-**	**-**	**-**	**-**	**-**	**97,009**	**44,054**	**6,296.136**
TOTALS	**LWRS**	**77,889**	**42,720**	**17,231**	**9,589**	**3,139**	**1,233**	**864**	**37**	**-**	**-**	**-**	**-**	**-**	**-**	**152,702**	**74,813**	**11,955.570**

APPENDIX B

Annual Whole Body Doses at Licensed Nuclear Power Facilities
CY 2003 (continued)

PLANT NAME	TYPE	Number of Individuals with Whole Body Doses in the Ranges (rems)														Total Number Monitored	Number With Meas. Dose	Total Collective TEDE (Person-Rem)
		No Meas. Exposure	Meas. <0.10	0.10-0.25	0.25-0.50	0.50-0.75	0.75-1.00	1.00-2.00	2.00-3.00	3.00-4.00	4.00-5.00	5.00-6.00	6.00-7.00	7.00-12.00	>12.0			
REACTORS NOT YET IN COMMERCIAL OPERATION																		
WATTS BAR 2	PWR Reported with Watts Bar 1																	
REACTORS NO LONGER IN COMMERCIAL OPERATION																		
BIG ROCK POINT	BWR	89	154	41	50	33	15	43	-	-	-	-	-	-	-	425	336	121.045
HADDAM NECK	PWR	584	201	102	45	22	17	13	-	-	-	-	-	-	-	984	400	82.022
HUMBOLDT BAY	BWR	103	14	-	-	-	-	-	-	-	-	-	-	-	-	117	14	0.351
LACROSSE	BWR	6	59	6	-	-	-	-	-	-	-	-	-	-	-	71	65	1.836
MAINE YANKEE	PWR	288	239	56	29	7	6	5	-	-	-	-	-	-	-	630	342	43.775
MILLSTONE 1	BWR	155	105	40	24	10	5	10	1	-	-	-	-	-	-	350	195	10.675
RANCHO SECO	PWR	154	69	21	20	9	2	-	-	-	-	-	-	-	-	275	121	18.300
SAN ONOFRE 1	PWR	1,306	149	36	19	10	7	5	-	-	-	-	-	-	-	1,532	226	35.596
TROJAN	PWR	271	56	11	19	16	3	-	-	-	-	-	-	-	-	376	105	23.996
YANKEE-ROWE	PWR	434	76	21	11	15	11	2	-	-	-	-	-	-	-	570	136	30.934
ZION 1, 2	PWR	98	2	-	-	-	-	-	-	-	-	-	-	-	-	100	2	0.049
REACTORS NO LONGER IN COMMERCIAL OPERATION, REPORTED WITH OTHER UNITS																		
BROWNS FERRY 1	BWR	Reported with Browns Ferry 2, 3																
DRESDEN 1	BWR	Reported with Dresden 2,3																
INDIAN POINT 1	PWR	Reported with Indian Point 2																
THREE MILE ISLAND 2	PWR	Reported with Three Mile Island 1; estimated dose from Unit 2 is 0.260 person-rem.																
Total Reporting*	**12**	**3,488**	**1,124**	**334**	**217**	**122**	**66**	**78**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**5,430**	**1,942**	**368.839**

* These numbers are for the reactors no longer in commercial operation which report their doses separately (i.e., do not report their doses with other units).

Appendix C*

PERSONNEL, DOSE, AND POWER GENERATION SUMMARY

1969 - 2003

* A discussion of the methods used to collect and calculate the information contained in this Appendix is given in Section 2.1.

Reporting Organization	Year	Megawatt Years MW-YR	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose	Average Measurable Dose (rems)	Collective Dose MW-yr
ARKANSAS 1, 2	1975	588.0	76.5	147	21	0.14	0.04
Docket 50-313, 50-368;	1976	464.6	56.6	476	289	0.61	0.62
DPR-51; NPF-6	1977	610.3	76.8	601	256	0.43	0.42
1st commercial operation	1978	627.2	77.5	722	189	0.26	0.30
12/74, 3/80	1979	397.0	55.3	1,321	369	0.28	0.93
Type - PWRs	1980	452.8	63.7	1,233	342	0.28	0.76
Capacity - 836, 858 MWe	1981	1,104.7	68.3	2,225	1,102	0.50	1.00
	1982	905.4	58.6	1,608	803	0.50	0.89
	1983	915.0	54.7	2,109	1,397	0.66	1.53
	1984	1,289.1	77.4	1,742	806	0.46	0.63
	1985	1,192.3	73.6	1,262	286	0.23	0.24
	1986	1,070.3	66.9	2,135	1,141	0.53	1.07
	1987	1,366.1	88.9	1,123	382	0.34	0.28
	1988	1,070.3	69.4	2,421	1,387	0.57	1.30
	1989	1,066.3	72.0	2,063	711	0.34	0.67
	1990	1,351.9	84.2	2,493	762	0.31	0.56
	1991	1,515.8	88.4	2,064	351	0.17	0.23
	1992	1,352.1	77.4	3,114	876	0.28	0.65
	1993	1,606.0	91.3	1,981	268	0.14	0.17
	1994	1,662.8	93.6	1,361	172	0.13	0.10
	1995	1,397.0	82.7	2,259	386	0.17	0.28
	1996	1,596.0	89.5	1,441	203	0.14	0.13
	1997	1,621.9	95.9	1,195	119	0.10	0.07
	1998	1,494.6	88.1	1,249	167	0.13	0.11
	1999	1,477.3	86.9	1,463	184	0.13	0.12
	2000	1,329.2	79.5	1,977	242	0.12	0.18
	2001	1,684.0	95.8	1,082	106	0.10	0.06
	2002	1,659.0	91.8	1,581	265	0.17	0.16
	2003	1,675.8	93.1	973	99	0.10	0.06
BEAVER VALLEY 1, 2	1977	355.6	57.0	331	878	0.26	2.47
Docket 50-334, 50-412;	1978	304.2	40.8	646	190	0.29	0.62
DPR-66, NPF-73	1979	221.0	40.0	704	132	0.19	0.60
1st commercial operation	1980	39.8	6.8	1,817	553	0.30	13.89
10/76, 11/87	1981	573.4	73.6	1,237	229	0.19	0.40
Type - PWRs	1982	326.7	41.6	1,755	599	0.34	1.83
Capacity - 821, 831 MWe	1983	561.2	68.2	1,485	772	0.52	1.38
	1984	576.7	71.8	1,393	504	0.36	0.87
	1985	717.7	91.9	619	60	0.10	0.08
	1986	581.3	70.7	1,575	627	0.40	1.08
	1987	684.1	83.8	1,282	210	0.16	0.31
	1988	1,386.1	87.4	1,764	530	0.30	0.38
	1989	1,017.4	69.6	2,349	1,378	0.59	1.35
	1990	1,271.0	85.3	1,675	348	0.21	0.27
	1991	1,267.5	78.6	1,689	495	0.29	0.39
	1992	1,441.9	89.1	1,414	289	0.20	0.20
	1993	1,157.9	73.1	2,087	621	0.30	0.54
	1994	1,514.6	88.6	487	44	0.09	0.03
	1995	1,389.2	83.1	1,536	453	0.29	0.33
	1996	1,269.0	76.5	1,688	449	0.27	0.35
	1997	1,159.3	72.1	1,391	306	0.22	0.26
	1998	523.1	33.5	700	59	0.08	0.11
	1999	1,353.7	85.9	841	99	0.12	0.07
	2000	1,378.7	87.3	1,730	338	0.20	0.24
	2001	1,500.8	92.3	1,202	184	0.15	0.12
	2002	1,548.0	95.4	1,048	90	0.09	0.06
	2003	1,437.0	88.4	1,623	277	0.17	0.19

Reporting Organization	Year	Megawatt Years MW-YR	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose	Average Measurable Dose (rems)	Collective Dose MW-yr
BIG ROCK POINT[1]	1969	48.1		165	136	0.82	2.83
Docket 50-155; DPR-6	1970	43.5		290	194	0.67	4.46
1st commercial operation 3/63	1971	44.4		260	184	0.71	4.14
Type - BWR	1972	43.5		195	181	0.93	4.16
Capacity - (67) MWe	1973	50.9		241	285	1.18	5.60
	1974	40.7	70.3	281	276	0.98	6.78
	1975	35.1	59.8	300	180	0.60	5.13
	1976	29.5	50.1	488	289	0.59	9.80
	1977	43.6	73.4	465	334	0.72	7.66
	1978	48.5	77.9	285	175	0.61	3.61
	1979	13.0	23.5	623	455	0.73	35.00
	1980	48.9	79.0	599	354	0.59	7.24
	1981	56.9	90.6	479	160	0.33	2.81
	1982	43.6	70.8	521	328	0.63	7.52
	1983	42.3	71.0	493	263	0.53	6.22
	1984	50.3	78.6	297	155	0.52	3.08
	1985	43.8	73.5	435	291	0.67	6.64
	1986	61.0	95.5	202	84	0.42	1.38
	1987	45.3	71.0	251	222	0.88	4.90
	1988	46.1	72.8	303	170	0.56	3.69
	1989	50.2	79.0	418	177	0.42	3.53
	1990	51.3	77.2	351	232	0.66	4.52
	1991	59.1	85.2	435	226	0.52	3.82
	1992	32.7	54.5	496	277	0.56	8.47
	1993	51.2	79.4	419	152	0.36	2.97
	1994	49.5	75.3	310	119	0.38	2.40
	1995	62.2	95.0	205	54	0.26	0.87
	1997	22.4	54.1	258	55	0.21	2.46
	1998	0.0	0.0	432	104	0.24	---
	1999	0.0	0.0	285	87	0.31	---
	2000	0.0	0.0	226	89	0.40	---
	2001	0.0	0.0	167	48	0.28	---
	2002	0.0	0.0	170	44	0.26	---
	2003	0.0	0.0	336	121	0.36	---
BRAIDWOOD 1, 2	1989	1,381.8	75.4	1,460	296	0.20	0.21
Docket 50-456, 50-457;	1990	1,740.2	84.1	1,081	186	0.17	0.11
NPF-72, NPF-77	1991	1,377.2	68.9	1,641	550	0.34	0.40
1st commercial operation	1992	1,885.9	89.0	1,059	228	0.22	0.12
7/88, 10/88	1993	1,899.3	86.9	1,043	273	0.26	0.14
Type - PWRs	1994	1,666.1	77.2	1,237	298	0.24	0.18
Capacity - 1161, 1154 MWe	1995	1,914.7	85.4	1,134	236	0.21	0.12
	1996	1,854.9	82.1	1,356	334	0.25	0.18
	1997	1,863.3	85.4	1,693	321	0.19	0.17
	1998	1,979.1	88.9	1,869	259	0.14	0.13
	1999	2,161.6	95.8	1,153	146	0.13	0.07
	2000	2,142.8	94.9	1,562	194	0.12	0.09
	2001	2,186.4	95.8	881	101	0.11	0.05
	2002	2,284.0	96.8	975	91	0.09	0.04
	2003	2,279.9	95.6	1,572	245	0.16	0.11

[1] Big Rock Point was shut down in 9/97 and is no longer included in the count of operating reactors. Parentheses indicate plant capacity when plant was operational.

Reporting Organization	Year	Megawatt Years MW-YR	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose	Average Measurable Dose (rems)	Collective Dose MW-yr
BROWNS FERRY 1[2], 2, 3	1975	161.7	17.8	2,743	347	0.13	2.15
Docket 50-259, 50-260,	1976	337.6	26.9	2,530	232	0.09	0.69
50-296	1977	1,327.5	73.7	1,985	876	0.44	0.66
DPR - 33, - 52, - 68	1978	1,992.1	73.5	2,479	1,776	0.72	0.89
1st commercial operation	1979	2,393.0	79.1	2,869	1,593	0.56	0.67
8/74, 3/75, 3/77	1980	2,182.1	73.6	2,838	1,768	0.62	0.81
Type - BWRs	1981	2,132.9	69.5	3,497	2,398	0.69	1.12
Capacity - (1065), 1118,	1982	2,025.4	67.6	3,360	2,230	0.66	1.10
1118 MWe	1983	1,641.0	54.3	3,410	3,375	0.99	2.06
	1984	1,431.9	54.2	3,172	1,954	0.62	1.36
	1985	368.2	11.9	2,854	1,164	0.41	3.16
	1986	0.0	0.0	3,074	1,054	0.34	---
	1987	0.0	0.0	3,184	1,186	0.37	---
	1988	0.0	0.0	3,390	1,158	0.34	---
	1989	0.0	0.0	2,707	657	0.24	---
	1990	0.0	0.0	2,725	1,311	0.48	---
	1991	445.0	17.7	1,831	356	0.19	0.80
	1992	979.9	32.2	2,670	519	0.19	0.53
	1993	675.1	66.8	3,594	870	0.24	1.29
	1994	860.2	83.4	3,362	861	0.26	1.00
	1995	1,165.8	98.6	2,567	413	0.16	0.35
	1996	1,972.8	93.0	1,904	389	0.20	0.20
	1997	1,928.8	90.2	2,268	522	0.23	0.27
	1998	1,961.9	87.7	1,612	368	0.23	0.19
	1999	2,091.0	85.1	1,741	447	0.26	0.21
	2000	2,143.8	97.1	1,657	333	0.20	0.16
	2001	2,074.0	90.7	1,525	294	0.19	0.14
	2002	2,069.0	95.4	1,977	358	0.18	0.17
	2003	2,014.5	93.6	2,608	603	0.23	0.30
BRUNSWICK 1, 2	1976	297.2	56.0	1,265	326	0.26	1.10
Docket 50-324, 50-325;	1977	291.1	55.7	1,512	1,120	0.74	3.85
DPR-62, -71	1978	1,173.1	83.7	1,458	1,004	0.69	0.86
1st commercial operation	1979	810.0	60.1	2,891	2,602	0.90	3.21
3/77, 11/75	1980	687.2	52.2	3,788	3,870	1.02	5.63
Type - BWRs	1981	925.2	56.9	3,854	2,638	0.68	2.85
Capacity - 872, 811 MWe	1982	540.3	50.3	4,957	3,792	0.76	7.02
	1983	636.7	44.3	5,602	3,475	0.62	5.46
	1984	761.3	51.5	5,046	3,260	0.65	4.28
	1985	822.2	58.4	4,057	2,804	0.69	3.41
	1986	1,051.3	69.1	3,370	1,909	0.57	1.82
	1987	1,152.4	80.6	3,052	1,419	0.46	1.23
	1988	990.8	70.1	2,648	1,747	0.66	1.76
	1989	990.9	65.8	3,844	1,786	0.46	1.80
	1990	991.6	67.8	3,182	1,548	0.49	1.56
	1991	952.8	64.5	2,586	778	0.30	0.82
	1992	375.9	27.9	2,690	623	0.23	1.66
	1993	470.0	33.8	2,921	872	0.30	1.86
	1994	1,268.4	83.0	3,049	999	0.70	0.79
	1995	1,411.7	92.9	2,657	683	0.26	0.48
	1996	1,261.1	85.9	2,784	716	0.26	0.57
	1997	1,474.0	94.1	2,212	411	0.19	0.28
	1998	1,521.0	94.3	2,005	396	0.20	0.26
	1999	1,494.7	92.8	1,818	418	0.23	0.28
	2000	1,571.2	95.6	1,648	322	0.20	0.20
	2001	1,576.0	95.8	1,623	303	0.19	0.19
	2002	1,568.0	94.5	1,743	276	0.16	0.18
	2003	1,676.9	95.6	1,794	249	0.14	0.15

[2] Browns Ferry 1 remains in the count of operating reactors, but was placed on Administrative Hold in June of 1985. Parentheses indicate plant capacity when plant was operational.

Reporting Organization	Year	Megawatt Years MW-YR	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose	Average Measurable Dose (rems)	Collective Dose MW-yr
BYRON 1, 2	1986	894.5	88.6	1,081	76	0.07	0.08
Docket 50-454, 50-455;	1987	650.9	70.9	1,826	769	0.42	1.18
NPF-37, NPF-66	1988	1,534.7	86.3	1,222	459	0.38	0.30
1st commercial operation	1989	1,812.6	90.2	1,109	172	0.16	0.09
9/85, 8/87	1990	1,567.3	78.8	1,396	434	0.31	0.28
Type - PWRs	1991	1,816.3	89.9	1,077	268	0.25	0.15
Capacity - 1163, 1131 MWe	1992	1,888.4	90.1	1,021	199	0.19	0.11
	1993	1,785.6	83.5	1,370	432	0.32	0.24
	1994	1,953.3	90.7	962	280	0.29	0.14
	1995	1,900.6	85.5	1,107	306	0.28	0.16
	1996	1,758.4	79.3	1,610	455	0.28	0.26
	1997	1,856.7	86.6	1,546	241	0.16	0.13
	1998	1,869.8	85.9	1,809	275	0.15	0.15
	1999	2,064.2	92.3	1,478	239	0.16	0.12
	2000	2,196.9	97.4	959	194	0.20	0.09
	2001	2,301.5	97.8	719	59	0.08	0.03
	2002	2,205.0	93.8	1,287	195	0.15	0.09
	2003	2,294.8	97.2	824	87	0.11	0.04
CALLAWAY 1	1985	967.4	90.0	964	36	0.04	0.04
Docket 50-483; NPF-30	1986	865.2	81.3	1,052	225	0.21	0.26
1st commercial operation 12/84	1987	759.0	71.1	1,082	393	0.36	0.52
Type - PWR	1988	1,069.2	93.4	353	27	0.08	0.03
Capacity - 1125 MWe	1989	1,000.3	85.4	1,055	283	0.27	0.28
	1990	960.7	84.1	1,134	442	0.39	0.46
	1991	1,193.1	99.7	280	21	0.07	0.02
	1992	967.5	83.0	1,133	336	0.30	0.35
	1993	1,002.9	86.4	1,126	225	0.20	0.22
	1994	1,196.4	100.0	191	14	0.07	0.01
	1995	989.6	84.7	1,062	187	0.18	0.19
	1996	1,066.0	90.5	980	248	0.25	0.23
	1997	1,022.2	100.0	248	12	0.05	0.01
	1998	972.2	91.3	929	201	0.22	0.21
	1999	981.3	88.7	1,098	321	0.29	0.33
	2000	1,137.5	99.8	244	16	0.07	0.01
	2001	954.5	86.7	873	107	0.12	0.11
	2002	955.0	86.2	983	96	0.10	0.10
	2003	1,104.3	96.2	252	8	0.03	0.01
CALVERT CLIFFS 1, 2	1976	753.4	95.2	507	74	0.15	0.10
Docket 50-317, 50-318;	1977	583.0	72.1	2,265	547	0.24	0.94
DPR-53, -69	1978	1,188.5	75.8	1,391	500	0.36	0.42
1st commercial operation	1979	1,161.0	74.0	1,428	805	0.56	0.69
5/75, 4/77	1980	1,309.9	84.1	1,496	677	0.45	0.52
Type - PWRs	1981	1,379.7	83.1	1,555	607	0.39	0.44
Capacity - 825, 835 MWe	1982	1,238.3	73.7	1,805	1,057	0.59	0.85
	1983	1,397.2	81.6	1,915	668	0.35	0.48
	1984	1,389.4	79.3	1,369	479	0.35	0.34
	1985	1,189.8	68.4	1,598	694	0.43	0.58
	1986	1,530.0	87.2	1,296	347	0.27	0.23
	1987	1,207.3	71.8	1,384	412	0.30	0.34
	1988	1,397.7	81.0	1,296	291	0.22	0.21
	1989	333.6	20.1	1,786	346	0.19	1.04
	1990	161.1	11.0	2,019	304	0.15	1.89
	1991	1,085.0	64.7	1,974	132	0.07	0.12
	1992	1,271.2	73.9	1,979	330	0.17	0.26
	1993	1,462.1	83.9	1,462	405	0.28	0.28
	1994	1,342.1	79.4	1,482	454	0.31	0.34
	1995	1,542.8	89.9	1,203	235	0.20	0.15
	1996	1,438.5	82.4	1,167	239	0.20	0.17
	1997	1,499.6	89.1	1,091	229	0.21	0.15
	1998	1,523.1	89.3	1,042	187	0.18	0.12

Reporting Organization	Year	Megawatt Years MW-YR	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose	Average Measurable Dose (rems)	Collective Dose MW-yr
CALVERT CLIFFS 1, 2	1999	1,521.4	90.1	1,134	192	0.17	0.13
(continued)	2000	1,575.7	92.7	912	135	0.15	0.09
	2001	1,554.7	91.7	895	167	0.19	0.11
	2002	1,380.0	81.7	1,582	245	0.16	0.18
	2003	1,558.4	90.9	1,671	265	0.16	0.17
CATAWBA 1, 2	1986	638.9	49.9	1,724	286	0.17	0.45
Docket 50-413, 50-414;	1987	1,651.2	75.9	1,865	449	0.24	0.27
NPF-35, NPF-52	1988	1,675.2	77.2	2,009	556	0.28	0.33
1st commercial operation	1989	1,733.6	79.5	1,660	334	0.20	0.19
6/85, 8/86	1990	1,616.3	70.8	2,174	809	0.37	0.50
Type - PWRs	1991	1,691.5	74.6	1,871	462	0.25	0.27
Capacity - 1129, 1129 MWe	1992	1,962.8	83.9	1,515	414	0.27	0.21
	1993	1,896.1	81.5	1,564	396	0.25	0.21
	1994	2,105.2	90.2	1,268	207	0.16	0.10
	1995	2,011.9	85.3	1,892	462	0.24	0.23
	1996	1,879.1	80.5	1,588	302	0.19	0.16
	1997	2,028.2	89.3	1,561	266	0.17	0.13
	1998	2,006.4	89.6	1,123	162	0.14	0.08
	1999	2,046.7	90.2	1,024	119	0.12	0.06
	2000	2,038.3	90.3	1,185	187	0.16	0.09
	2001	2,119.9	92.9	960	116	0.12	0.06
	2002	2,238.0	97.2	884	81	0.09	0.04
	2003	1,991.8	89.2	1,409	211	0.15	0.11
CLINTON	1988	701.3	84.2	769	130	0.17	0.19
Docket 50-461; NPF-62	1989	348.3	48.5	1,196	372	0.31	1.07
1st commercial operation 11/87	1990	435.8	55.1	1,390	553	0.40	1.27
Type - BWR	1991	722.7	80.8	1,010	233	0.23	0.32
Capacity - 1022 MWe	1992	589.7	68.6	1,195	431	0.36	0.73
	1993	701.5	79.6	1,253	498	0.40	0.71
	1994	883.3	94.8	409	63	0.15	0.07
	1995	731.1	83.0	1,182	316	0.27	0.43
	1996	634.7	66.7	1,154	350	0.30	0.55
	1997	0.0	0.0	738	172	0.23	---
	1998	0.0	0.0	866	177	0.17	---
	1999	537.0	63.5	637	87	0.14	0.16
	2000	784.2	87.8	1,248	253	0.20	0.32
	2001	896.8	98.5	329	34	0.10	0.04
	2002	872.0	90.5	1,418	208	0.15	0.24
	2003	990.5	99.1	372	57	0.15	0.06
COLUMBIA GENERATING[3]	1985	616.0	87.6	755	119	0.16	0.19
Docket 50-397; NPF-21	1986	616.0	74.4	1,013	222	0.22	0.36
1st commercial operation 12/84	1987	639.0	70.8	1,201	406	0.34	0.64
Type - BWR	1988	707.7	71.8	1,050	353	0.34	0.50
Capacity - 1107 MWe	1989	727.2	78.3	1,299	492	0.38	0.68
	1990	684.7	67.5	1,348	536	0.40	0.78
	1991	508.5	50.3	1,088	387	0.36	0.76
	1992	682.3	65.6	1,489	612	0.41	0.90
	1993	849.6	79.5	1,385	469	0.34	0.55
	1994	803.8	75.2	1,870	866	0.46	1.08
	1995	824.7	83.8	1,694	456	0.27	0.55
	1996	662.9	82.2	1,453	373	0.26	0.56
	1997	697.0	72.7	1,218	251	0.21	0.36
	1998	789.5	75.3	1,220	286	0.23	0.36
	1999	694.7	70.0	1,022	155	0.15	0.22
	2000	979.6	96.3	706	53	0.08	0.05
	2001	939.3	88.1	1,515	227	0.15	0.24
	2002	1,023.0	97.5	647	47	0.07	0.05
	2003	866.9	81.8	1,618	205	0.13	0.24

[3] Energy Northwest has changed the name of Washington Nuclear 2 to Columbia Generating Station.

Reporting Organization	Year	Megawatt Years MW-YR	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose	Average Measurable Dose (rems)	Collective Dose MW-yr
COMANCHE PEAK 1, 2	1991	644.4	82.2	985	148	0.15	0.23
Docket 50-445, 50-446;	1992	830.8	84.0	1,128	188	0.17	0.23
NPF-87, 89	1993	853.8	81.2	945	109	0.12	0.13
1st commercial operation	1994	1,750.0	93.7	970	90	0.09	0.05
8/90, 8/93	1995	2,022.6	92.5	951	179	0.19	0.09
Type - PWR	1996	1,804.8	81.4	1,462	288	0.20	0.16
Capacity - 1150, 1150 MWe	1997	2,002.4	93.4	870	146	0.17	0.07
	1998	2,037.8	94.9	967	232	0.24	0.11
	1999	1,981.5	90.9	1,316	251	0.19	0.13
	2000	2,104.7	95.3	759	78	0.10	0.04
	2001	2,085.9	94.7	853	115	0.13	0.06
	2002	1,887.0	86.9	1,106	225	0.20	0.12
	2003	2,020.6	91.6	639	66	0.10	0.03
COOK 1, 2	1976	807.4	83.1	395	116	0.29	0.14
Docket 50-315; DPR-58, -74	1977	573.0	76.1	802	300	0.37	0.52
1st commercial operation	1978	744.8	73.6	778	336	0.43	0.45
8/75, 7/78	1979	1,373.0	65.3	1,445	718	0.50	0.52
Type - PWRs	1980	1,552.4	74.1	1,345	493	0.37	0.32
Capacity - 1000, 1060 MWe	1981	1,557.3	73.4	1,341	656	0.49	0.42
	1982	1,461.6	69.8	1,527	699	0.46	0.48
	1983	1,456.5	71.2	1,418	658	0.46	0.45
	1984	1,526.0	75.3	1,559	762	0.49	0.50
	1985	925.4	47.6	1,984	945	0.48	1.02
	1986	1,307.1	73.4	1,774	745	0.42	0.57
	1987	1,199.5	70.2	1,696	666	0.39	0.56
	1988	1,160.4	63.5	2,266	867	0.38	0.75
	1989	1,433.1	72.8	1,575	493	0.31	0.34
	1990	1,318.5	67.9	1,851	580	0.31	0.44
	1991	1,837.4	90.2	815	69	0.08	0.04
	1992	760.9	50.8	1,954	492	0.25	0.65
	1993	1,927.7	98.5	587	44	0.07	0.02
	1994	1,105.2	65.2	1,748	479	0.27	0.43
	1995	1,656.0	82.1	1,310	203	0.15	0.12
	1996	1,938.9	92.7	1,114	214	0.19	0.11
	1997	1,189.7	59.7	1,864	550	0.30	0.46
	1998	0.0	0.0	1,155	105	0.09	---
	1999	0.0	0.0	1,662	171	0.10	---
	2000	560.1	28.1	2,506	338	0.14	0.60
	2001	1,794.3	89.2	423	27	0.06	0.02
	2002	1,756.0	87.3	1,624	278	0.17	0.16
	2003	1,557.6	75.7	1,408	210	0.15	0.13
COOPER STATION	1975	456.4	83.6	579	117	0.20	0.26
Docket 50-298; DPR-46	1976	433.3	75.5	763	350	0.46	0.81
1st commercial operation 7/74	1977	538.2	86.2	315	198	0.63	0.37
Type - BWR	1978	576.0	91.0	297	158	0.53	0.27
Capacity - 764 MWe	1979	591.0	87.6	426	221	0.52	0.37
	1980	448.3	71.2	785	859	1.09	1.92
	1981	457.1	71.2	935	579	0.62	1.27
	1982	622.3	84.6	743	542	0.73	0.87
	1983	396.6	63.3	1,383	1,293	0.93	3.26
	1984	411.9	67.2	1,598	799	0.50	1.94
	1985	127.3	21.5	1,980	1,333	0.67	10.47
	1986	480.0	74.7	895	320	0.36	0.67
	1987	652.3	96.2	549	103	0.19	0.16
	1988	493.4	67.9	942	251	0.27	0.51
	1989	564.3	76.2	1,202	343	0.29	0.61
	1990	602.0	79.4	1,174	379	0.32	0.63
	1991	566.3	78.8	1,099	405	0.37	0.72

Reporting Organization	Year	Megawatt Years MW-YR	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose	Average Measurable Dose (rems)	Collective Dose MW-yr
COOPER STATION	1992	731.0	96.4	463	84	0.18	0.11
(continued)	1993	436.1	58.8	1,130	391	0.35	0.90
	1994	262.2	35.1	333	79	0.24	0.30
	1995	486.5	66.8	1,095	228	0.21	0.47
	1996	742.1	97.9	468	48	0.10	0.06
	1997	622.8	84.4	1,125	174	0.16	0.28
	1998	555.9	75.9	977	182	0.19	0.33
	1999	743.2	98.1	318	48	0.15	0.06
	2000	539.2	74.2	963	200	0.21	0.37
	2001	592.7	80.9	1,309	169	0.13	0.28
	2002	719.0	98.6	362	39	0.11	0.05
	2003	511.4	74.1	882	135	0.15	0.26
CRYSTAL RIVER 3	1978	311.5	41.4	643	321	0.50	1.03
Docket 50-302; DPR-72	1979	453.0	58.9	1,150	495	0.43	1.09
1st commercial operation 3/77	1980	404.1	53.2	1,053	625	0.59	1.55
Type - PWR	1981	490.4	62.2	1,120	408	0.36	0.83
Capacity - 834 MWe	1982	589.8	76.0	780	177	0.23	0.30
	1983	452.1	58.8	1,720	552	0.32	1.22
	1984	774.2	94.5	549	49	0.09	0.06
	1985	344.2	47.6	1,976	689	0.35	2.00
	1986	319.5	41.8	1,057	472	0.45	1.48
	1987	436.0	60.9	1,384	488	0.35	1.12
	1988	690.2	84.0	569	64	0.11	0.09
	1989	352.8	48.8	880	234	0.27	0.66
	1990	497.8	63.8	1,441	476	0.33	0.96
	1991	654.6	82.0	821	116	0.14	0.18
	1992	632.1	76.1	1,403	424	0.30	0.67
	1993	722.4	85.0	683	60	0.09	0.08
	1994	711.9	84.3	1,079	228	0.21	0.32
	1995	866.3	100.0	209	8	0.04	0.01
	1996	290.8	37.7	1,192	353	0.30	1.21
	1997	0.0	0.0	973	179	0.18	---
	1998	739.9	90.3	313	19	0.06	0.03
	1999	727.5	87.8	1,324	251	0.19	0.35
	2000	819.4	97.6	257	15	0.06	0.02
	2001	741.6	89.2	902	148	0.16	0.20
	2002	831.0	99.4	128	5	0.04	0.01
	2003	749.0	90.8	961	127	0.13	0.17
DAVIS-BESSE 1	1978	326.4	48.7	421	48	0.11	0.15
Docket 50-346; NPF-3	1979	381.0	67.0	304	30	0.10	0.08
1st commercial operation 7/78	1980	256.4	36.2	1,283	154	0.12	0.60
Type - PWR	1981	531.4	67.4	578	58	0.10	0.11
Capacity - 882 MWe	1982	390.8	51.5	1,350	164	0.12	0.42
	1983	592.1	73.0	718	80	0.11	0.14
	1984	518.5	62.5	1,088	177	0.16	0.34
	1985	238.3	31.2	718	71	0.10	0.30
	1986	3.3	1.3	981	124	0.13	37.58
	1987	618.0	89.6	625	47	0.08	0.08
	1988	144.1	27.1	1,183	307	0.26	2.13
	1989	880.0	98.6	404	38	0.09	0.04
	1990	500.0	56.7	1,377	489	0.36	0.98
	1991	703.6	81.8	1,000	216	0.22	0.31
	1992	915.2	100.0	287	19	0.07	0.02
	1993	729.5	83.4	1,244	348	0.28	0.48
	1994	768.4	88.0	861	144	0.17	0.19
	1995	920.4	100.0	256	7	0.03	0.01
	1996	775.8	85.3	949	167	0.18	0.22
	1997	820.0	94.0	213	10	0.05	0.01

Reporting Organization	Year	Megawatt Years MW-YR	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose	Average Measurable Dose (rems)	Collective Dose MW-yr
DAVIS-BESSE 1	1998	699.8	83.2	980	155	0.16	0.22
(continued)	1999	841.3	95.6	397	28	0.07	0.03
	2000	770.8	87.3	1,109	168	0.15	0.22
	2001	875.6	100.0	119	6	0.05	0.01
	2002	106.0	12.6	1,983	403	0.20	3.81
	2003	0.0	0.0	1,047	220	0.21	---
DIABLO CANYON 1, 2	1986	641.5	80.6	1,260	304	0.24	0.47
Docket 50-275, 50-323;	1987	1,688.6	83.0	1,170	336	0.29	0.20
DPR-80, DPR-82	1988	1,386.1	67.6	1,826	877	0.48	0.63
1st commercial operation	1989	1,899.0	87.5	1,646	465	0.28	0.24
5/85, 3/86	1990	1,952.6	91.0	1,441	323	0.22	0.17
Type - PWRs	1991	1,809.6	83.8	2,040	546	0.27	0.30
Capacity - 1087, 1087 MWe	1992	1,995.7	90.9	1,850	459	0.25	0.23
	1993	2,008.6	91.4	1,508	281	0.19	0.14
	1994	1,832.6	83.3	2,317	590	0.26	0.32
	1995	1,950.3	90.0	1,615	286	0.18	0.15
	1996	2,003.6	90.7	1,462	176	0.12	0.09
	1997	1,948.7	92.7	1,331	219	0.17	0.11
	1998	1,955.1	92.8	1,313	173	0.13	0.09
	1999	1,902.8	90.1	1,566	449	0.29	0.24
	2000	1,940.1	92.0	1,057	181	0.17	0.09
	2001	2,067.7	96.4	1,074	118	0.11	0.06
	2002	1,860.0	88.4	1,016	149	0.15	0.08
	2003	1,970.7	91.6	1,004	135	0.13	0.07
DRESDEN 1[4] , 2, 3	1969	99.7			286		2.87
Docket 50-010, 50-237, 50-249;	1970	163.1			143		0.88
DPR-2, -19, -25	1971	394.5			715		1.81
1st commercial operation 7/60,	1972	1,243.7			728		0.59
6/70, 11/71	1973	1,112.2		1,341	939	0.70	0.84
Type - BWRs	1974	842.5	54.9	1,594	1,662	1.04	1.97
Capacity - (197), 850, 850 MWe	1975	708.1	54.6	2,310	3,423	1.48	4.83
	1976	1,127.2	80.8	1,746	1,680	0.96	1.49
	1977	1,132.9	77.0	1,862	1,694	0.91	1.50
	1978	1,242.2	79.5	1,946	1,529	0.79	1.23
	1979	1,013.0	74.7	2,407	1,800	0.75	1.78
	1980	1,074.4	55.0	2,717	2,105	0.77	1.96
	1981	1,035.7	51.5	2,331	2,802	1.20	2.71
	1982	1,085.3	77.9	2,572	2,923	1.14	2.69
	1983	913.6	65.6	2,854	3,582	1.26	3.92
	1984	789.8	55.3	2,261	1,774	0.78	2.25
	1985	903.0	64.5	2,817	1,686	0.60	1.87
	1986	740.5	52.6	3,111	2,668	0.86	3.60
	1987	933.9	74.0	2,052	1,145	0.56	1.23
	1988	1,014.7	75.8	2,414	1,409	0.58	1.39
	1989	1,184.2	83.1	2,259	1,131	0.50	0.96
	1990	1,107.8	76.6	2,235	1,400	0.63	1.26
	1991	675.2	60.7	2,044	1,005	0.49	1.49
	1992	872.4	75.4	1,812	619	0.34	0.71
	1993	960.1	68.5	2,751	1,655	0.60	1.72
	1994	690.2	51.7	2,336	833	0.36	1.21
	1995	643.1	49.8	2,482	875	0.35	1.36
	1996	612.6	47.7	1,788	456	0.26	0.74
	1997	1,096.2	79.5	2,747	467	0.17	0.43
	1998	1,354.7	90.6	2,311	427	0.18	0.32
	1999	1,410.9	92.5	3,243	591	0.18	0.42

[4] Dresden 1 has been shut down since 1978, and in 1985 it was decided that it would not be put in commercial operation again. Therefore, it is no longer included in the count of operating reactors. Parentheses indicate plant capacity when plant was operational.

Reporting Organization	Year	Megawatt Years MW-YR	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose	Average Measurable Dose (rems)	Collective Dose MW-yr
DRESDEN 1[4] , 2, 3	2000	1,506.4	97.3	2,341	262	0.11	0.17
(continued)	2001	1,427.4	94.5	2,769	401	0.14	0.28
	2002	1,547.0	95.7	2,819	355	0.13	0.23
	2003	1,555.9	93.5	2,098	357	0.17	0.23
DUANE ARNOLD	1976	305.2	78.0	350	105	0.30	0.34
Docket 50-331; DPR-49	1977	353.6	78.9	538	299	0.56	0.85
1st commercial operation 2/75	1978	149.2	33.2	1,112	974	0.88	6.53
Type - BWR	1979	352.0	78.0	757	275	0.36	0.78
Capacity - 566 MWe	1980	339.1	73.3	1,108	671	0.61	1.98
	1981	277.7	69.8	1,286	790	0.61	2.84
	1982	278.5	74.7	524	229	0.44	0.82
	1983	283.0	62.9	1,468	1,135	0.77	4.01
	1984	329.4	72.9	611	189	0.31	0.57
	1985	236.2	53.8	1,414	1,112	0.79	4.71
	1986	365.5	82.0	476	187	0.39	0.51
	1987	308.4	64.7	1,094	667	0.61	2.16
	1988	386.5	75.2	1,136	614	0.54	1.59
	1989	388.5	79.0	425	194	0.46	0.50
	1990	367.4	75.8	1,460	861	0.59	2.34
	1991	503.7	94.5	336	202	0.60	0.40
	1992	416.5	81.9	1,043	502	0.48	1.21
	1993	393.4	79.5	1,043	407	0.39	1.03
	1994	498.6	94.0	493	120	0.24	0.24
	1995	452.5	83.8	1,129	357	0.32	0.79
	1996	476.8	90.7	1,093	270	0.25	0.57
	1997	474.4	94.4	352	63	0.18	0.13
	1998	438.3	86.6	1,019	237	0.23	0.54
	1999	416.6	84.3	834	201	0.24	0.48
	2000	507.3	98.4	317	44	0.14	0.09
	2001	439.5	86.8	898	138	0.15	0.31
	2002	522.0	94.4	319	35	0.11	0.07
	2003	455.2	84.8	829	124	0.15	0.27
FARLEY 1, 2	1978	713.8	86.5	527	108	0.20	0.15
Docket 50-348, 50-364;	1979	211.0	28.6	1,227	643	0.52	3.05
NPF-2, -8	1980	557.3	69.3	1,330	435	0.33	0.78
1st commercial operation	1981	310.2	41.4	1,331	512	0.38	1.65
12/77, 7/81	1982	1,271.5	79.2	1,453	484	0.33	0.38
Type - PWRs	1983	1,356.5	83.0	1,938	1,021	0.53	0.75
Capacity - 830, 839 MWe	1984	1,447.0	86.6	2,046	902	0.44	0.62
	1985	1,368.2	81.1	2,551	799	0.31	0.58
	1986	1,409.4	83.8	2,314	858	0.37	0.61
	1987	1,369.7	84.7	1,871	598	0.32	0.44
	1988	1,567.7	92.3	1,840	552	0.30	0.35
	1989	1,402.9	84.6	2,206	749	0.34	0.53
	1990	1,464.0	86.7	1,700	457	0.27	0.31
	1991	1,464.0	88.1	1,645	648	0.39	0.44
	1992	1,331.7	81.8	2,018	805	0.40	0.60
	1993	1,455.5	88.3	1,284	333	0.26	0.23
	1994	1,587.2	93.0	1,035	250	0.24	0.16
	1995	1,311.2	83.8	1,574	460	0.29	0.35
	1996	1,549.2	90.9	1,150	232	0.20	0.15
	1997	1,449.7	89.0	1,105	278	0.25	0.19
	1998	1,313.9	80.9	1,380	432	0.31	0.33
	1999	1,436.0	91.4	1,102	190	0.17	0.13

[4] Dresden 1 has been shut down since 1978, and in 1985 it was decided that it would not be put in commercial operation again. Therefore, it is no longer included in the count of operating reactors. Parentheses indicate plant capacity when plant was operational.

Reporting Organization	Year	Megawatt Years MW-YR	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose	Average Measurable Dose (rems)	Collective Dose MW-yr
FARLEY 1, 2	2000	1,430.1	88.6	1,683	360	0.21	0.25
(continued)	2001	1,384.3	84.4	1,810	321	0.18	0.23
	2002	1,558.0	93.5	772	96	0.13	0.06
	2003	1,592.6	95.3	788	111	0.14	0.07
FERMI 2	1989	624.0	68.5	1,270	255	0.20	0.41
Docket 50-341; NPF-43	1990	848.2	84.7	462	83	0.18	0.10
1st commercial operation 1/88	1991	739.0	77.0	1,223	228	0.19	0.31
Type - BWR	1992	874.3	81.3	1,213	245	0.20	0.28
Capacity - 1089 MWe	1993	984.3	92.9	360	35	0.10	0.04
	1994	0.0	2.2	1,130	213	0.19	---
	1995	618.3	86.9	390	28	0.07	0.05
	1996	577.5	69.1	1,402	157	0.11	0.27
	1997	637.0	66.6	623	49	0.08	0.08
	1998	815.8	79.9	1,362	208	0.15	0.25
	1999	1,082.7	99.5	461	36	0.08	0.03
	2000	939.6	87.6	1,266	146	0.12	0.15
	2001	975.0	90.9	1,202	169	0.14	0.17
	2002	1,059.0	98.7	463	38	0.08	0.04
	2003	925.3	86.9	1,207	168	0.14	0.18
FITZPATRICK	1976	489.0	71.6	600	202	0.34	0.41
Docket 50-333; DPR-59	1977	460.5	68.4	1,380	1,080	0.78	2.35
1st commercial operation 7/75	1978	497.0	72.1	904	909	1.01	1.83
Type - BWR	1979	349.0	50.8	850	859	1.01	2.46
Capacity - 813 MWe	1980	509.5	70.3	2,056	2,040	0.99	4.00
	1981	562.9	74.7	2,490	1,425	0.57	2.53
	1982	583.6	75.0	2,322	1,190	0.51	2.04
	1983	546.2	70.6	1,715	1,090	0.64	2.00
	1984	576.2	76.8	1,610	971	0.60	1.69
	1985	492.3	63.7	1,845	1,051	0.57	2.13
	1986	711.2	90.6	1,185	411	0.35	0.58
	1987	496.2	70.3	1,578	940	0.60	1.89
	1988	514.0	69.0	1,553	786	0.51	1.53
	1989	727.5	92.3	1,027	377	0.37	0.52
	1990	543.8	72.6	1,536	884	0.58	1.63
	1991	399.7	53.4	1,269	333	0.26	0.83
	1992	0.0	0.0	2,374	674	0.28	---
	1993	559.6	81.7	1,427	232	0.16	0.41
	1994	588.4	83.2	1,595	322	0.20	0.55
	1995	569.8	74.5	1,249	327	0.26	0.57
	1996	623.3	83.1	1,384	357	0.26	0.57
	1997	756.2	95.9	662	91	0.14	0.12
	1998	562.8	78.0	1,781	358	0.20	0.64
	1999	749.7	95.5	558	68	0.12	0.09
	2000	685.9	88.4	1267	301	0.24	0.44
	2001	807.2	98.9	665	63	0.10	0.08
	2002	751.0	93.3	1,234	231	0.19	0.31
	2003	793.0	97.9	298	51	0.17	0.06
FORT CALHOUN	1975	252.3	67.4	469	294	0.63	1.17
Docket 50-285; DPR-40	1976	265.9	69.5	516	313	0.61	1.18
1st commercial operation 6/74	1977	351.8	79.4	535	297	0.56	0.84
Type - PWR	1978	342.3	75.1	596	410	0.69	1.20
Capacity - 478 MWe	1979	440.0	95.7	451	126	0.28	0.29
	1980	242.3	60.4	891	668	0.75	2.76
	1981	260.9	72.3	822	458	0.56	1.76
	1982	418.0	89.7	604	217	0.36	0.52
	1983	330.4	73.1	860	433	0.50	1.31
	1984	279.2	59.9	913	563	0.62	2.02
	1985	367.0	73.7	982	373	0.38	1.02
	1986	431.8	94.3	756	75	0.10	0.17

Reporting Organization	Year	Megawatt Years MW-YR	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose	Average Measurable Dose (rems)	Collective Dose MW-yr
FORT CALHOUN	1987	366.0	75.4	1,247	388	0.31	1.06
(continued)	1988	315.5	74.1	1,594	272	0.17	0.86
	1989	395.7	89.2	1,210	93	0.08	0.24
	1990	290.0	64.2	760	290	0.38	1.00
	1991	391.1	91.7	284	57	0.20	0.15
	1992	303.4	65.9	802	272	0.34	0.90
	1993	369.7	80.8	713	157	0.22	0.42
	1994	492.8	99.6	211	23	0.11	0.05
	1995	402.8	83.2	627	139	0.22	0.35
	1996	374.9	79.5	740	226	0.31	0.60
	1997	435.9	93.6	258	41	0.16	0.09
	1998	387.7	82.5	788	224	0.28	0.58
	1999	409.2	89.2	676	159	0.24	0.39
	2000	443.8	93.5	249	35	0.14	0.08
	2001	401.2	88.3	770	226	0.29	0.56
	2002	434.0	92.3	742	164	0.22	0.38
	2003	399.6	87.0	914	212	0.23	0.53
GINNA	1971	327.8		340	430	1.26	1.31
Docket 50-244; DPR-18	1972	293.6		677	1,032	1.52	3.51
1st commercial operation 7/70	1973	409.5		319	224	0.70	0.55
Type - PWR	1974	253.7	62.4	884	1,225	1.39	4.83
Capacity - 480 MWe	1975	365.2	76.7	685	538	0.79	1.47
	1976	248.8	58.2	758	636	0.84	2.56
	1977	365.6	85.5	530	401	0.76	1.10
	1978	386.5	80.6	657	450	0.68	1.16
	1979	355.0	72.8	878	592	0.67	1.67
	1980	370.5	76.0	1,073	708	0.66	1.91
	1981	399.0	82.1	925	655	0.71	1.64
	1982	289.0	58.8	1,117	1,140	1.02	3.94
	1983	365.0	74.6	969	855	0.88	2.34
	1984	378.1	77.2	713	395	0.55	1.04
	1985	436.7	87.9	845	426	0.50	0.98
	1986	433.3	87.4	901	357	0.40	0.82
	1987	459.0	91.5	773	344	0.45	0.75
	1988	423.1	87.4	897	295	0.33	0.70
	1989	369.2	75.9	1,254	605	0.48	1.64
	1990	414.3	84.4	991	347	0.35	0.84
	1991	418.6	86.7	947	328	0.35	0.78
	1992	417.6	86.9	832	261	0.31	0.63
	1993	419.6	86.3	856	193	0.23	0.46
	1994	405.3	83.2	679	138	0.20	0.34
	1995	437.0	89.6	738	136	0.18	0.31
	1996	347.9	71.1	976	168	0.17	0.48
	1997	444.6	91.8	533	81	0.15	0.18
	1998	491.8	100.0	161	15	0.09	0.03
	1999	403.4	85.6	641	175	0.27	0.43
	2000	434.2	91.6	429	76	0.18	0.18
	2001	488.0	100.0	140	10	0.07	0.02
	2002	438.0	91.3	535	80	0.15	0.18
	2003	440.4	91.1	510	75	0.15	0.17
GRAND GULF	1986	494.7	60.9	1,486	436	0.29	0.88
Docket 50-416; NPF-29	1987	920.7	82.2	1,358	420	0.31	0.46
1st commercial operation 7/85	1988	1,136.6	96.7	692	147	0.21	0.13
Type - BWR	1989	932.6	80.0	1,972	498	0.25	0.53
Capacity - 1207 MWe	1990	883.5	78.9	1,765	482	0.27	0.55
	1991	1,085.2	94.0	699	94	0.13	0.09
	1992	969.0	83.7	2,032	484	0.24	0.50
	1993	936.4	81.5	1,807	332	0.18	0.35
	1994	1,143.2	96.6	455	56	0.12	0.05
	1995	952.9	80.4	1,589	342	0.22	0.36

Reporting Organization	Year	Megawatt Years MW-YR	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose	Average Measurable Dose (rems)	Collective Dose MW-yr
GRAND GULF	1996	1,096.2	88.7	1,564	357	0.23	0.33
(continued)	1997	1,234.9	100.0	514	105	0.20	0.09
	1998	1,049.2	88.9	1,410	304	0.22	0.29
	1999	962.1	81.3	1,180	226	0.19	0.23
	2000	1,217.5	99.4	289	35	0.12	0.03
	2001	1,129.8	93.0	1,109	185	0.17	0.16
	2002	1,145.0	93.6	1,060	176	0.17	0.15
	2003	1,241.2	98.6	290	31	0.11	0.03
HADDAM NECK[5]	1969	438.5		138	106	0.77	0.24
Docket 50-213; DPR-61	1970	424.7		734	689	0.94	1.62
1st commercial operation 1/68	1971	502.2		289	342	1.18	0.68
Type - PWR	1972	515.6		355	325	0.91	0.63
Capacity - (560) MWe	1973	293.1		951	697	0.73	2.38
	1974	521.4	91.2	550	201	0.37	0.39
	1975	494.3	89.9	795	703	0.88	1.42
	1976	482.9	82.5	644	449	0.70	0.93
	1977	480.7	83.9	894	641	0.72	1.33
	1978	563.4	98.6	216	117	0.54	0.21
	1979	493.0	87.5	1,226	1,162	0.95	2.36
	1980	426.8	75.0	1,860	1,353	0.73	3.17
	1981	487.5	84.3	1,554	1,036	0.67	2.13
	1982	543.9	93.4	559	126	0.23	0.23
	1983	453.7	77.8	1,645	1,384	0.84	3.05
	1984	404.0	71.7	1,430	1,216	0.85	3.01
	1985	556.1	98.4	384	101	0.26	0.18
	1986	294.8	53.6	1,945	1,567	0.81	5.32
	1987	304.6	54.0	1,763	750	0.43	2.46
	1988	397.4	70.3	735	237	0.32	0.60
	1989	356.4	67.2	1,455	596	0.41	1.67
	1990	142.7	32.2	979	421	0.43	2.95
	1991	444.4	76.4	1,168	590	0.51	1.33
	1992	465.2	80.1	797	202	0.25	0.43
	1993	448.6	81.6	1,004	408	0.41	0.91
	1994	455.6	77.7	463	135	0.29	0.30
	1995	439.4	77.7	1,006	442	0.44	1.01
	1996	331.8	55.7	673	175	0.26	0.53
	1997	-1.3	0.0	219	11	0.05	---
	1998	0.0	0.0	423	94	0.22	---
	1999	0.0	0.0	545	109	0.20	---
	2000	0.0	0.0	555	262	0.47	---
	2001	0.0	0.0	361	95	0.26	---
	2002	0.0	0.0	258	52	0.20	---
	2003	0.0	0.0	400	82	0.21	---
HARRIS 1	1988	652.9	75.0	721	169	0.23	0.26
Docket 50-400; NPF-63	1989	690.6	79.5	929	156	0.17	0.23
1st commercial operation 5/87	1990	776.4	89.6	453	85	0.19	0.11
Type - PWR	1991	724.8	81.5	872	226	0.26	0.31
Capacity - 900 MWe	1992	661.8	74.9	930	213	0.23	0.32
	1993	913.0	99.7	327	31	0.09	0.03
	1994	740.8	82.7	1,089	222	0.20	0.30
	1995	731.1	83.8	1,068	174	0.16	0.24
	1996	860.6	95.4	444	17	0.04	0.02
	1997	673.6	80.4	1,131	149	0.13	0.22
	1998	766.2	90.4	931	133	0.14	0.17
	1999	827.0	97.9	247	16	0.06	0.02

[5] Haddam Neck (also known as Connecticut Yankee) was shut down 12/4/96 and is no longer in the count of operating reactors. Parentheses indicate plant capacity when plant was operational.

Reporting Organization	Year	Megawatt Years MW-YR	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose	Average Measurable Dose (rems)	Collective Dose MW-yr
HARRIS 1	2000	783.0	92.5	888	101	0.11	0.13
(continued)	2001	611.2	72.4	1,586	252	0.16	0.41
	2002	892.0	99.4	145	7	0.05	0.01
	2003	823.9	93.2	786	68	0.09	0.08
HATCH 1, 2	1976	496.3	83.8	630	134	0.21	0.27
Docket 50-321, 50-366;	1977	446.8	66.3	1,303	465	0.36	1.04
DPR-57; NPF-05	1978	513.0	72.8	1,304	248	0.19	0.48
1st commercial operation	1979	401.0	54.6	2,131	582	0.27	1.45
12/75, 9/79	1980	1,008.7	70.9	1,930	449	0.23	0.45
Type - BWRs	1981	870.9	64.3	2,899	1,337	0.46	1.54
Capacity - 856, 883 MWe	1982	768.0	56.6	3,418	1,460	0.43	1.90
	1983	934.7	68.6	3,428	1,299	0.38	1.39
	1984	658.6	47.3	4,110	2,218	0.54	3.37
	1985	1,211.0	79.6	2,841	818	0.29	0.68
	1986	872.0	64.8	3,486	1,497	0.43	1.72
	1987	1,295.4	89.7	2,202	816	0.37	0.63
	1988	1,001.4	70.4	2,509	1,401	0.56	1.40
	1989	1,271.1	87.1	1,350	556	0.41	0.44
	1990	1,268.0	83.5	2,902	1,455	0.50	1.15
	1991	1,152.4	77.4	2,508	1,161	0.46	1.01
	1992	1,293.8	88.6	1,615	550	0.34	0.43
	1993	1,189.6	85.5	1,733	669	0.39	0.56
	1994	1,289.0	87.1	2,243	864	0.39	0.67
	1995	1,376.3	90.6	1,458	488	0.33	0.35
	1996	1,519.6	94.0	1,495	441	0.29	0.29
	1997	1,374.7	88.1	1,945	722	0.37	0.53
	1998	1,458.4	91.7	1,610	320	0.20	0.22
	1999	1,487.4	90.0	1,866	329	0.18	0.22
	2000	1,515.0	88.7	1,913	402	0.21	0.26
	2001	1,603.0	93.5	1,407	230	0.16	0.14
	2002	1,600.0	94.0	1,299	214	0.17	0.13
	2003	1,606.3	94.5	1,295	168	0.13	0.10
HOPE CREEK 1	1987	869.2	86.4	589	117	0.20	0.13
Docket 50-354; NPF-57	1988	832.7	80.7	1,734	287	0.17	0.34
1st commercial operation 12/86	1989	791.1	77.8	1,873	465	0.25	0.59
Type - BWR	1990	966.4	91.6	1,394	196	0.14	0.20
Capacity - 1049 MWe	1991	882.5	84.2	1,700	373	0.22	0.42
	1992	841.9	80.8	1,694	436	0.26	0.52
	1993	1,049.2	97.8	688	98	0.14	0.09
	1994	852.0	81.2	1,779	326	0.18	0.38
	1995	844.5	79.8	1,571	196	0.12	0.23
	1996	806.9	77.4	1,069	158	0.15	0.20
	1997	731.8	77.8	1,747	350	0.20	0.48
	1998	993.2	98.0	620	55	0.09	0.06
	1999	879.1	86.7	1,111	279	0.25	0.32
	2000	827.8	87.9	1,236	188	0.15	0.23
	2001	918.2	91.1	1,532	156	0.10	0.17
	2002	1,007.0	99.2	220	26	0.12	0.03
	2003	826.6	84.6	1,597	139	0.09	0.17
HUMBOLDT BAY[6]	1969	44.6		125	164	1.31	3.68
Docket 50-133; DPR-7	1970	49.3		115	209	1.82	4.24
1st commercial operation 8/63	1971	39.6		140	292	2.09	7.37
Type - BWR	1972	43.1		127	253	1.99	5.87
Capacity - (63) MWe	1973	50.1		210	266	1.27	5.31
	1974	43.4	83.8	296	318	1.07	7.33

[6] Humboldt Bay had been shut down since 1976, and in 1984 it was decided that it would not be placed in operation again. Therefore, it is no longer included in the count of operating reactors. Parentheses indicate plant capacity when plant was operational.

Reporting Organization	Year	Megawatt Years MW-YR	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose	Average Measurable Dose (rems)	Collective Dose MW-yr
HUMBOLDT BAY[6]	1975	45.3	83.9	265	339	1.28	7.48
(continued)	1976	23.5	46.4	523	683	1.31	29.06
	1977	0.0	0.0	1,063	1,905	1.79	---
	1978	0.0	0.0	320	335	1.05	---
	1979	0.0	0.0	135	31	0.23	---
	1980	0.0	0.0	142	22	0.15	---
	1981	0.0	0.0	75	9	0.12	---
	1982	0.0	0.0	71	19	0.27	---
	1983	0.0	0.0	84	17	0.20	---
	1993	0.0	0.0	24	1	0.04	---
	1994	0.0	0.0	21	1	0.05	---
	1995	0.0	0.0	42	2	0.05	---
	1996	0.0	0.0	66	5	0.08	---
	1997	0.0	0.0	105	16	0.15	---
	1998	0.0	0.0	38	1	0.03	---
	1999	0.0	0.0	28	1	0.04	---
	2000	0.0	0.0	20	1	0.05	---
	2001	0.0	0.0	10	0	0.04	---
	2002	0.0	0.0	18	2	0.08	---
	2003	0.0	0.0	14	0	0.03	---
INDIAN POINT 1[7]**, 2, 3**[8]	1969	206.2			298		1.45
Docket 50-3, 50-247, 50-286;	1970	43.3			1,639		37.85
DPR-5, -26, -64	1971	154.0			768		4.99
1st commercial operation	1972	142.3			967		6.80
10/62, 8/74, 8/76	1973	0.0		2,998	5,262	1.76	---
Type - PWRs	1974	556.1	59.4	1,019	910	0.89	1.64
Capacity - (265), 951, 965 MWe	1975	584.4	74.8	891	705	0.79	1.21
	1976	273.9	34.8	1,590	1,950	1.23	7.12
	1977	1,278.3	75.3	1,391	1,070	0.77	0.84
	1978	1,172.3	67.8	1,909	2,006	1.05	1.71
INDIAN POINT 1[7]**, 2**	1979	574.0	71.4	1,349	1,279	0.95	2.23
	1980	510.8	64.8	1,577	971	0.62	1.90
	1982	532.4	65.4	2,144	1,635	0.76	3.07
	1983	702.6	84.0	1,057	486	0.46	0.69
INDIAN POINT 2	1984	416.7	51.9	2,919	2,644	0.91	6.35
Docket 50-247; DPR-26	1985	791.4	95.7	708	192	0.27	0.24
1st commercial operation 8/74	1986	457.5	56.2	1,926	1,250	0.65	2.73
Type - PWR	1987	611.4	73.4	1,980	1,217	0.61	1.99
Capacity - 956 MWe	1988	719.3	86.9	890	235	0.26	0.33
	1989	532.5	64.6	2,093	1,436	0.69	2.70
	1990	618.0	66.6	1,061	608	0.57	0.98
	1991	461.2	55.7	1,810	1,468	0.81	3.18
	1992	930.9	99.1	489	97	0.20	0.10
	1993	702.1	75.7	1,514	675	0.45	0.96
	1994	903.8	100.0	381	48	0.13	0.05
	1995	582.4	70.8	1,690	548	0.32	0.94
	1996	927.8	94.8	388	54	0.14	0.06
	1997	360.6	45.1	1,340	367	0.27	1.02

[6] Humboldt Bay had been shut down since 1976, and in 1984 it was decided that it would not be placed in operation again. Therefore, it is no longer included in the count of operating reactors. Parentheses indicate plant capacity when plant was operational.

[7] Indian Point 1 was defueled in 1975, and in 1984 it was decided that it would not be placed in operation again. Therefore, it is no longer included in the count of operating reactors. Parentheses indicate plant capacity when plant was operational.

[8] Indian Point 3 was purchased by a different utility in 1979 and subsequently reported its dose separately. Although Indian Point 1, 2, and 3 have been owned by Entergy since 2001, Indian Point 3 still reports separately.

Reporting Organization	Year	Megawatt Years MW-YR	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose	Average Measurable Dose (rems)	Collective Dose MW-yr
INDIAN POINT 2	1998	282.8	31.5	1,154	290	0.25	1.03
(continued)	1999	831.8	88.2	350	41	0.12	0.05
	2000	115.4	13.0	2,003	567	0.28	4.90
	2001	887.2	97.2	399	22	0.06	0.02
	2002	860.0	91.3	1,361	248	0.18	0.29
	2003	953.0	98.9	241	12	0.05	0.01
INDIAN POINT 3[8]	1979	574.0	66.5	808	636	0.79	1.11
Docket 50-286; DPR-64	1980	367.3	53.2	977	308	0.32	0.84
1st commercial operation 8/76	1981	367.5	59.8	677	364	0.54	0.99
Type - PWR	1982	171.5	22.5	1,477	1,226	0.83	7.15
Capacity - 979 MWe	1983	7.8	2.6	941	607	0.65	77.82
	1984	714.4	76.3	658	230	0.35	0.32
	1985	566.5	66.0	1,093	570	0.52	1.01
	1986	655.3	73.4	588	202	0.34	0.31
	1987	574.6	62.7	1,308	500	0.38	0.87
	1988	792.5	83.3	451	93	0.21	0.12
	1989	587.8	61.1	1,800	876	0.49	1.49
	1990	595.3	62.9	1,066	358	0.34	0.60
	1991	862.8	87.5	299	40	0.13	0.05
	1992	561.7	61.4	1,003	212	0.21	0.38
	1993	140.5	14.9	478	60	0.13	0.43
	1994	0.0	0.0	529	58	0.11	---
	1995	174.8	21.4	638	67	0.11	0.38
	1996	695.3	74.8	289	22	0.08	0.03
	1997	495.1	54.9	1,608	234	0.15	0.47
	1998	874.0	95.3	213	15	0.07	0.02
	1999	829.8	88.3	893	117	0.13	0.14
	2000	960.0	99.3	143	9	0.06	0.01
	2001	903.9	93.1	1,014	118	0.12	0.13
	2002	960.0	98.5	156	7	0.04	0.01
	2003	866.2	89.8	902	96	0.11	0.11
KEWAUNEE	1975	401.9	88.2	104	28	0.27	0.07
Docket 50-305; DPR-43	1976	405.9	78.9	381	270	0.71	0.67
1st commercial operation 6/74	1977	425.0	79.9	312	140	0.45	0.33
Type - PWR	1978	466.6	89.5	335	154	0.46	0.33
Capacity - 526 MWe	1979	412.0	79.0	343	127	0.37	0.31
	1980	433.8	82.1	401	165	0.41	0.38
	1981	451.8	86.7	383	141	0.37	0.31
	1982	458.4	87.6	353	101	0.29	0.22
	1983	444.1	83.7	445	165	0.37	0.37
	1984	455.3	85.7	482	139	0.29	0.31
	1985	443.1	82.4	519	176	0.34	0.40
	1986	461.7	85.8	502	169	0.34	0.37
	1987	480.0	89.7	755	226	0.30	0.47
	1988	467.5	88.3	705	210	0.30	0.45
	1989	449.1	84.9	570	239	0.42	0.53
	1990	468.8	87.9	490	145	0.30	0.31
	1991	441.8	83.4	495	221	0.45	0.50
	1992	471.4	88.0	450	122	0.27	0.26
	1993	457.1	86.8	436	106	0.24	0.23
	1994	475.6	88.8	364	72	0.20	0.15
	1995	455.6	87.8	415	109	0.26	0.24
	1996	380.4	71.8	474	126	0.27	0.33
	1997	269.8	56.0	278	56	0.20	0.21

[8] Indian Point 3 was purchased by a different utility in 1979 and subsequently reported its dose separately. Although Indian Point 1, 2, and 3 have been owned by Entergy since 2001, Indian Point 3 still reports separately.

Reporting Organization	Year	Megawatt Years MW-YR	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose	Average Measurable Dose (rems)	Collective Dose MW-yr
KEWAUNEE	1998	423.0	87.2	284	88	0.23	0.21
(continued)	1999	505.1	100.0	103	5	0.05	0.01
	2000	432.6	88.8	394	100	0.25	0.23
	2001	394.1	80.8	1,110	200	0.18	0.51
	2002	509.0	97.4	102	4	0.04	0.01
	2003	473.5	90.5	439	73	0.17	0.15
LACROSSE[9]	1970	15.3			111		7.25
Docket 50-409; DPR-45	1971	323.1		218	158	0.72	0.49
1st commercial operation 11/69	1972	29.2			151	1.14	5.17
Type - BWR	1973	24.4			157	1.41	6.43
Capacity - (48) MWe	1974	37.9	81.0	115	139	1.21	3.67
	1975	32.0	69.6	165	234	1.42	7.31
	1976	21.2	47.6	118	110	0.93	5.19
	1977	11.3	33.7	141	225	1.60	19.91
	1978	21.6	62.0	182	164	0.90	7.59
	1979	24.0	71.8	153	186	1.22	7.75
	1980	26.4	68.5	124	218	1.76	8.26
	1981	29.6	76.0	187	123	0.66	4.16
	1982	17.2	44.6	148	205	1.39	11.92
	1983	24.8	59.7	160	313	1.96	12.62
	1984	38.5	80.5	288	252	0.88	6.55
	1985	39.2	86.7	373	173	0.46	4.41
	1986	19.6	46.1	260	290	1.12	14.80
	1987	0.0	0.0	127	68	0.54	---
	1993	0.0	0.0	48	8	0.17	---
	1994	0.0	0.0	65	8	0.12	---
	1995	0.0	0.0	31	3	0.10	---
	1996	0.0	0.0	25	4	0.15	---
	1997	0.0	0.0	23	2	0.09	---
	1998	0.0	0.0	27	2	0.07	---
	1999	0.0	0.0	66	4	0.06	---
	2000	0.0	0.0	37	4	0.10	---
	2001	0.0	0.0	45	3	0.06	---
	2002	0.0	0.0	47	2	0.05	---
	2003	0.0	0.0	65	2	0.03	---
LASALLE 1, 2	1984	677.8	77.8	1,245	252	0.20	0.37
Docket 50-373, -374;	1985	987.9	53.0	1,635	685	0.42	0.69
NPF-11, -18	1986	929.5	50.6	1,614	898	0.56	0.97
1st commercial operation	1987	1,030.0	59.3	1,744	1,396	0.80	1.36
1/84, 6/84	1988	1,317.6	71.6	2,737	2,471	0.90	1.88
Type - BWRs	1989	1,503.5	73.1	2,475	1,386	0.56	0.92
Capacity - 1111, 1111 MWe	1990	1,754.3	84.6	1,830	948	0.52	0.54
	1991	1,837.0	86.7	1,985	806	0.41	0.44
	1992	1,447.4	72.0	2,418	1,167	0.48	0.81
	1993	1,542.0	76.0	1,701	854	0.50	0.55
	1994	1,580.0	77.6	1,812	726	0.40	0.46
	1995	1,696.6	82.1	1,623	512	0.32	0.30
	1996	1,053.8	54.3	2,782	819	0.29	0.78
	1997	0.0	0.0	1,661	316	0.19	---
	1998	380.9	19.3	2,099	422	0.20	1.11
	1999	1,671.9	81.8	2,689	576	0.21	0.34
	2000	2,138.6	97.1	1,831	260	0.14	0.12
	2001	2,223.8	98.9	535	83	0.15	0.04
	2002	2,040.0	92.1	2,012	450	0.22	0.22
	2003	2,100.2	94.8	2,253	464	0.21	0.22

[9] LaCrosse ended commercial operation in 1987 and will not be put in commercial operation again. Therefore, it is no longer included in the count of operating reactors. Parentheses indicate plant capacity when plant was operational.

Reporting Organization	Year	Megawatt Years MW-YR	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose	Average Measurable Dose (rems)	Collective Dose MW-yr
LIMERICK 1, 2	1987	636.1	70.2	2,156	174	0.08	0.27
Docket 50-352, 50-353;	1988	794.9	96.5	950	52	0.05	0.07
NPF-39,-85	1989	628.4	66.0	1,818	266	0.15	0.42
1st commercial operation	1990	1,527.7	78.2	1,422	175	0.12	0.11
2/86, 1/90	1991	1,810.9	86.8	1,151	106	0.09	0.06
Type - BWRs	1992	1,741.4	84.8	1,559	330	0.21	0.19
Capacity - 1134, 1134 MWe	1993	1,913.2	91.6	1,287	217	0.17	0.11
	1994	1,944.4	94.9	1,543	275	0.18	0.14
	1995	1,957.1	93.0	1,581	260	0.16	0.13
	1996	2,026.2	93.3	1,654	234	0.14	0.12
	1997	2,001.7	95.8	1,463	234	0.16	0.12
	1998	1,907.2	89.5	1,854	357	0.19	0.19
	1999	2,089.6	94.2	1,800	272	0.15	0.13
	2000	2,154.9	95.8	1,279	261	0.20	0.12
	2001	2,205.9	97.3	1,127	210	0.19	0.10
	2002	2,197.0	97.1	1,248	160	0.13	0.07
	2003	2.213.6	97.2	1,298	147	0.11	0.07
MAINE YANKEE[10]	1973	408.7		782	117	0.15	0.29
Docket 50-309; DPR-36	1974	432.6	68.7	619	420	0.68	0.97
1st commercial operation 12/72	1975	542.9	79.9	440	319	0.72	0.59
Type - PWR	1976	712.2	95.0	244	85	0.35	0.12
Capacity - (860) MWe	1977	617.6	82.2	508	245	0.48	0.40
	1978	642.7	84.1	638	420	0.66	0.65
	1979	537.0	68.4	393	154	0.39	0.29
	1980	527.0	72.2	735	462	0.63	0.88
	1981	624.2	78.2	868	424	0.49	0.68
	1982	542.5	69.1	1,295	619	0.48	1.14
	1983	677.1	83.6	592	165	0.28	0.24
	1984	605.7	74.4	1,262	884	0.70	1.46
	1985	635.4	79.2	1,009	700	0.69	1.10
	1986	737.6	87.8	495	100	0.20	0.14
	1987	478.1	65.3	1,100	722	0.66	1.51
	1988	591.9	79.1	1,058	725	0.69	1.22
	1989	819.2	93.7	375	99	0.26	0.12
	1990	573.0	71.0	1,359	682	0.50	1.19
	1991	738.1	86.6	426	105	0.25	0.14
	1992	631.7	79.1	1,189	461	0.39	0.73
	1993	674.8	79.8	1,016	377	0.37	0.56
	1994	782.8	90.9	297	84	0.28	0.11
	1995	23.6	3.7	1,167	653	0.56	27.67
	1996	602.9	78.1	408	56	0.14	0.09
	1997	0.0	0.0	991	153	0.15	---
	1998	0.0	0.0	438	163	0.37	---
	1999	0.0	0.0	365	135	0.37	---
	2000	0.0	0.0	490	121	0.25	---
	2001	0.0	0.0	412	68	0.17	---
	2002	0.0	0.0	452	66	0.15	---
	2003	0.0	0.0	342	44	0.13	---

[10] Maine Yankee was shut down in 8/97 and is no longer included in the count of operating reactors. Parentheses indicate plant capacity when plant was operational.

Reporting Organization	Year	Megawatt Years MW-YR	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose	Average Measurable Dose (rems)	Collective Dose MW-yr
MCGUIRE 1, 2	1982	524.9	80.4	1,560	169	0.11	0.32
Docket 50-369, -370;	1983	558.3	55.4	1,751	521	0.30	0.93
NPF-9, -17	1984	764.1	68.5	1,663	507	0.30	0.66
1st commercial operation	1985	808.4	77.0	2,217	771	0.35	0.95
12/81, 3/84	1986	1,360.0	60.1	2,326	1,015	0.44	0.75
Type - PWRs	1987	1,774.7	79.2	2,865	1,043	0.36	0.59
Capacity - 1100, 1100 MWe	1988	1,830.7	80.2	2,808	1,104	0.39	0.60
	1989	1,810.2	80.8	1,994	620	0.31	0.34
	1990	1,340.3	61.3	2,289	727	0.32	0.54
	1991	1,945.1	85.0	1,723	361	0.21	0.19
	1992	1,696.8	74.4	1,619	418	0.26	0.25
	1993	1,470.4	66.2	1,685	463	0.27	0.31
	1994	1,848.0	80.2	1,637	397	0.24	0.21
	1995	2,132.3	92.9	1,259	138	0.11	0.06
	1996	1,881.8	82.8	1,622	238	0.15	0.13
	1997	1,558.2	73.0	2,193	492	0.22	0.32
	1998	2,139.8	95.1	1,045	142	0.14	0.07
	1999	1,961.7	88.9	1,274	257	0.20	0.13
	2000	2,100.1	94.2	940	133	0.14	0.06
	2001	2,113.3	93.9	963	137	0.14	0.06
	2002	2,051.0	91.7	1,167	181	0.16	0.09
	2003	2,156.2	96.0	841	71	0.08	0.03
MILLSTONE UNIT 1[11]	1972	377.6		612	596	0.97	1.58
Docket 50-245; DPR-21	1973	225.1		1,184	663	0.56	2.95
1st commercial operation 3/71	1974	430.3	79.1	2,477	1,430	0.58	3.32
Type - BWR	1975	465.4	75.6	2,587	2,022	0.78	4.34
Capacity - (641) MWe	1976	449.8	76.1	1,387	1,194	0.86	2.65
	1977	575.7	89.6	1,075	394	0.37	0.68
	1978	556.6	87.6	1,391	1,416	1.02	2.54
	1979	505.0	77.3	2,001	1,795	0.90	3.55
	1980	405.8	69.0	3,024	2,157	0.71	5.32
	1981	304.3	51.6	2,506	1,496	0.60	4.92
	1982	490.2	79.9	1,370	929	0.68	1.90
	1983	640.1	95.6	309	244	0.79	0.38
	1984	516.1	78.8	1,992	836	0.42	1.62
	1985	548.5	83.6	732	608	0.83	1.11
	1986	626.8	95.4	389	150	0.39	0.24
	1987	523.4	79.6	1,588	684	0.43	1.31
	1988	658.8	98.6	327	144	0.44	0.22
	1989	554.6	84.2	852	462	0.54	0.83
	1990	608.3	91.6	365	131	0.36	0.22
	1991	213.1	35.4	1,154	409	0.35	1.92
	1992	431.8	68.1	348	99	0.28	0.23
	1993	627.9	96.8	305	81	0.27	0.13
	1994	394.0	63.6	1,321	391	0.30	0.99
	1995	520.6	80.0	910	620	0.68	1.19
	1996	0.0	0.0	747	431	0.58	---
	1997	-2.9	0.0	1,053	195	0.19	---
	1998	-2.7	0.0	347	13	0.04	---
	1999	0.0	0.0	397	10	0.02	---
	2000	0.0	0.0	478	60	0.13	---
	2001	0.0	0.0	414	15	0.04	---
	2002	0.0	0.0	185	4	0.02	---
	2003	0.0	0.0	195	11	0.05	---

[11] Millstone Unit 1 was shut down 6/30/98 and is no longer included in the count of operating reactors. Parentheses indicate plant capacity when plant was operational.

Reporting Organization	Year	Megawatt Years MW-YR	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose	Average Measurable Dose (rems)	Collective Dose MW-yr
MILLSTONE UNIT 2, 3	1976	545.7	78.7	620	168	0.27	0.31
Docket 50-336, 50-423;	1977	518.7	65.7	667	242	0.36	0.47
DPR-65, NPF-49	1978	536.6	67.3	1,420	1,444	1.02	2.69
1st commercial operation	1979	520.0	62.8	525	471	0.90	0.91
12/75, 4/86	1980	579.3	69.2	893	637	0.71	1.10
Type - PWRs	1981	722.4	82.6	890	531	0.60	0.74
Capacity - 866, 1131 MWe	1982	595.9	70.6	2,083	1,413	0.68	2.37
	1983	294.0	34.2	2,383	1,881	0.79	6.40
	1984	782.7	93.5	285	120	0.42	0.15
	1985	417.8	49.4	1,905	1,581	0.83	3.78
	1986	1,313.8	80.4	2,393	993	0.41	0.76
	1987	1,624.5	84.1	1,441	505	0.35	0.31
	1988	1,594.8	83.2	1,827	804	0.44	0.50
	1989	1,428.3	72.9	1,984	1,079	0.54	0.76
	1990	1,614.9	87.1	1,652	593	0.36	0.37
	1991	819.5	69.7	1,084	381	0.35	0.46
	1992	1,115.1	59.9	3,190	1,280	0.40	1.15
	1993	1,525.2	79.7	2,064	557	0.27	0.37
	1994	1,556.6	73.1	1,249	188	0.15	0.12
	1995	1,278.1	60.5	1,691	416	0.25	0.33
	1996	418.1	19.3	983	126	0.13	0.30
	1997	0.0	0.0	1,435	253	0.18	---
	1998	374.9	20.9	1,179	113	0.10	0.30
	1999	1,446.3	73.3	1,688	252	0.15	0.17
	2000	1,865.8	92.4	1,385	143	0.10	0.08
	2001	1,759.3	92.0	1,327	174	0.13	0.10
	2002	1,703.0	87.5	1,548	292	0.19	0.17
	2003	1,834.6	91.0	1,274	323	0.25	0.18
MONTICELLO	1972	424.4		99	61	0.62	0.14
Docket 50-263; DPR-22	1973	389.5		401	176	0.44	0.45
1st commercial operation 6/71	1974	349.3	74.9	842	349	0.41	1.00
Type - BWR	1975	344.8	72.2	1,353	1,353	1.00	3.92
Capacity - 578 MWe	1976	476.4	91.5	325	263	0.81	0.55
	1977	425.6	79.9	860	1,000	1.16	2.35
	1978	459.4	87.2	679	375	0.55	0.82
	1979	522.0	97.6	372	157	0.42	0.30
	1980	411.8	78.2	1,114	531	0.48	1.29
	1981	389.3	72.6	1,446	1,004	0.69	2.58
	1982	291.1	63.3	1,307	993	0.76	3.41
	1983	494.6	96.3	416	121	0.29	0.24
	1984	33.7	9.2	1,872	2,462	1.32	73.06
	1985	509.8	91.7	586	327	0.56	0.64
	1986	402.7	79.1	895	596	0.67	1.48
	1987	422.5	81.9	941	568	0.60	1.34
	1988	542.5	99.8	375	110	0.29	0.20
	1989	318.2	76.2	1,102	507	0.46	1.59
	1990	536.0	96.9	336	94	0.28	0.18
	1991	429.4	80.8	964	465	0.48	1.08
	1992	528.3	97.5	454	114	0.25	0.22
	1993	458.1	84.4	954	494	0.52	1.08
	1994	471.3	87.0	788	395	0.50	0.84
	1995	564.7	100.0	200	44	0.22	0.08
	1996	461.6	86.9	757	240	0.32	0.52
	1997	417.4	75.9	399	106	0.27	0.25
	1998	470.2	88.1	674	209	0.31	0.44
	1999	530.7	92.9	451	70	0.16	0.13
	2000	483.2	84.2	792	216	0.27	0.45
	2001	441.3	78.5	834	221	0.26	0.50
	2002	571.0	99.0	399	40	0.10	0.07
	2003	522.8	91.7	858	169	0.20	0.32

Reporting Organization	Year	Megawatt Years MW-YR	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose	Average Measurable Dose (rems)	Collective Dose MW-yr
NINE MILE POINT 1, 2	1970	227.0		821	44	0.05	0.19
Docket 50-220, 50-410;	1971	346.5		1,006	195	0.19	0.56
DPR-63, NPF-69	1972	381.8		735	285	0.39	0.75
1st commercial operation	1973	411.0		550	567	1.03	1.38
12/69, 4/88	1974	385.9	70.5	740	824	1.11	2.14
Type - BWRs	1975	359.0	72.1	649	681	1.05	1.90
Capacity - 565, 1120 MWe	1976	484.6	88.2	392	428	1.09	0.88
	1977	347.4	59.2	1,093	1,383	1.27	3.98
	1978	527.7	95.1	561	314	0.56	0.60
	1979	354.0	66.1	1,326	1,497	1.13	4.23
	1980	533.9	92.3	1,174	591	0.50	1.11
	1981	385.2	66.0	2,029	1,592	0.78	4.13
	1982	133.5	21.4	1,352	1,264	0.93	9.47
	1983	329.8	56.2	1,405	860	0.61	2.61
	1984	426.8	71.9	1,530	890	0.58	2.09
	1985	580.9	96.4	1,007	265	0.26	0.46
	1986	371.0	65.3	1,878	1,275	0.68	3.44
	1987	542.6	93.3	1,190	141	0.12	0.26
	1988	0.0	0.0	2,626	854	0.33	---
	1989	527.5	29.7	2,737	564	0.21	1.07
	1990	656.2	46.6	2,405	699	0.29	1.07
	1991	1,250.8	79.7	1,543	292	0.19	0.23
	1992	965.9	61.8	1,800	563	0.31	0.58
	1993	1,380.2	84.6	2,352	633	0.27	0.46
	1994	1,589.6	95.9	800	149	0.19	0.09
	1995	1,382.2	82.5	2,304	759	0.33	0.55
	1996	1,598.6	91.6	1,596	290	0.18	0.18
	1997	1,321.5	74.8	1,425	429	0.30	0.32
	1998	1,387.3	87.0	1,744	378	0.22	0.27
	1999	1,409.5	81.3	1,709	447	0.26	0.32
	2000	1,443.9	88.1	1,783	283	0.16	0.20
	2001	1,506.9	88.9	1,371	343	0.25	0.23
	2002	1,517.0	90.4	2,449	517	0.21	0.34
	2003	1,585.6	91.4	1,501	375	0.25	0.24
NORTH ANNA 1, 2	1979	507.0	61.7	2,025	449	0.22	0.89
Docket 50-338; NPF-04, -09	1980	681.8	86.5	2,086	218	0.10	0.32
1st commercial operation	1981	1,241.9	71.5	2,416	680	0.28	0.55
6/78, 12/80	1982	777.7	45.8	2,872	1,915	0.67	2.46
Type - PWRs	1983	1,338.4	76.1	2,228	665	0.30	0.50
Capacity - 925, 917 MWe	1984	1,021.3	58.8	3,062	1,945	0.64	1.90
	1985	1,516.9	86.1	2,436	838	0.34	0.55
	1986	1,484.5	83.0	2,831	722	0.26	0.49
	1987	1,112.6	67.8	2,624	1,521	0.58	1.37
	1988	1,772.7	96.7	992	112	0.11	0.06
	1989	1,226.8	72.5	2,861	1,471	0.51	1.20
	1990	1,590.4	90.5	2,161	590	0.27	0.37
	1991	1,597.5	88.6	2,085	629	0.30	0.39
	1992	1,403.2	84.1	2,159	576	0.27	0.41
	1993	1,428.4	80.1	2,768	908	0.33	0.64
	1994	1,717.1	95.9	1,036	193	0.19	0.11
	1995	1,666.4	90.8	1,551	367	0.24	0.22
	1996	1,569.6	89.1	1,203	291	0.24	0.19
	1997	1,711.5	96.2	856	103	0.12	0.06
	1998	1,632.8	92.7	1,201	266	0.22	0.16
	1999	1,747.7	96.1	727	94	0.13	0.05
	2000	1,734.1	95.8	730	65	0.09	0.04
	2001	1,491.0	84.8	1,231	309	0.25	0.21
	2002	1,557.0	84.3	914	143	0.16	0.09
	2003	1,569.1	87.2	1,041	187	0.18	0.12

Reporting Organization	Year	Megawatt Years MW-YR	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose	Average Measurable Dose (rems)	Collective Dose MW-yr
OCONEE 1, 2, 3	1974	650.6	60.1	844	517	0.61	0.79
Docket 50-269, 50-270,	1975	1,838.3	75.5	829	497	0.60	0.27
50-287;	1976	1,561.4	63.0	1,215	1,026	0.84	0.66
DPR-38, -47, -55	1977	1,566.4	65.9	1,595	1,329	0.83	0.85
1st commercial operation	1978	1,909.0	75.8	1,636	1,393	0.85	0.73
7/73, 9/74, 12/74	1979	1,708.0	67.7	2,100	1,001	0.48	0.59
Type - PWRs	1980	1,703.7	70.1	2,124	1,055	0.50	0.62
Capacity - 846, 846, 846 MWe	1981	1,661.5	66.8	2,445	1,211	0.50	0.73
	1982	1,293.1	52.5	2,445	1,792	0.73	1.39
	1983	2,141.5	82.2	1,902	1,207	0.63	0.56
	1984	2,242.9	85.7	2,085	1,106	0.53	0.49
	1985	2,036.3	80.5	2,729	1,304	0.48	0.64
	1986	1,995.6	79.0	2,499	949	0.38	0.48
	1987	1,962.6	82.4	2,672	1,142	0.43	0.58
	1988	2,228.9	87.2	2,672	871	0.33	0.39
	1989	2,188.6	85.4	2,205	684	0.31	0.31
	1990	2,405.2	91.4	1,948	404	0.21	0.17
	1991	2,275.0	86.7	1,966	551	0.28	0.24
	1992	2,110.7	82.0	1,954	612	0.31	0.29
	1993	2,399.2	91.3	1,499	237	0.16	0.10
	1994	2,144.3	82.2	1,923	537	0.28	0.25
	1995	2,366.1	89.5	1,586	304	0.19	0.13
	1996	1,847.9	70.3	1,479	257	0.17	0.14
	1997	1,563.7	67.7	1,379	223	0.16	0.14
	1998	1,989.1	81.3	1,695	366	0.22	0.18
	1999	2,264.5	90.3	1,568	202	0.13	0.09
	2000	2,321.0	91.6	1,686	273	0.16	0.12
	2001	2,167.6	86.8	2,002	579	0.29	0.27
	2002	2,355.0	92.5	1,723	225	0.13	0.10
	2003	2,177.7	86.3	2,180	245	0.11	0.11
OYSTER CREEK	1970	413.6		95	63	0.66	0.15
Docket 50-219; DPR-16	1971	448.9		249	240	0.96	0.53
1st commercial operation 12/69	1972	515.0		339	582	1.72	1.13
Type - BWR	1973	424.6		782	1,236	1.58	2.91
Capacity - 619 MWe	1974	434.5	70.4	935	984	1.05	2.26
	1975	373.6	73.3	1,210	1,140	0.94	3.05
	1976	456.5	79.3	1,582	1,078	0.68	2.36
	1977	385.7	70.1	1,673	1,614	0.96	4.18
	1978	431.8	74.3	1,411	1,279	0.91	2.96
	1979	541.0	85.9	842	467	0.55	0.86
	1980	232.9	41.4	1,966	1,733	0.88	7.44
	1981	314.8	59.8	1,689	917	0.54	2.91
	1982	242.7	62.5	1,270	865	0.68	3.56
	1983	27.9	11.5	2,303	2,257	0.98	80.90
	1984	37.1	9.6	2,369	2,054	0.87	55.36
	1985	446.1	89.4	2,342	748	0.32	1.68
	1986	157.3	31.5	3,740	2,436	0.65	15.49
	1987	371.0	64.2	1,932	522	0.27	1.41
	1988	419.6	65.9	2,875	1,504	0.52	3.58
	1989	287.5	57.3	2,395	910	0.38	3.17
	1990	511.8	89.1	1,941	310	0.16	0.61
	1991	351.6	60.5	3,089	1,185	0.38	3.37
	1992	536.3	85.9	2,771	657	0.24	1.23
	1993	551.9	87.8	2,560	416	0.16	0.75
	1994	431.7	70.8	2,382	844	0.35	1.96
	1995	615.4	97.4	761	90	0.12	0.15
	1996	515.0	82.6	1,833	449	0.24	0.87
	1997	579.1	94.3	509	50	0.10	0.09
	1998	490.8	82.4	1,408	308	0.22	0.63

Reporting Organization	Year	Megawatt Years MW-YR	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose	Average Measurable Dose (rems)	Collective Dose MW-yr
OYSTER CREEK	1999	615.1	100.0	466	42	0.09	0.07
(continued)	2000	444.9	83.3	2,044	614	0.30	1.38
	2001	595.0	97.6	442	46	0.10	0.08
	2002	573.0	94.0	1,468	266	0.18	0.46
	2003	598.4	97.2	416	43	0.10	0.07
PALISADES	1972	216.8			78		0.36
Docket 50-255; DPR-20	1973	286.8		975	1,133	1.16	3.95
1st commercial operation 12/71	1974	10.7	5.5	774	627	0.81	58.60
Type - PWR	1975	302.0	64.5	495	306	0.62	1.01
Capacity - 730 MWe	1976	346.9	55.2	742	696	0.94	2.01
	1977	616.6	91.4	332	100	0.30	0.16
	1978	320.2	49.7	849	764	0.90	2.39
	1979	415.0	59.9	1,599	854	0.53	2.06
	1980	288.3	42.9	1,307	424	0.32	1.47
	1981	418.2	57.2	2,151	902	0.42	2.16
	1982	404.3	54.7	1,554	330	0.21	0.82
	1983	454.4	60.3	2,167	977	0.45	2.15
	1984	98.7	15.2	1,344	573	0.43	5.81
	1985	639.2	83.8	1,355	507	0.37	0.79
	1986	102.3	15.1	1,438	672	0.47	6.57
	1987	319.2	48.2	1,122	456	0.41	1.43
	1988	413.4	56.8	1,472	730	0.50	1.77
	1989	442.8	69.1	1,026	314	0.31	0.71
	1990	366.7	58.7	2,414	766	0.32	2.09
	1991	587.0	78.1	1,315	211	0.16	0.36
	1992	581.9	76.1	1,267	295	0.23	0.51
	1993	424.4	53.7	908	289	0.32	0.68
	1994	541.8	67.0	397	60	0.15	0.11
	1995	583.5	75.8	1,230	462	0.38	0.79
	1996	638.2	81.4	1,109	318	0.29	0.50
	1997	662.5	89.9	338	48	0.14	0.07
	1998	615.4	83.5	895	217	0.24	0.35
	1999	585.4	80.2	939	218	0.23	0.37
	2000	654.4	88.0	255	26	0.10	0.04
	2001	268.2	36.3	1,032	363	0.35	1.35
	2002	725.0	94.8	224	24	0.11	0.03
	2003	701.1	90.7	822	203	0.25	0.29
PALO VERDE 1, 2, 3	1987	1,638.1	66.1	1,792	669	0.37	0.41
Docket 50-528, 50-529; 50-530	1988	1,700.9	65.5	2,173	688	0.32	0.40
NPF-41, NPF-51, NPF-74	1989	965.3	26.5	2,615	720	0.28	0.75
1st commercial operation	1990	2,500.9	67.5	2,236	499	0.22	0.20
1/86,9/86,1/88	1991	3,043.9	78.9	2,242	605	0.27	0.20
Type - PWRs	1992	3,102.3	82.0	1,981	541	0.27	0.17
Capacity - 1243, 1243,	1993	2,677.1	74.3	2,124	592	0.28	0.22
1247 MWe	1994	2,827.6	79.1	2,048	462	0.23	0.16
	1995	3,265.2	85.6	1,875	482	0.26	0.15
	1996	3,482.7	90.0	1,717	302	0.18	0.09
	1997	3,369.2	92.2	1,585	246	0.16	0.07
	1998	3,454.4	93.2	1,410	192	0.14	0.06
	1999	3,471.2	93.2	1,275	146	0.11	0.04
	2000	3,458.6	93.0	1,279	158	0.12	0.05
	2001	3,280.2	88.6	1,361	182	0.13	0.06
	2002	3,513.0	94.0	1,343	140	0.10	0.04
	2003	3,254.4	88.6	1,943	211	0.11	0.06

Reporting Organization	Year	Megawatt Years MW-YR	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose	Average Measurable Dose (rems)	Collective Dose MW-yr
PEACH BOTTOM 2, 3	1975	1,234.3	80.9	971	228	0.23	0.18
Docket 50-277, 50-278;	1976	1,379.2	73.0	2,136	840	0.39	0.61
DPR-44, -56	1977	1,052.4	58.7	2,827	2,036	0.72	1.93
1st commercial operation	1978	1,636.3	84.0	2,244	1,317	0.59	0.80
7/74, 12/74	1979	1,740.0	84.5	2,276	1,388	0.61	0.80
Type - BWRs	1980	1,374.2	66.3	2,774	2,302	0.83	1.68
Capacity - 1112, 1112 MWe	1981	1,161.8	58.0	2,857	2,506	0.88	2.16
	1982	1,583.3	76.9	2,734	1,977	0.72	1.25
	1983	824.7	41.0	3,107	2,963	0.95	3.59
	1984	1,165.8	57.5	3,313	2,450	0.74	2.10
	1985	682.7	37.5	4,209	3,354	0.80	4.91
	1986	1,395.0	71.7	2,454	1,080	0.44	0.77
	1987	365.7	20.3	4,363	2,195	0.50	6.00
	1988	0.0	0.0	4,204	2,327	0.55	---
	1989	491.0	35.0	2,301	728	0.32	1.48
	1990	1,684.0	85.7	1,585	377	0.24	0.22
	1991	1,210.9	62.3	2,702	934	0.35	0.77
	1992	1,516.6	78.7	1,911	502	0.26	0.33
	1993	1,654.0	81.9	1,757	552	0.31	0.33
	1994	1,927.4	93.8	2,133	579	0.27	0.30
	1995	1,955.9	95.1	1,940	398	0.21	0.20
	1996	2,012.4	96.9	1,657	282	0.17	0.14
	1997	1,956.3	95.0	1,872	490	0.26	0.25
	1998	1,881.2	93.2	1,903	366	0.19	0.19
	1999	2,057.2	96.0	1,630	319	0.20	0.16
	2000	2,058.3	96.7	1,729	331	0.19	0.16
	2001	2,037.1	95.8	1,445	344	0.24	0.17
	2002	2,105.0	96.7	1,915	333	0.17	0.16
	2003	2,072.4	94.9	1,641	356	0.22	0.17
PERRY	1988	869.3	79.0	782	105	0.13	0.12
Docket 50-440; NPF-58	1989	642.2	57.0	1,883	767	0.41	1.19
1st commercial operation 11/87	1990	792.7	67.1	1,537	638	0.42	0.80
Type - BWR	1991	1,074.2	91.9	600	146	0.24	0.14
Capacity - 1235 MWe	1992	856.2	75.5	1,487	571	0.38	0.67
	1993	479.2	48.2	1,235	278	0.23	0.58
	1994	550.8	50.2	2,098	691	0.33	1.25
	1995	1,090.9	95.6	587	64	0.11	0.06
	1996	895.6	77.2	1,622	307	0.19	0.34
	1997	930.6	84.7	1,524	272	0.18	0.29
	1998	1,163.1	99.3	385	42	0.11	0.04
	1999	1,041.7	89.9	1,758	326	0.19	0.31
	2000	1,148.2	97.1	501	56	0.11	0.05
	2001	885.9	79.6	1,392	258	0.19	0.29
	2002	1,136.0	95.0	436	70	0.16	0.06
	2003	973.7	83.8	1,880	607	0.32	0.62
PILGRIM 1	1973	484.0		230	126	0.55	0.26
Docket 50-293; DPR-35	1974	234.1	39.2	454	415	0.91	1.77
1st commercial operation 12/72	1975	308.1	71.3	473	798	1.69	2.59
Type - BWR	1976	287.8	60.7	1,317	2,648	2.01	9.20
Capacity - 685 MWe	1977	316.6	61.4	1,875	3,142	1.68	9.92
	1978	519.5	83.1	1,667	1,327	0.80	2.55
	1979	574.0	89.4	2,458	1,015	0.41	1.77
	1980	360.3	56.2	3,549	3,626	1.02	10.06
	1981	408.9	65.9	2,803	1,836	0.66	4.49
	1982	389.9	63.9	2,854	1,539	0.54	3.95
	1983	559.5	87.2	2,326	1,162	0.50	2.08
	1984	1.4	0.4	4,542	4,082	0.90	2915.71
	1985	587.3	91.5	2,209	893	0.40	1.52
	1986	121.9	18.8	2,635	874	0.33	7.17
	1987	0.0	0.0	4,710	1,579	0.34	---

Reporting Organization	Year	Megawatt Years MW-YR	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose	Average Measurable Dose (rems)	Collective Dose MW-yr
PILGRIM 1	1988	0.0	0.0	2,073	392	0.19	---
(continued)	1989	204.6	64.1	1,797	207	0.12	1.01
	1990	503.5	82.1	1,898	225	0.12	0.45
	1991	406.3	65.8	2,836	605	0.21	1.49
	1992	561.0	85.4	1,332	281	0.21	0.50
	1993	513.7	80.9	1,328	435	0.33	0.85
	1994	453.6	71.4	758	200	0.26	0.44
	1995	531.7	80.7	1,294	482	0.37	0.91
	1996	631.3	95.4	517	116	0.22	0.18
	1997	492.1	80.7	1,655	588	0.36	1.19
	1998	650.5	100.0	530	71	0.13	0.11
	1999	510.7	84.4	1,222	344	0.28	0.67
	2000	627.5	98.3	422	51	0.12	0.08
	2001	585.6	91.0	1,113	180	0.16	0.31
	2002	657.0	100.0	463	38	0.08	0.06
	2003	566.6	87.5	1,437	250	0.17	0.44
POINT BEACH 1, 2	1971	393.4			164		0.42
Docket 50-266, 50-301;	1972	378.3			580		1.53
DPR-24, -27	1973	693.7		501	588	1.17	0.85
1st commercial operation	1974	760.2	81.3	400	295	0.74	0.39
12/70, 10/72	1975	801.2	82.9	339	459	1.35	0.57
Type - PWRs	1976	857.3	86.7	313	370	1.18	0.43
Capacity - 516, 518 MWe	1977	873.9	87.3	417	430	1.03	0.49
	1978	914.4	90.9	336	320	0.95	0.35
	1979	808.0	80.8	610	644	1.06	0.80
	1980	727.2	82.5	561	598	1.07	0.82
	1981	760.4	83.6	773	596	0.77	0.78
	1982	757.2	84.3	767	609	0.79	0.80
	1983	648.2	72.7	1,702	1,403	0.82	2.16
	1984	788.9	78.6	1,372	789	0.58	1.00
	1985	831.3	82.5	671	482	0.72	0.58
	1986	858.9	85.7	664	402	0.61	0.47
	1987	857.5	85.5	720	554	0.77	0.65
	1988	899.3	88.6	734	410	0.56	0.46
	1989	847.8	85.5	736	504	0.68	0.59
	1990	875.5	86.5	617	378	0.61	0.43
	1991	874.8	87.1	724	265	0.37	0.30
	1992	866.7	85.8	617	256	0.41	0.30
	1993	911.0	90.0	559	186	0.33	0.20
	1994	914.5	91.2	548	170	0.31	0.19
	1995	858.4	86.1	548	190	0.35	0.22
	1996	831.6	84.7	1,029	276	0.27	0.33
	1997	186.8	21.8	670	92	0.14	0.49
	1998	649.7	69.7	881	169	0.19	0.26
	1999	806.0	83.1	962	194	0.20	0.24
	2000	872.0	88.7	765	139	0.18	0.16
	2001	915.9	93.4	740	132	0.18	0.14
	2002	909.0	91.1	945	181	0.19	0.20
	2003	917.2	92.1	627	85	0.14	0.09
PRAIRIE ISLAND 1, 2	1974	181.9	43.9	150	18	0.12	0.10
Docket 50-282, 50-306;	1975	836.0	83.3	477	123	0.26	0.15
DPR-42, -60	1976	725.2	76.6	818	447	0.55	0.62
1st commercial operation	1977	922.9	87.2	718	300	0.42	0.33
12/73, 12/74	1978	941.1	92.2	546	221	0.40	0.23
Type - PWRs	1979	865.0	86.0	594	180	0.30	0.21
Capacity - 522, 522 MWe	1980	800.7	79.9	983	353	0.36	0.44
	1981	844.9	80.5	836	329	0.39	0.39
	1982	944.9	90.4	645	229	0.36	0.24
	1983	921.1	86.8	654	233	0.36	0.25
	1984	972.4	91.7	546	147	0.27	0.15

Reporting Organization	Year	Megawatt Years MW-YR	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose	Average Measurable Dose (rems)	Collective Dose MW-yr
PRAIRIE ISLAND 1, 2	1985	882.6	84.0	1,082	416	0.38	0.47
(continued)	1986	930.6	90.3	818	255	0.31	0.27
	1987	969.6	91.6	593	135	0.23	0.14
	1988	932.0	89.1	732	199	0.27	0.21
	1989	1,001.8	94.7	476	99	0.21	0.10
	1990	925.4	89.2	737	188	0.26	0.20
	1991	1,023.3	95.6	586	98	0.17	0.10
	1992	811.6	76.2	845	211	0.25	0.26
	1993	978.3	90.7	532	106	0.20	0.11
	1994	996.9	91.5	478	109	0.10	0.11
	1995	1,023.2	93.9	499	107	0.21	0.10
	1996	992.1	91.4	558	112	0.20	0.11
	1997	817.6	81.4	753	174	0.23	0.21
	1998	860.3	83.4	582	117	0.20	0.14
	1999	989.3	93.8	542	72	0.13	0.07
	2000	992.2	93.1	632	106	0.17	0.11
	2001	900.8	85.8	691	125	0.18	0.14
	2002	987.0	93.6	969	128	0.13	0.13
	2003	1,006.1	96.4	594	61	0.10	0.06
QUAD CITIES 1, 2	1974	958.1	72.3	678	482	0.71	0.50
Docket 50-254, 50-265;	1975	833.6	68.4	1,083	1,618	1.49	1.94
DPR-29, -30	1976	951.2	73.1	1,225	1,651	1.35	1.74
1st commercial operation	1977	970.1	84.0	907	1,031	1.14	1.06
2/73, 3/73	1978	1,124.5	88.6	1,207	1,618	1.34	1.44
Type - BWRs	1979	1,075.0	84.6	1,688	2,158	1.28	2.01
Capacity - 855, 855 MWe	1980	866.9	64.4	3,089	4,838	1.57	5.58
	1981	1,156.9	81.1	2,246	3,146	1.40	2.72
	1982	1,018.7	76.0	2,314	3,757	1.62	3.69
	1983	1,088.5	79.2	1,802	2,491	1.38	2.29
	1984	994.6	65.7	1,678	1,579	0.94	1.59
	1985	1,268.0	82.7	1,184	990	0.84	0.78
	1986	1,093.2	71.0	1,451	950	0.65	0.87
	1987	1,126.6	75.3	1,429	720	0.50	0.64
	1988	1,173.7	84.1	1,486	827	0.56	0.70
	1989	1,196.3	85.9	1,721	900	0.52	0.75
	1990	1,148.9	77.8	2,186	1,028	0.47	0.89
	1991	1,044.5	73.2	1,722	509	0.30	0.49
	1992	960.8	68.0	2,413	1,157	0.48	1.20
	1993	974.9	67.0	2,150	849	0.39	0.87
	1994	681.5	48.7	2,163	1,128	0.52	1.66
	1995	1,002.5	70.4	2,041	736	0.36	0.73
	1996	876.6	60.1	2,248	1,025	0.46	1.17
	1997	935.3	66.5	2,474	654	0.26	0.70
	1998	794.8	55.1	2,177	761	0.35	0.96
	1999	1,476.5	95.9	1,000	201	0.20	0.14
	2000	1,410.4	93.9	2,840	894	0.32	0.63
	2001	1,478.2	95.9	736	144	0.20	0.10
	2002	1,396.0	89.0	3,818	1,786	0.47	1.28
	2003	1,569.4	93.1	998	438	0.44	0.28
RANCHO SECO[12]	1976	268.1	30.4	297	58	0.20	0.22
Docket 50-312; DPR-54	1977	706.4	77.1	515	391	0.76	0.55
1st commercial operation 4/75	1978	607.7	80.5	508	323	0.64	0.53
Type - PWR	1979	687.0	91.1	287	126	0.44	0.18
Capacity - (873) MWe	1980	530.9	60.4	890	412	0.46	0.78
	1981	321.2	40.2	772	402	0.52	1.25

[12] Rancho Seco was shut down 6/89 and is no longer in the count of operating reactors. Parentheses indicate plant capacity when plant was operational.

Reporting Organization	Year	Megawatt Years MW-YR	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose	Average Measurable Dose (rems)	Collective Dose MW-yr
RANCHO SECO[12]	1982	409.5	53.3	766	337	0.44	0.82
(continued)	1983	347.9	46.8	1,338	787	0.59	2.26
	1984	460.0	58.3	802	222	0.28	0.48
	1985	238.7	30.8	1,764	756	0.43	3.17
	1986	0.0	0.0	1,513	402	0.27	---
	1987	0.0	0.0	1,533	300	0.20	---
	1988	355.8	63.1	693	78	0.11	0.22
	1989	179.9	54.7	603	81	0.13	0.45
	1990	0.0	0.0	111	13	0.12	---
	1991	0.0	0.0	101	9	0.09	---
	1992	0.0	0.0	70	7	0.10	---
	1993	0.0	0.0	35	4	0.11	---
	1994	0.0	0.0	18	1	0.06	---
	1995	0.0	0.0	16	1	0.06	---
	1996	0.0	0.0	16	1	0.04	---
	1997	0.0	0.0	16	0	0.00	---
	1998	0.0	0.0	61	3	0.05	---
	1999	0.0	0.0	302	11	0.04	---
	2000	0.0	0.0	219	26	0.12	---
	2001	0.0	0.0	210	18	0.09	---
	2002	0.0	0.0	193	27	0.14	---
	2003	0.0	0.0	121	18	0.15	---
RIVER BEND 1	1987	605.2	68.4	1,268	378	0.30	0.62
Docket 50-458; NPF-47	1988	880.7	94.3	513	107	0.21	0.12
1st commercial operation 6/86	1989	584.5	69.1	1,566	558	0.36	0.95
Type - BWR	1990	682.2	78.0	1,616	489	0.30	0.72
Capacity - 966 MWe	1991	814.7	87.2	780	144	0.18	0.18
	1992	336.1	39.7	2,022	710	0.35	2.11
	1993	640.0	71.6	847	180	0.21	0.28
	1994	595.7	64.9	2,209	519	0.24	0.87
	1995	967.1	99.6	667	85	0.13	0.09
	1996	836.1	85.3	2,093	473	0.23	0.57
	1997	778.8	86.3	1,671	347	0.21	0.45
	1998	894.2	96.2	466	58	0.12	0.06
	1999	651.2	75.2	1,327	344	0.26	0.53
	2000	837.1	89.7	1,104	216	0.20	0.26
	2001	889.3	93.6	1,249	208	0.17	0.23
	2002	965.0	98.5	373	35	0.09	0.04
	2003	871.3	92.7	1,296	217	0.17	0.25
ROBINSON 2	1972	580.0		245	215	0.88	0.37
Docket 50-261; DPR-23	1973	455.1		831	695	0.84	1.53
1st commercial operation 3/71	1974	578.1	83.3	853	672	0.79	1.16
Type - PWR	1975	501.8	72.7	849	1,142	1.35	2.28
Capacity - 710 MWe	1976	585.5	84.7	597	715	1.20	1.22
	1977	511.5	85.2	634	455	0.72	0.89
	1978	480.5	72.0	943	963	1.02	2.00
	1979	482.0	70.8	1,454	1,188	0.82	2.46
	1980	387.3	62.2	2,009	1,852	0.92	4.78
	1981	426.6	73.0	1,462	733	0.50	1.72
	1982	277.5	48.9	2,011	1,426	0.71	5.14
	1983	409.8	75.5	2,244	923	0.41	2.25
	1984	28.0	7.0	4,127	2,880	0.70	102.86
	1985	629.5	87.9	1,378	311	0.23	0.49
	1986	577.1	80.3	1,571	539	0.34	0.93
	1987	510.1	72.5	1,379	499	0.36	0.98

[12] Rancho Seco was shut down 6/89 and is no longer in the count of operating reactors. Parentheses indicate plant capacity when plant was operational.

Reporting Organization	Year	Megawatt Years MW-YR	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose	Average Measurable Dose (rems)	Collective Dose MW-yr
ROBINSON 2	1988	385.0	65.9	1,351	564	0.42	1.46
(continued)	1989	336.6	48.7	1,098	195	0.18	0.58
	1990	400.3	64.8	1,626	437	0.27	1.09
	1991	575.1	81.4	885	193	0.22	0.34
	1992	487.2	66.8	1,267	352	0.28	0.72
	1993	502.7	70.7	1,221	337	0.28	0.67
	1994	560.3	79.5	420	63	0.15	0.11
	1995	618.7	84.7	1,058	215	0.20	0.35
	1996	654.8	88.6	1,031	167	0.16	0.26
	1997	707.5	99.0	304	13	0.04	0.02
	1998	628.5	88.9	978	170	0.17	0.27
	1999	648.9	91.8	807	124	0.15	0.19
	2000	710.0	99.7	138	8	0.06	0.01
	2001	627.9	90.6	827	125	0.15	0.20
	2002	638.0	91.2	830	111	0.13	0.17
	2003	733.1	100.0	109	5	0.04	0.01
SALEM 1, 2	1978	546.4	55.6	574	122	0.21	0.22
Docket 50-272, -311;	1979	250.0	25.5	1,488	584	0.39	2.34
DPR-70, -75	1980	680.6	69.2	1,704	449	0.26	0.66
1st commercial operation	1981	743.0	78.1	1,652	254	0.15	0.34
6/77, 10/81	1982	1,440.4	72.6	3,228	1,203	0.37	0.84
Type - PWRs	1983	742.0	30.5	2,383	581	0.24	0.78
Capacity - 1096, 1116 MWe	1984	650.1	31.8	1,395	681	0.49	1.05
	1985	1,657.7	75.8	1,112	204	0.18	0.12
	1986	1,484.3	70.4	3,554	599	0.17	0.40
	1987	1,478.2	73.3	2,543	600	0.24	0.41
	1988	1,591.6	73.6	1,609	503	0.31	0.32
	1989	1,675.4	79.5	2,944	338	0.11	0.20
	1990	1,362.6	65.1	3,636	272	0.07	0.20
	1991	1,726.4	79.3	4,201	458	0.11	0.27
	1992	1,200.9	61.1	4,376	431	0.10	0.36
	1993	1,366.3	65.4	3,559	408	0.11	0.30
	1994	1,367.4	73.8	950	188	0.20	0.14
	1995	558.1	29.3	1,195	218	0.18	0.39
	1996	0.0	0.0	1,671	300	0.18	---
	1997	279.3	17.8	894	175	0.20	0.63
	1998	1,629.3	79.1	408	41	0.10	0.03
	1999	1,821.8	86.8	1,200	318	0.27	0.17
	2000	1,973.4	93.0	1,191	198	0.17	0.10
	2001	1,961.2	91.1	1,274	153	0.12	0.08
	2002	1,934.0	89.4	2,460	293	0.12	0.15
	2003	1,957.2	90.7	1,301	124	0.10	0.06
SAN ONOFRE 1[13], 2, 3	1969	314.1		123	42	0.34	0.13
Docket 50-206, -361, -362;	1970	365.9		251	155	0.62	0.42
DPR-13, NPF-10, NPF-15	1971	362.1		121	50	0.41	0.14
1st commercial operation	1972	338.5		326	256	0.79	0.76
1/68, 8/83, 4/84	1973	273.7		570	353	0.62	1.29
Type - PWRs	1974	377.8	86.1	219	71	0.32	0.19
Capacity - (436), 1070,	1975	389.0	87.4	424	292	0.69	0.75
1080 MWe	1976	297.9	70.2	1,330	880	0.66	2.95
	1977	281.2	63.7	985	847	0.86	3.01
	1978	323.2	80.2	764	401	0.52	1.24
	1979	401.0	90.2	521	139	0.27	0.35
	1980	97.3	22.3	3,063	2,386	0.78	24.52
	1981	95.9	26.7	2,902	3,223	1.11	33.61

[13] San Onofre 1 was shut down 11/92 and is no longer in the count of operating reactors. Parentheses indicate plant capacity when plant was operational.

Reporting Organization	Year	Megawatt Years MW-YR	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose	Average Measurable Dose (rems)	Collective Dose MW-yr
SAN ONOFRE 1[13], 2, 3	1982	61.6	15.7	3,055	832	0.27	13.51
(continued)	1983	0.0	0.0	1,701	155	0.09	---
	1984	670.4	68.3	7,514	986	0.27	1.47
	1985	1,381.8	132.9	5,742	722	0.24	0.52
	1986	1,698.2	61.1	3,594	824	0.24	0.49
	1987	1,983.0	78.8	2,138	696	0.33	0.35
	1988	1,982.3	68.4	2,324	781	0.34	0.39
	1989	1,840.8	64.9	2,237	567	0.25	0.31
	1990	1,980.5	69.1	2,224	885	0.40	0.45
	1991	1,987.6	75.3	1,814	412	0.23	0.21
	1992	2,228.6	87.1	1,651	324	0.20	0.15
	1993	1,771.3	79.9	2,193	767	0.35	0.43
	1994	2,220.7	100.0	528	32	0.06	0.01
	1995	1,686.9	79.1	1,914	455	0.24	0.27
	1996	2,089.3	93.2	1,272	129	0.10	0.06
	1997	1,533.9	72.9	1,652	341	0.21	0.22
	1998	1,996.4	92.0	1,091	196	0.18	0.10
SAN ONOFRE 1[13]	1999	0.0	0.0	241	16	0.07	---
Docket 50-206;	2000	0.0	0.0	416	71	0.17	---
DPR-13,	2001	0.0	0.0	338	58	0.17	---
1st commercial operation 1/68	2002	0.0	0.0	308	61	0.20	---
Type - PWR	2003	0.0	0.0	226	36	0.16	---
Capacity - (436) MWe							
SAN ONOFRE 2, 3	1999	1,901.4	86.9	1,477	354	0.24	0.19
Docket 50-361, -362;	2000	2,067.2	94.7	1,073	115	0.11	0.06
NPF-10, NPF-15	2001	1,727.2	78.9	1,083	131	0.12	0.08
1st commercial operation	2002	2,056.0	93.4	1,140	136	0.12	0.07
8/83, 4/84	2003	2,084.3	94.0	1,275	164	0.13	0.08
Type - PWRs							
Capacity - 1070, 1080 MWe							
SEABROOK	1991	810.4	75.9	699	92	0.13	0.11
Docket 50-443; NPF-86	1992	932.4	81.3	806	147	0.18	0.16
1st commercial operation 8/90	1993	1,071.5	93.6	110	6	0.05	0.01
Type - PWR	1994	736.4	63.5	852	113	0.13	0.15
Capacity - 1155 Mwe	1995	995.5	87.5	800	102	0.13	0.10
	1996	1,168.6	99.6	206	10	0.05	0.01
	1997	907.0	79.8	1,571	186	0.12	0.21
	1998	957.6	84.5	559	19	0.03	0.02
	1999	991.5	87.5	1,339	106	0.08	0.11
	2000	901.8	79.3	1,158	70	0.06	0.08
	2001	989.6	89.1	423	9	0.02	0.01
	2002	1,058.0	92.8	1,095	67	0.06	0.06
	2003	1,055.9	93.6	981	71	0.07	0.07
SEQUOYAH 1, 2	1982	583.5	52.8	1,968	570	0.29	0.98
Docket 50-327, -328;	1983	1,663.7	75.1	1,769	491	0.28	0.30
DPR-77, -79	1984	1,481.9	69.0	2,373	1,119	0.47	0.76
1st commercial operation	1985	1,151.3	51.3	1,853	1,072	0.58	0.93
7/81, 6/82	1986	0.0	0.0	1,738	527	0.30	---
Type - PWR	1987	0.0	0.0	2,080	420	0.20	---
Capacity - 1125, 1126 MWe	1988	490.8	31.8	2,441	678	0.28	1.38
	1989	1,851.7	85.7	2,007	657	0.33	0.35
	1990	1,662.6	77.2	2,935	1,687	0.57	1.01
	1991	1,965.4	88.0	1,933	700	0.36	0.36

[13] San Onofre 1 was shut down 11/92 and is no longer in the count of operating reactors. Parentheses indicate plant capacity when plant was operational.

Reporting Organization	Year	Megawatt Years MW-YR	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose	Average Measurable Dose (rems)	Collective Dose MW-yr
SEQUOYAH 1, 2	1992	1,849.0	85.4	1,714	465	0.27	0.25
(continued)	1993	405.7	21.8	1,631	373	0.23	0.92
	1994	1,418.7	66.3	1,702	295	0.17	0.21
	1995	1,864.2	86.1	1,650	368	0.22	0.20
	1996	2,003.9	87.9	1,444	269	0.19	0.13
	1997	1,946.1	89.0	1,962	420	0.21	0.22
	1998	2,135.3	95.3	1,530	266	0.17	0.12
	1999	2,165.1	97.0	1,346	165	0.12	0.08
	2000	1,910.0	86.8	2,039	357	0.18	0.19
	2001	2,158.3	95.7	1,292	145	0.11	0.07
	2002	2,106.0	94.1	1,257	108	0.09	0.05
	2003	1,776.4	80.0	2,484	431	0.17	0.24
SOUTH TEXAS 1, 2	1989	769.3	65.6	989	161	0.16	0.21
Docket 50-498, 50-499;	1990	1,504.1	65.9	1,136	206	0.18	0.14
NPF -76,-80	1991	1,741.5	72.4	1,144	257	0.22	0.15
1st commercial operation	1992	2,096.0	83.8	923	147	0.16	0.07
8/88, 6/89	1993	163.1	8.3	1,138	251	0.22	1.54
Type - PWRs	1994	1,700.2	70.6	661	47	0.07	0.03
Capacity - 1251, 1251 MWe	1995	2,294.2	89.9	1,485	291	0.20	0.13
	1996	2,465.9	95.0	1,145	137	0.12	0.06
	1997	2,265.5	93.6	1,583	273	0.17	0.12
	1998	2,379.4	96.9	1,171	184	0.16	0.08
	1999	2,219.7	91.6	1,328	260	0.20	0.12
	2000	2,180.0	89.7	1,372	232	0.17	0.11
	2001	2,262.7	92.2	1,325	238	0.18	0.11
	2002	2,173.0	87.5	1,510	329	0.22	0.15
	2003	1,796.3	72.1	909	143	0.16	0.08
ST. LUCIE 1, 2	1977	649.1	84.7	445	152	0.34	0.23
Docket 50-335, -389;	1978	606.4	76.5	797	337	0.42	0.56
DPR-67; NPF-16	1979	592.0	74.0	907	438	0.48	0.74
1st commercial operation	1980	627.9	77.5	1,074	532	0.50	0.85
12/76, 8/83	1981	599.1	72.7	1,473	929	0.63	1.55
Type - PWRs	1982	816.8	94.0	1,045	272	0.26	0.33
Capacity - 839, 839 MWe	1983	290.3	15.4	2,211	1,204	0.54	4.15
	1984	1,183.0	69.6	2,090	1,263	0.60	1.07
	1985	1,445.8	82.5	1,971	1,344	0.68	0.93
	1986	1,588.6	89.1	1,279	491	0.38	0.31
	1987	1,407.9	81.9	2,012	951	0.47	0.68
	1988	1,639.7	93.0	1,448	611	0.42	0.37
	1989	1,493.1	85.1	1,414	495	0.35	0.33
	1990	1,188.4	70.0	1,876	777	0.41	0.65
	1991	1,592.8	90.8	1,282	479	0.37	0.30
	1992	1,511.9	87.3	1,251	264	0.21	0.17
	1993	1,227.6	77.7	1,462	492	0.34	0.40
	1994	1,424.8	85.0	1,896	505	0.27	0.35
	1995	1,306.6	76.0	1,498	413	0.28	0.32
	1996	1,473.4	86.5	1,433	385	0.27	0.26
	1997	1,394.6	83.6	2,314	646	0.28	0.46
	1998	1,572.5	94.2	1,170	134	0.11	0.09
	1999	1,569.1	93.8	1,107	177	0.16	0.11
	2000	1,630.0	96.0	990	99	0.10	0.06
	2001	1,527.5	91.6	1,375	228	0.17	0.15
	2002	1,633.0	96.6	992	156	0.16	0.10
	2003	1,524.7	91.5	937	142	0.15	0.09

Reporting Organization	Year	Megawatt Years MW-YR	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose	Average Measurable Dose (rems)	Collective Dose MW-yr
SUMMER 1	1984	504.6	61.1	1,120	295	0.26	0.58
Docket 50-395; NPF-12	1985	627.7	71.6	1,201	379	0.32	0.60
1st commercial operation 1/84	1986	853.7	95.3	392	23	0.06	0.03
Type - PWR	1987	618.7	71.0	1,075	560	0.52	0.91
Capacity - 966 MWe	1988	605.3	69.1	1,127	511	0.45	0.84
	1989	652.4	83.1	374	52	0.14	0.08
	1990	730.0	83.9	1,090	376	0.34	0.52
	1991	642.5	82.9	984	291	0.30	0.45
	1992	892.6	97.4	249	27	0.11	0.03
	1993	728.3	84.0	1,121	297	0.26	0.41
	1994	536.7	69.5	1,549	374	0.24	0.70
	1995	899.8	97.2	257	13	0.05	0.01
	1996	850.4	90.3	701	97	0.14	0.11
	1997	829.7	89.8	820	163	0.20	0.20
	1998	934.8	98.8	285	14	0.05	0.01
	1999	842.0	89.4	827	120	0.15	0.14
	2000	723.9	76.6	933	167	0.18	0.23
	2001	769.3	83.3	486	69	0.14	0.09
	2002	840.0	87.9	685	60	0.09	0.07
	2003	837.0	87.4	745	71	0.10	0.08
SURRY 1, 2	1973	420.6		936	152	0.16	0.36
Docket 50-280, 50-281;	1974	717.4	49.8	1,715	884	0.52	1.23
DPR-32, -37	1975	1,079.0	70.8	1,948	1,649	0.85	1.53
1st commercial operation	1976	930.7	60.4	2,753	3,165	1.15	3.40
12/72, 5/73	1977	1,139.0	72.2	1,860	2,307	1.24	2.03
Type - PWRs	1978	1,210.6	77.2	2,203	1,837	0.83	1.52
Capacity - 810, 815 MWe	1979	343.0	42.3	5,065	3,584	0.71	10.45
	1980	568.2	40.3	5,317	3,836	0.72	6.75
	1981	907.6	59.3	3,753	4,244	1.13	4.68
	1982	1,323.3	88.5	1,878	1,490	0.79	1.13
	1983	916.2	61.3	2,754	3,220	1.17	3.51
	1984	1,026.7	71.0	3,198	2,247	0.70	2.19
	1985	1,166.4	78.2	3,206	1,815	0.57	1.56
	1986	1,080.5	69.0	3,763	2,356	0.63	2.18
	1987	1,132.7	72.7	2,675	712	0.27	0.63
	1988	750.4	50.0	3,184	1,542	0.48	2.05
	1989	489.3	33.0	3,100	836	0.27	1.71
	1990	1,276.4	83.9	1,947	575	0.30	0.45
	1991	1,271.9	84.5	1,547	510	0.33	0.40
	1992	1,396.3	88.9	1,660	539	0.32	0.39
	1993	1,283.1	84.6	1,402	383	0.27	0.30
	1994	1,320.9	85.2	1,530	378	0.25	0.29
	1995	1,333.0	84.2	1,883	406	0.22	0.30
	1996	1,562.9	93.1	983	209	0.21	0.13
	1997	1,380.3	87.1	1,335	320	0.24	0.23
	1998	1,476.2	91.6	1,165	189	0.16	0.13
	1999	1,483.0	93.5	995	138	0.14	0.09
	2000	1,490.0	92.7	1,197	193	0.16	0.13
	2001	1,441.5	89.5	1,243	329	0.26	0.23
	2002	1,557.0	96.0	799	88	0.11	0.06
	2003	1,255.9	79.7	1,628	326	0.20	0.26
SUSQUEHANNA 1, 2	1984	719.9	72.6	2,827	308	0.11	0.43
Docket 50-387, 50-388;	1985	1,452.2	76.4	3,669	1,106	0.30	0.76
NPF-14; NPF-22	1986	1,344.8	67.0	2,996	828	0.28	0.62
1st commercial operation	1987	1,749.5	85.3	2,548	621	0.24	0.35
6/83, 2/85	1988	1,691.0	83.5	1,904	516	0.27	0.31
Type - BWRs	1989	1,572.5	77.1	2,063	704	0.34	0.45
Capacity - 1105, 1140 MWe	1990	1,746.9	85.4	1,691	440	0.26	0.25
	1991	1,878.0	89.8	1,844	507	0.27	0.27

Reporting Organization	Year	Megawatt Years MW-YR	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose	Average Measurable Dose (rems)	Collective Dose MW-yr
SUSQUEHANNA 1, 2	1992	1,604.2	79.7	1,885	724	0.38	0.45
(continued)	1993	1,602.1	77.3	1,488	335	0.23	0.21
	1994	1,814.4	85.4	1,580	442	0.28	0.24
	1995	1,850.8	85.3	1,773	476	0.27	0.26
	1996	1,998.7	90.7	1,430	289	0.20	0.14
	1997	1,918.9	89.6	1,646	433	0.26	0.23
	1998	1,879.6	88.3	1,575	361	0.23	0.19
	1999	1,896.0	89.6	1,787	431	0.24	0.23
	2000	1,994.6	92.6	1,812	331	0.18	0.17
	2001	2,027.6	94.2	1,807	288	0.16	0.14
	2002	1,973.0	91.6	1,890	260	0.14	0.13
	2003	2,050.8	93.4	1,934	250	0.13	0.12
THREE MILE ISLAND 1[14], 2[15]	1975	675.9	82.2	131	73	0.56	0.11
Docket 50-289, -320;	1976	530.0	65.4	819	286	0.35	0.54
DPR-50, -73	1977	664.5	80.9	1,122	360	0.32	0.54
1st commercial operation	1978	690.0	85.1	1,929	504	0.26	0.73
9/74, 12/78	1979	266.0	21.9	3,975	1,392	0.35	5.23
Type - PWRs	1980	0.0	0.0	2,328	394	0.17	---
Capacity - 786, (880) MWe	1981	0.0	0.0	2,103	376	0.18	---
	1982	0.0	0.0	2,123	1,004	0.47	---
	1983	0.0	0.0	1,592	1,159	0.73	---
	1984	0.0	0.0	1,079	688	0.64	---
	1985	103.6	10.6	1,890	857	0.45	8.27
THREE MILE ISLAND 1[14]	1986	585.2	70.9	1,360	213	0.16	0.36
Docket 50-289; DPR-50	1987	610.7	73.6	1,259	149	0.12	0.24
1st commercial operation 9/74	1988	661.0	77.8	1,012	210	0.21	0.32
Type - PWR	1989	871.3	100.0	670	54	0.08	0.06
Capacity - 802 MWe	1990	645.5	84.6	1,319	264	0.20	0.41
	1991	688.7	86.4	1,542	198	0.13	0.29
	1992	836.8	100.0	558	34	0.06	0.04
	1993	722.0	88.5	1,835	206	0.11	0.29
	1994	798.7	95.5	434	40	0.09	0.05
	1995	772.9	90.8	1,220	213	0.17	0.28
	1996	857.4	100.0	267	16	0.06	0.02
	1997	675.7	84.3	1,049	204	0.19	0.30
	1998	805.8	100.0	280	17	0.06	0.02
	1999	722.4	89.7	1,171	155	0.13	0.21
	2000	813.4	100.0	183	9	0.05	0.01
	2001	616.7	84.2	1,196	197	0.16	0.32
	2002	833.0	100.0	172	7	0.04	0.01
	2003	706.4	87.1	1,230	155	0.13	0.22
THREE MILE ISLAND 2[15]	1986	0.0	0.0	1,497	915	0.61	---
Docket 50-320; DPR-73	1987	0.0	0.0	1,378	977	0.71	---
1st commercial operation 12/78	1988	0.0	0.0	1,247	917	0.74	---
Type - PWR	1989	0.0	0.0	1,014	639	0.63	---
Capacity - (880) MWe	1990	0.0	0.0	484	136	0.28	---
	1991	0.0	0.0	153	37	0.24	---
	1992	0.0	0.0	315	157	0.50	---
	1993	0.0	0.0	167	33	0.20	---
	1994	0.0	0.0	259	7	0.03	---
	1995	0.0	0.0	191	2	0.01	---

[14] Three Mile Island 1 resumed commercial power generation 10/85 after being under regulatory restraint since 1979.

[15] Three Mile Island 2 has been shut down since the 1979 accident, but was still included in the count of reactors through 1988 since dose was still being accumulated to defuel and decontaminate the unit during this time period. Parentheses indicate plant capacity when plant was operational. Three Mile Island 2 no longer reports separately since 2001.

Reporting Organization	Year	Megawatt Years MW-YR	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose	Average Measurable Dose (rems)	Collective Dose MW-yr
THREE MILE ISLAND 2[15]	1996	0.0	0.0	122	2	0.02	---
(continued)	1997	0.0	0.0	232	1	0.00	---
	1998	0.0	0.0	105	1	0.01	---
	1999	0.0	0.0	203	1	0.00	---
	2000	0.0	0.0	70	0	0.01	---
	2001	0.0	0.0	0	0	---	---
TROJAN[16]	1977	792.0	92.6	591	174	0.29	0.22
Docket 50-344; NPF-1	1978	205.5	20.6	711	319	0.45	1.55
1st commercial operation 5/76	1979	631.0	58.1	736	258	0.35	0.41
Type - PWR	1980	727.5	72.5	1,159	421	0.36	0.58
Capacity - (1080) MWe	1981	775.6	74.1	1,311	609	0.46	0.79
	1982	579.5	60.8	977	419	0.43	0.72
	1983	494.2	62.4	969	307	0.32	0.62
	1984	567.0	54.4	1,042	433	0.42	0.76
	1985	829.1	76.7	852	363	0.43	0.44
	1986	852.4	79.7	1,321	381	0.29	0.45
	1987	525.5	54.0	1,209	363	0.30	0.69
	1988	758.6	67.5	1,408	401	0.28	0.53
	1989	666.8	61.9	1,360	421	0.31	0.63
	1990	732.4	66.3	1,169	258	0.22	0.35
	1991	181.6	16.1	1,496	567	0.38	3.12
	1992	553.9	68.4	567	84	0.15	0.15
	1993	0.0	68.4	54	21	0.39	---
	1994	0.0	0.0	51	9	0.18	---
	1995	0.0	0.0	141	44	0.31	---
	1996	0.0	0.0	112	41	0.37	---
	1997	0.0	0.0	227	41	0.18	---
	1998	0.0	0.0	283	46	0.16	---
	1999	0.0	0.0	274	52	0.19	---
	2000	0.0	0.0	127	18	0.14	---
	2001	0.0	0.0	14	1	0.08	---
	2002	0.0	0.0	13	1	0.04	---
	2003	0.0	0.0	105	24	0.23	---
TURKEY POINT 3, 4	1973	401.9		444	78	0.18	0.19
Docket 50-250, 50-251;	1974	953.6		794	454	0.57	0.48
DPR-31, -41	1975	1,003.7	74.9	1,176	876	0.74	0.87
1st commercial operation	1976	974.2	71.2	1,647	1,184	0.72	1.22
12/72, 9/73	1977	979.5	72.1	1,319	1,036	0.79	1.06
Type - PWRs	1978	1,000.2	78.8	1,336	1,032	0.77	1.03
Capacity - 693, 693 MWe	1979	811.0	62.4	2,002	1,680	0.84	2.07
	1980	990.6	73.6	1,803	1,651	0.92	1.67
	1981	654.0	46.8	2,932	2,251	0.77	3.44
	1982	915.7	65.2	2,956	2,119	0.72	2.31
	1983	878.4	62.8	2,930	2,681	0.92	3.05
	1984	946.7	68.5	2,010	1,255	0.62	1.33
	1985	1,034.9	74.7	1,905	1,253	0.66	1.21
	1986	754.1	54.9	1,808	946	0.52	1.25
	1987	431.3	36.6	1,980	1,371	0.69	3.18
	1988	809.8	59.5	1,841	738	0.40	0.91
	1989	689.9	56.8	1,625	433	0.27	0.63
	1990	933.1	69.0	2,099	730	0.35	0.78

[15] Three Mile Island 2 has been shut down since the 1979 accident, but was still included in the count of reactors through 1988 since dose was still being accumulated to defuel and decontaminate the unit during this time period. Parentheses indicate plant capacity when plant was operational. Three Mile Island 2 no longer reports separately since 2001.

[16] Trojan ended commercial operation as of 1/93, and will not be put in commercial operation again. It is no longer in the count of operating reactors. Parentheses indicate plant capacity when plant was operational.

Reporting Organization	Year	Megawatt Years MW-YR	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose	Average Measurable Dose (rems)	Collective Dose MW-yr
TURKEY POINT 3, 4	1991	258.2	21.0	2,087	939	0.45	3.64
(continued)	1992	968.9	75.5	1,374	325	0.24	0.34
	1993	1,244.8	91.0	1,271	275	0.22	0.22
	1994	1,172.9	87.2	1,489	476	0.32	0.41
	1995	1,320.3	94.6	1,142	215	0.19	0.16
	1996	1,307.8	94.0	1,157	187	0.16	0.14
	1997	1,220.9	88.6	1,581	414	0.26	0.34
	1998	1,323.0	94.5	1,045	156	0.15	0.12
	1999	1,352.5	96.5	919	128	0.14	0.09
	2000	1,283.7	92.2	1,292	220	0.17	0.17
	2001	1,324.1	95.0	827	102	0.12	0.08
	2002	1,374.0	97.9	793	74	0.09	0.05
	2003	1,253.2	91.6	1,442	247	0.17	0.20
VERMONT YANKEE	1973	222.1		244	85	0.35	0.38
Docket 50-271; DPR-28	1974	303.5		357	216	0.61	0.71
1st commercial operation 11/72	1975	429.0	87.8	282	153	0.54	0.36
Type - BWR	1976	389.6	77.1	815	411	0.50	1.05
Capacity - 510 MWe	1977	423.5	85.1	641	258	0.40	0.61
	1978	387.5	75.9	934	339	0.36	0.87
	1979	414.0	82.1	1,220	1,170	0.96	2.83
	1980	357.8	71.5	1,443	1,338	0.93	3.74
	1981	429.1	84.6	1,264	731	0.58	1.70
	1982	501.0	96.0	481	205	0.43	0.41
	1983	346.1	69.3	1,316	1,527	1.16	4.41
	1984	398.1	79.0	954	626	0.66	1.57
	1985	361.4	71.8	1,392	1,051	0.76	2.91
	1986	248.1	48.9	1,389	1,188	0.86	4.79
	1987	423.6	84.2	827	303	0.37	0.72
	1988	492.1	95.7	379	124	0.33	0.25
	1989	432.8	84.7	832	288	0.35	0.67
	1990	433.1	85.9	849	307	0.36	0.71
	1991	492.3	94.3	310	118	0.38	0.24
	1992	446.8	88.1	921	381	0.41	0.85
	1993	402.3	80.1	833	217	0.26	0.54
	1994	515.8	98.7	220	38	0.17	0.07
	1995	462.1	87.0	737	182	0.25	0.39
	1996	452.7	85.2	951	231	0.24	0.51
	1997	487.1	96.0	260	57	0.22	0.12
	1998	383.4	77.9	944	199	0.21	0.52
	1999	463.4	91.0	854	176	0.21	0.38
	2000	517.8	99.6	198	38	0.19	0.07
	2001	474.9	93.5	863	143	0.17	0.30
	2002	451.0	91.7	946	150	0.16	0.33
	2003	505.9	98.8	359	54	0.15	0.11
VOGTLE 1, 2	1988	820.4	77.7	1,108	138	0.12	0.17
Docket 50-424; 50-425;	1989	1,045.8	96.0	427	32	0.07	0.03
NPF-68, -81	1990	1,710.9	82.7	1,602	466	0.29	0.27
1st commercial operation	1991	1,966.5	89.2	1,357	362	0.27	0.18
6/87, 5/89	1992	2,047.9	90.0	1,262	426	0.34	0.21
Type - PWRs	1993	2,060.4	88.3	1,338	367	0.27	0.18
Capacity - 1152, 1149 MWe	1994	2,170.1	91.3	1,048	217	0.21	0.10
	1995	2,285.4	95.2	953	199	0.21	0.09
	1996	2,056.8	86.5	1,395	452	0.32	0.22
	1997	2,121.1	91.4	994	158	0.16	0.07
	1998	2,123.9	92.3	994	162	0.16	0.08
	1999	2,106.0	91.5	1,359	229	0.17	0.11
	2000	2,223.9	95.6	899	121	0.14	0.05
	2001	2,231.5	96.2	870	129	0.15	0.06
	2002	1,942.0	85.3	1,152	244	0.21	0.13
	2003	2,179.9	94.8	806	84	0.10	0.04

Reporting Organization	Year	Megawatt Years MW-YR	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose	Average Measurable Dose (rems)	Collective Dose MW-yr
WATERFORD	1986	875.7	79.1	1,244	223	0.18	0.25
Docket 50-382; NPF-38	1987	891.8	82.5	959	156	0.16	0.17
1st commercial operation 9/85	1988	784.3	75.4	1,246	259	0.21	0.33
Type - PWR	1989	909.8	82.6	1,306	265	0.20	0.29
Capacity - 1075 MWe	1990	1,027.9	92.8	432	47	0.11	0.05
	1991	870.6	79.8	1,301	364	0.28	0.42
	1992	909.6	83.2	1,213	226	0.19	0.25
	1993	1,088.3	99.4	195	15	0.08	0.01
	1994	949.1	87.0	1,167	191	0.16	0.20
	1995	927.4	83.4	1,092	153	0.14	0.16
	1996	1,064.8	94.2	342	27	0.08	0.03
	1997	767.2	71.2	1,186	148	0.13	0.19
	1998	984.1	91.9	282	24	0.09	0.02
	1999	849.5	79.6	833	123	0.15	0.14
	2000	965.1	88.8	825	132	0.16	0.14
	2001	1,086.0	99.6	91	5	0.05	0.00
	2002	1,007.0	93.2	811	109	0.14	0.11
	2003	968.0	90.9	710	95	0.13	0.10
WATTS BAR 1	1997	867.6	83.8	1,103	113	0.10	0.13
Docket 50-390; NPF-90	1998	1,105.1	99.1	96	3	0.03	0.00
1st commercial operation 5/96	1999	943.1	87.2	975	99	0.10	0.10
Type - PWR	2000	1,033.3	92.8	1,053	122	0.12	0.12
Capacity - 1121 MWe	2001	1,095.9	96.5	197	6	0.03	0.01
	2002	1,034.0	92.1	909	94	0.10	0.09
	2003	973.3	86.7	1,392	166	0.12	0.17
WOLF CREEK 1	1986	832.8	73.3	682	143	0.21	0.17
Docket 50-482; NPF-42	1987	778.8	71.1	675	138	0.20	0.18
1st commercial operation 9/85	1988	794.7	70.7	1,010	297	0.29	0.37
Type - PWR	1989	1,108.4	99.5	186	18	0.10	0.02
Capacity - 1167 MWe	1990	940.2	81.0	798	195	0.24	0.21
	1991	707.6	71.9	1,010	331	0.33	0.47
	1992	1,010.8	86.7	446	78	0.17	0.08
	1993	940.5	80.6	975	183	0.19	0.19
	1994	1,017.2	86.8	1,082	235	0.22	0.23
	1995	1,198.0	98.7	242	14	0.06	0.01
	1996	980.6	81.2	986	171	0.17	0.17
	1997	964.3	83.8	989	265	0.27	0.27
	1998	1,187.3	100.0	184	10	0.05	0.01
	1999	1,045.3	90.1	812	148	0.18	0.14
	2000	1,032.7	89.5	861	143	0.17	0.14
	2001	1,177.9	100.0	105	5	0.05	0.00
	2002	1,029.0	88.7	816	100	0.12	0.10
	2003	1,013.5	87.2	820	89	0.11	0.09
YANKEE ROWE[17]	1969	138.3		193	215	1.11	1.55
Docket 50-29; DPR-3	1970	146.1		355	255	0.72	1.75
1st commercial operation 7/61	1971	173.5		155	90	0.58	0.52
Type - PWR	1972	78.7		282	255	0.90	3.24
Capacity - (175) MWe	1973	127.1		133	99	0.74	0.78
	1974	111.3		243	205	0.84	1.84
	1975	145.1	82.4	249	116	0.47	0.80
	1976	152.2	89.8	152	59	0.39	0.39
	1977	124.6	73.9	725	356	0.49	2.86
	1978	145.0	81.0	565	282	0.50	1.94
	1979	149.0	81.6	441	127	0.29	0.85

[17] Yankee Rowe ended commercial operation as of 10/91, and will not be put in commercial operation again. It is no longer in the count of operating reactors. Parentheses indicate plant capacity when plant was operational.

Reporting Organization	Year	Megawatt Years MW-YR	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose	Average Measurable Dose (rems)	Collective Dose MW-yr
YANKEE ROWE[17]	1980	35.6	22.0	502	213	0.42	5.98
(continued)	1981	109.0	74.4	515	302	0.59	2.77
	1982	108.6	73.4	814	474	0.58	4.36
	1983	163.5	91.4	395	68	0.17	0.42
	1984	124.8	71.4	654	348	0.53	2.79
	1985	144.3	85.3	653	211	0.32	1.46
	1986	169.7	95.0	384	45	0.12	0.27
	1987	138.7	82.7	593	217	0.37	1.56
	1988	136.4	85.2	738	227	0.31	1.66
	1989	159.4	92.9	496	62	0.12	0.39
	1990	101.1	61.5	702	246	0.35	2.43
	1991	121.2	72.3	162	40	0.25	0.33
	1992	0.0	0.0	324	94	0.29	---
	1993	0.0	0.0	313	163	0.52	---
	1994	0.0	0.0	222	156	0.70	---
	1995	0.0	0.0	191	78	0.41	---
	1996	0.0	0.0	239	95	0.40	---
	1997	0.0	0.0	323	65	0.20	---
	1998	0.0	0.0	125	5	0.04	---
	1999	0.0	0.0	83	2	0.02	---
	2000	0.0	0.0	38	2	0.06	---
	2001	0.0	0.0	48	4	0.08	---
	2002	0.0	0.0	128	20	0.16	---
	2003	0.0	0.0	136	31	0.23	---
ZION 1[18]**, 2**[18]	1974	425.3	71.1	306	56	0.18	0.13
Docket 50-295; 50-304;	1975	1,181.5	74.9	436	127	0.29	0.11
DPR-39, -48	1976	1,134.9	61.9	774	571	0.74	0.50
1st commercial operation	1977	1,358.6	75.0	784	1,003	1.28	0.74
12/73, 9/74	1978	1,613.5	80.2	1,104	1,017	0.92	0.63
Type - PWRs	1979	1,238.0	67.6	1,472	1,274	0.87	1.03
Capacity - (1040), (1040) MWe	1980	1,411.2	74.1	1,363	920	0.67	0.65
	1981	1,366.9	72.3	1,754	1,720	0.98	1.26
	1982	1,186.4	64.3	1,575	2,103	1.34	1.77
	1983	1,222.3	69.4	1,285	1,311	1.02	1.07
	1984	1,389.9	69.6	1,110	786	0.71	0.57
	1985	1,187.9	62.9	1,498	1,166	0.78	0.98
	1986	1,462.0	73.2	967	474	0.49	0.32
	1987	1,337.0	71.0	1,046	653	0.62	0.49
	1988	1,549.1	78.3	1,926	1,260	0.65	0.81
	1989	1,514.1	77.6	1,282	624	0.49	0.41
	1990	860.4	46.9	1,385	696	0.50	0.81
	1991	1,125.7	58.2	902	173	0.19	0.15
	1992	1,128.8	59.0	1,732	1,043	0.60	0.92
	1993	1,458.2	70.9	1,772	643	0.36	0.44
	1994	1,224.9	59.9	1,176	306	0.26	0.25
	1995	1,471.6	72.4	1,807	797	0.44	0.54
	1996	1,538.4	75.8	1,567	437	0.28	0.28
	1997	123.2	7.1	924	119	0.13	0.97
	1998	0.0	0.0	246	12	0.05	---
	1999	0.0	0.0	67	4	0.06	---
	2000	0.0	0.0	26	3	0.12	---
	2001	0.0	0.0	6	0	0.05	---
	2002	0.0	0.0	12	0	0.02	---
	2003	0.0	0.0	2	0	0.02	---

[17] Yankee Rowe ended commercial operation as of 10/91, and will not be put in commercial operation again. It is no longer in the count of operating reactors. Parentheses indicate plant capacity when plant was operational.

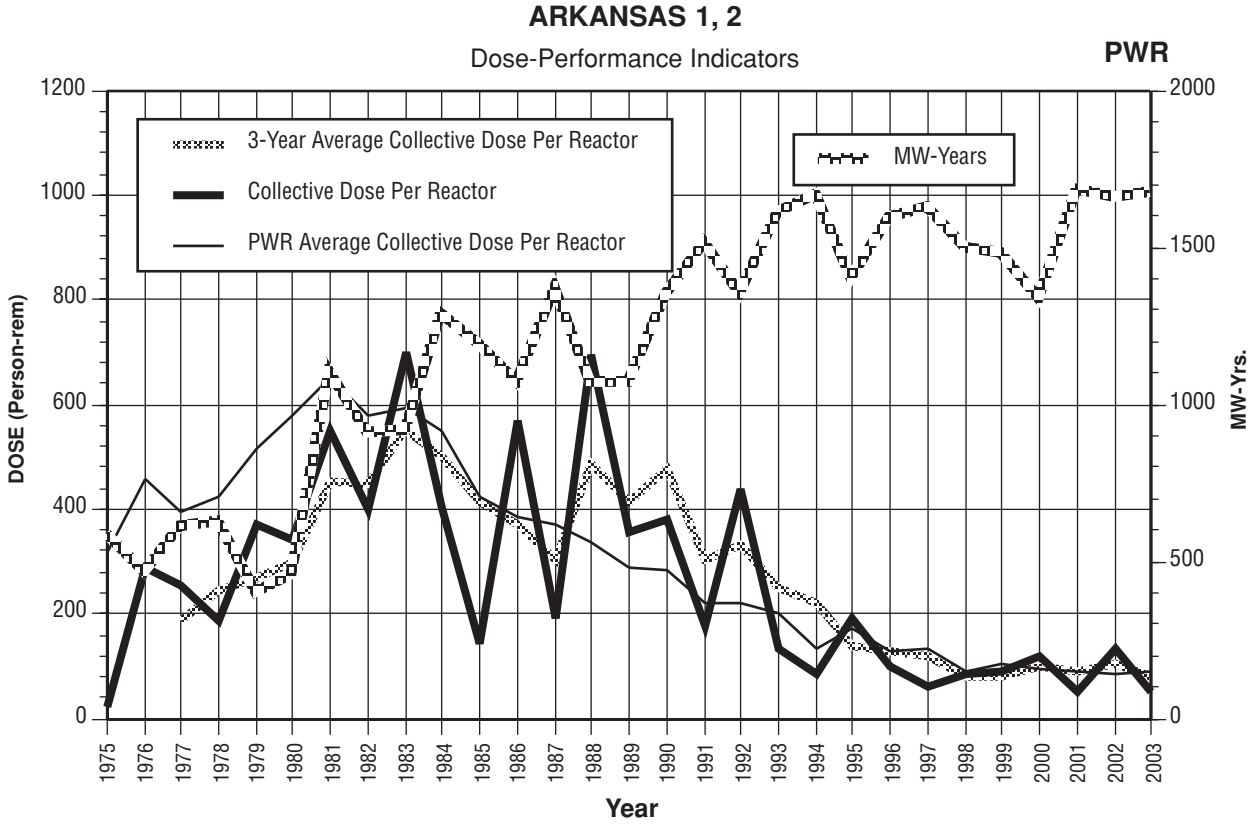
[18] Zion 1, 2 was shut down 12/97 and is no longer included in the count of operating reactors. Parentheses indicate plant capacity when plant was operational.

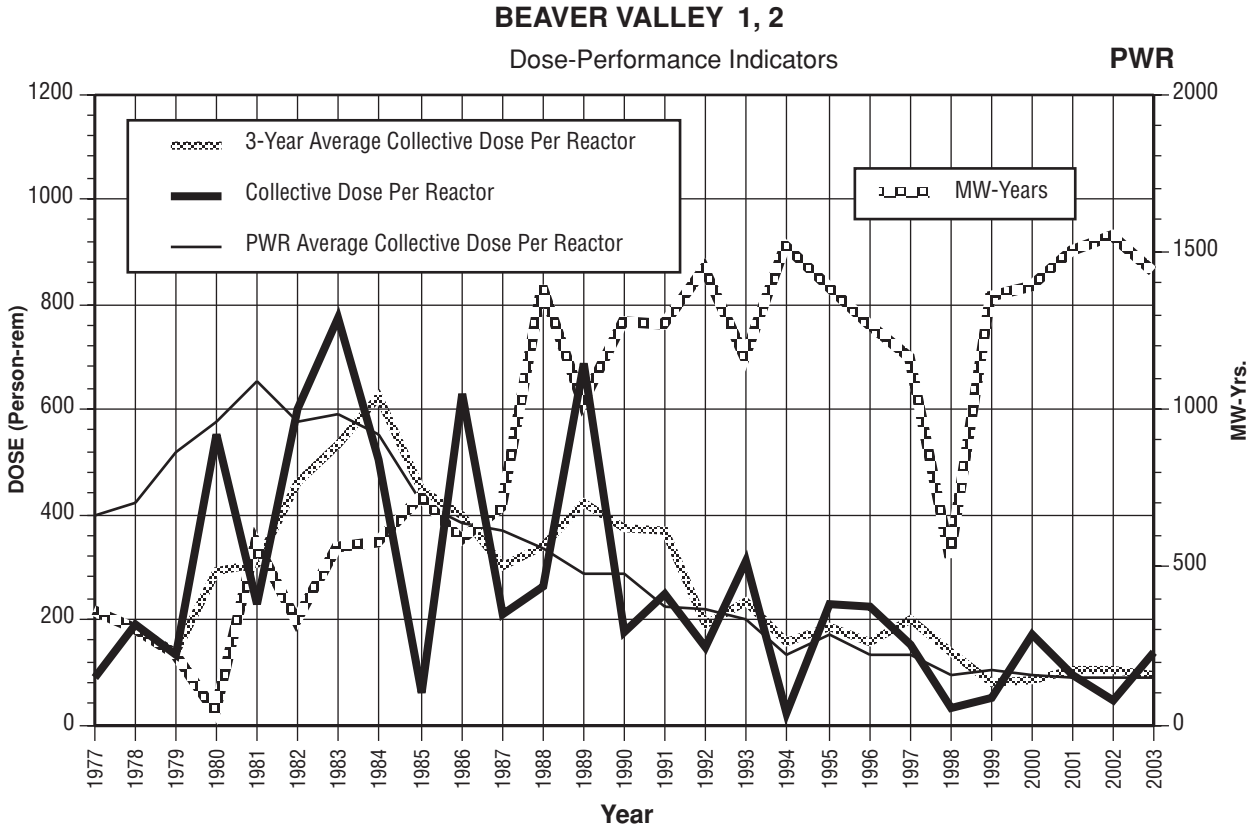
Appendix D

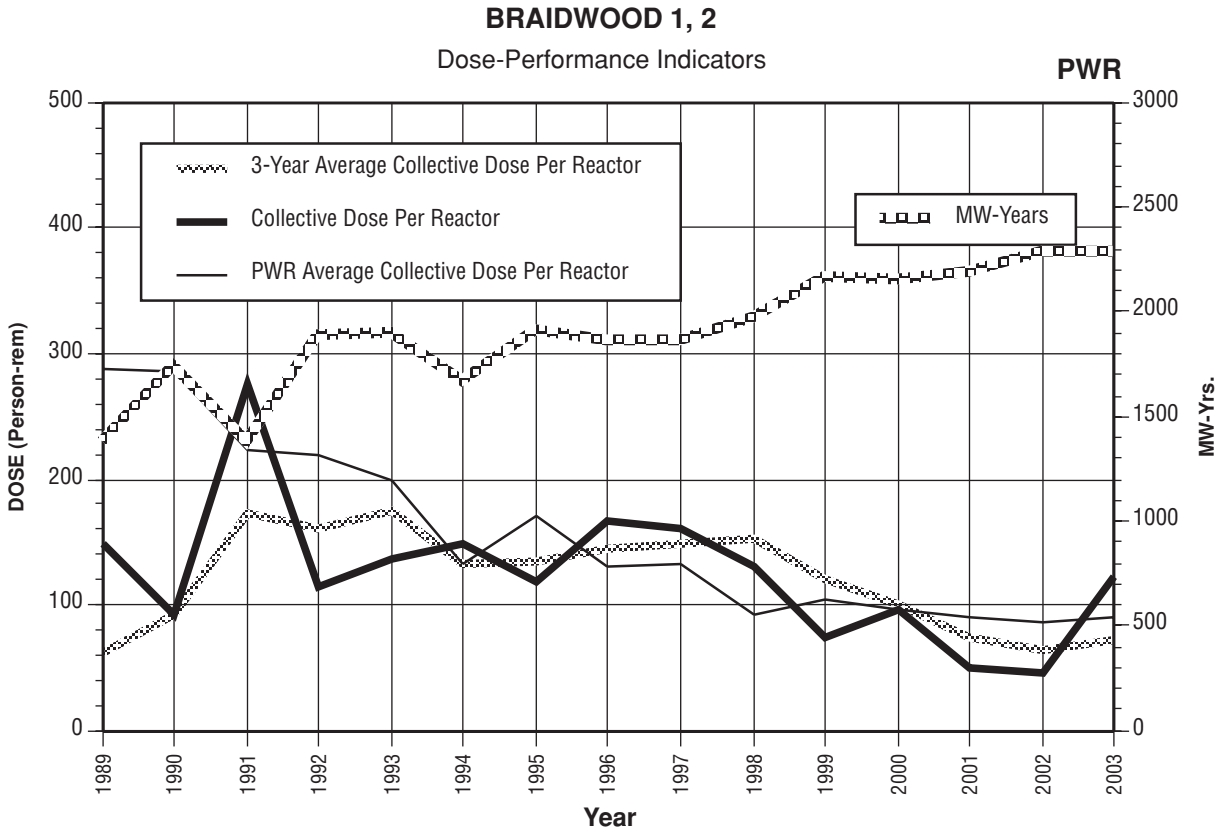
DOSE PERFORMANCE INDICATORS BY REACTOR SITE

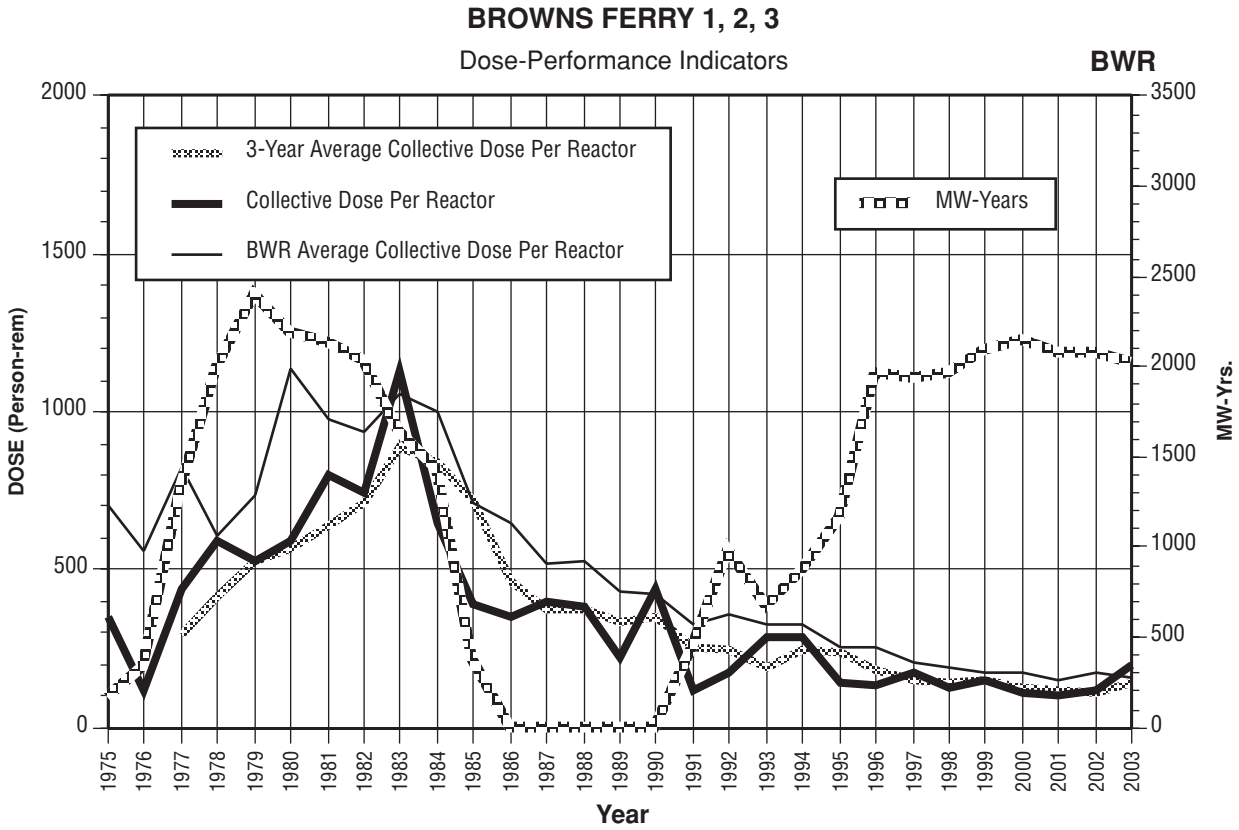
1973 - 2003

NOTE: Appendix D only contains data on plants in operation during 2003.


ARKANSAS 1, 2
Dose-Performance Indicators
PWR
3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
PWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year


BEAVER VALLEY 1, 2
Dose-Performance Indicators
PWR
3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
PWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year


BRAIDWOOD 1, 2
Dose-Performance Indicators
PWR
3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
PWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year
0
100
200
300
400
500
500
1000
1500
2000
2500
3000
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003


BROWNS FERRY 1, 2, 3
Dose-Performance Indicators
BWR
3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
BWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year
0
500
1000
1500
2000
500
1000
1500
2000
2500
3000
3500
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
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1989
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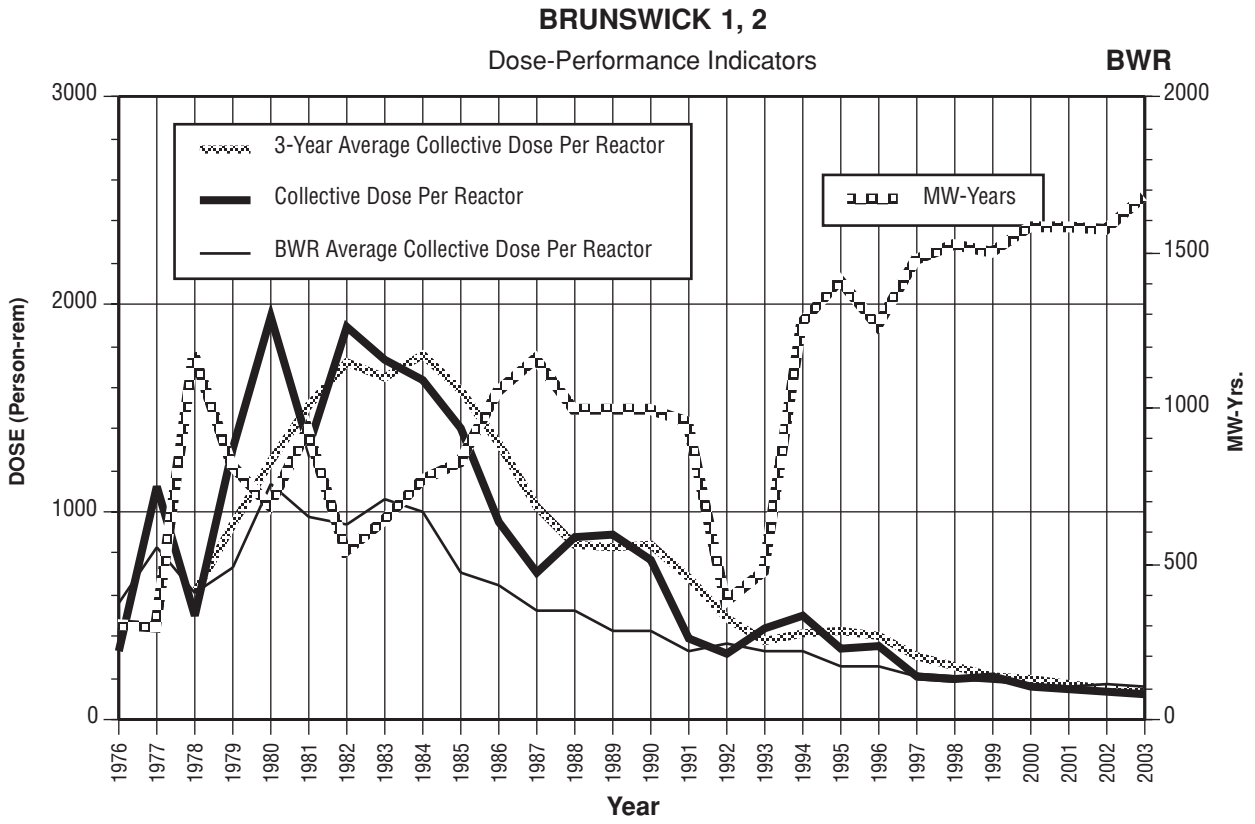
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003


BRUNSWICK 1, 2
Dose-Performance Indicators
BWR
3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
BWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year
0
1000
2000
3000
500
1500
2000
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
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1989
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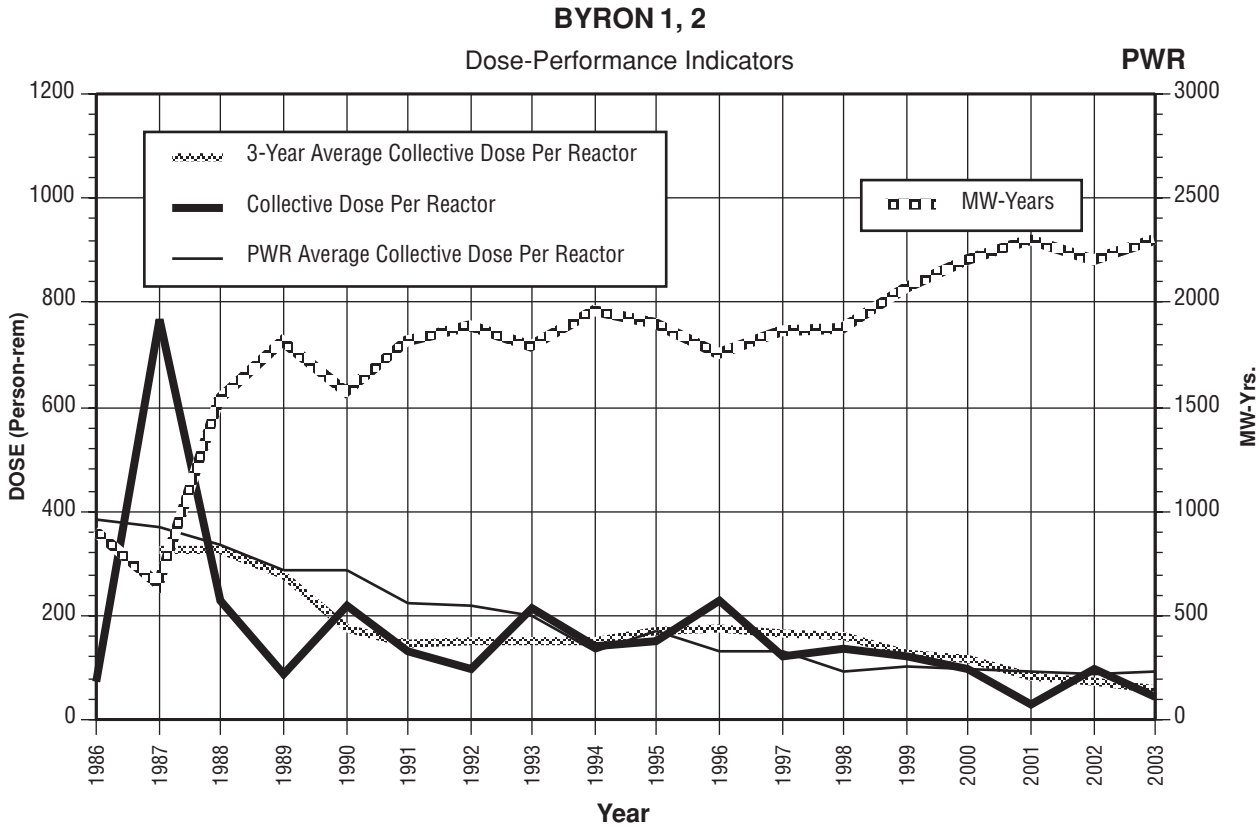
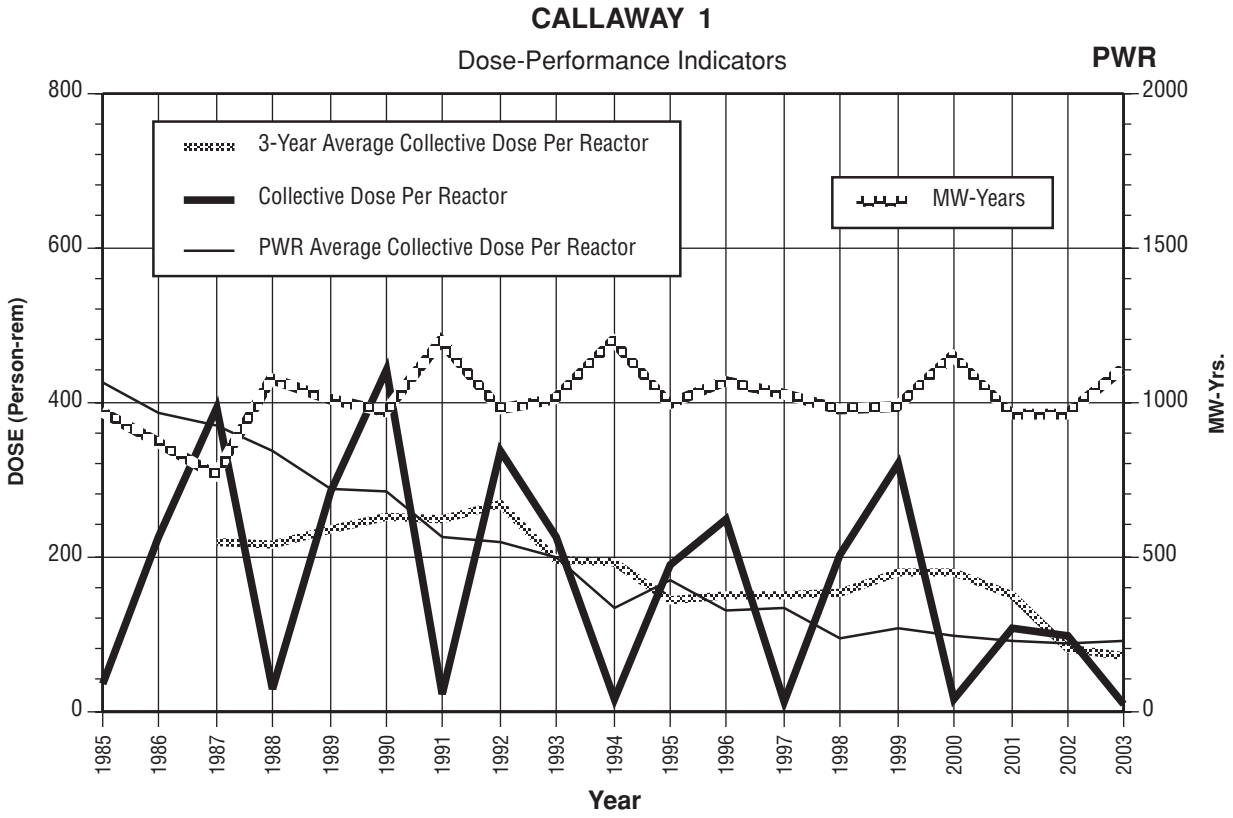
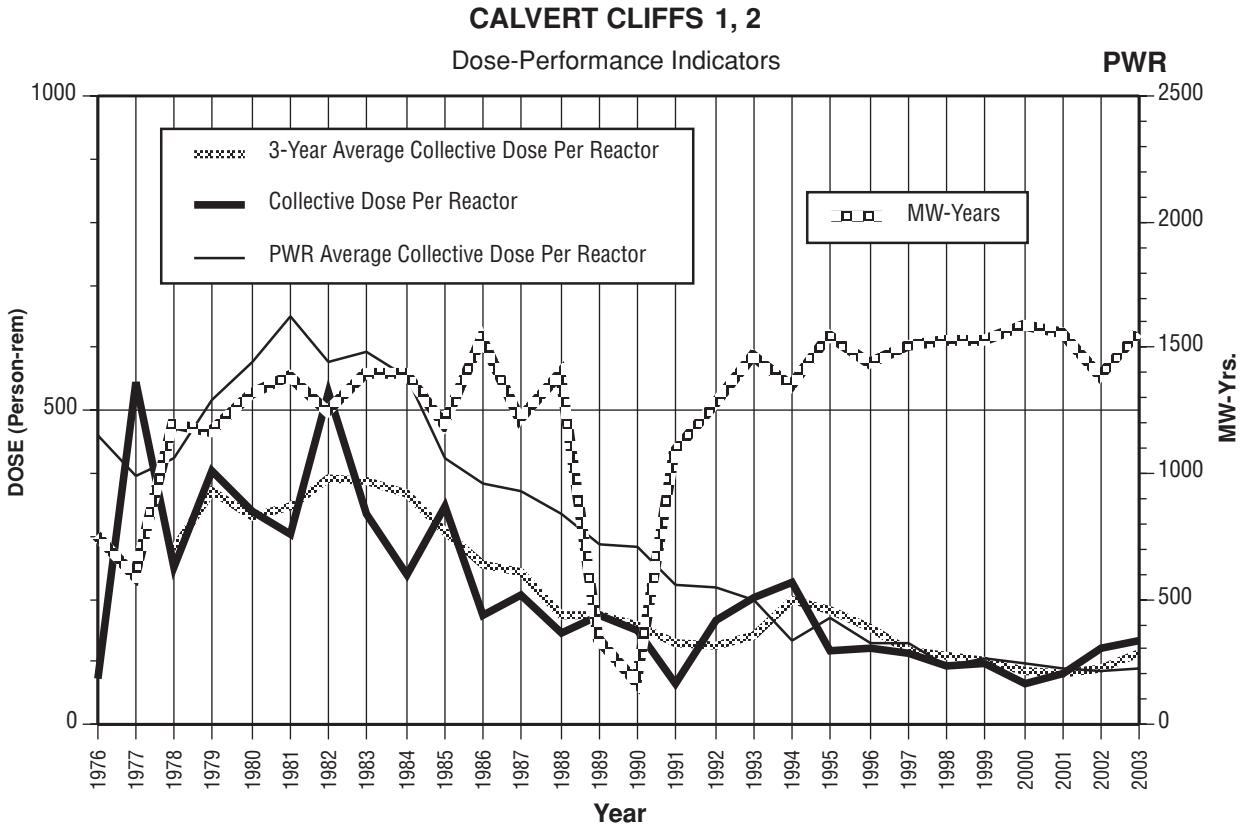
1997
1998
1999
2000
2001
2002
2003


BYRON 1, 2
Dose-Performance Indicators
PWR
3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
PWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year
0
200
400
600
800
1000
1200
500
1000
1500
2000
2500
3000
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003


CALLAWAY 1
Dose-Performance Indicators
PWR
3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
PWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year
0
200
400
600
800
500
1000
1500
2000
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003


CALVERT CLIFFS 1, 2
Dose-Performance Indicators
PWR
3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
PWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year
0
500
1000
500
1000
1500
2000
2500
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
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1989
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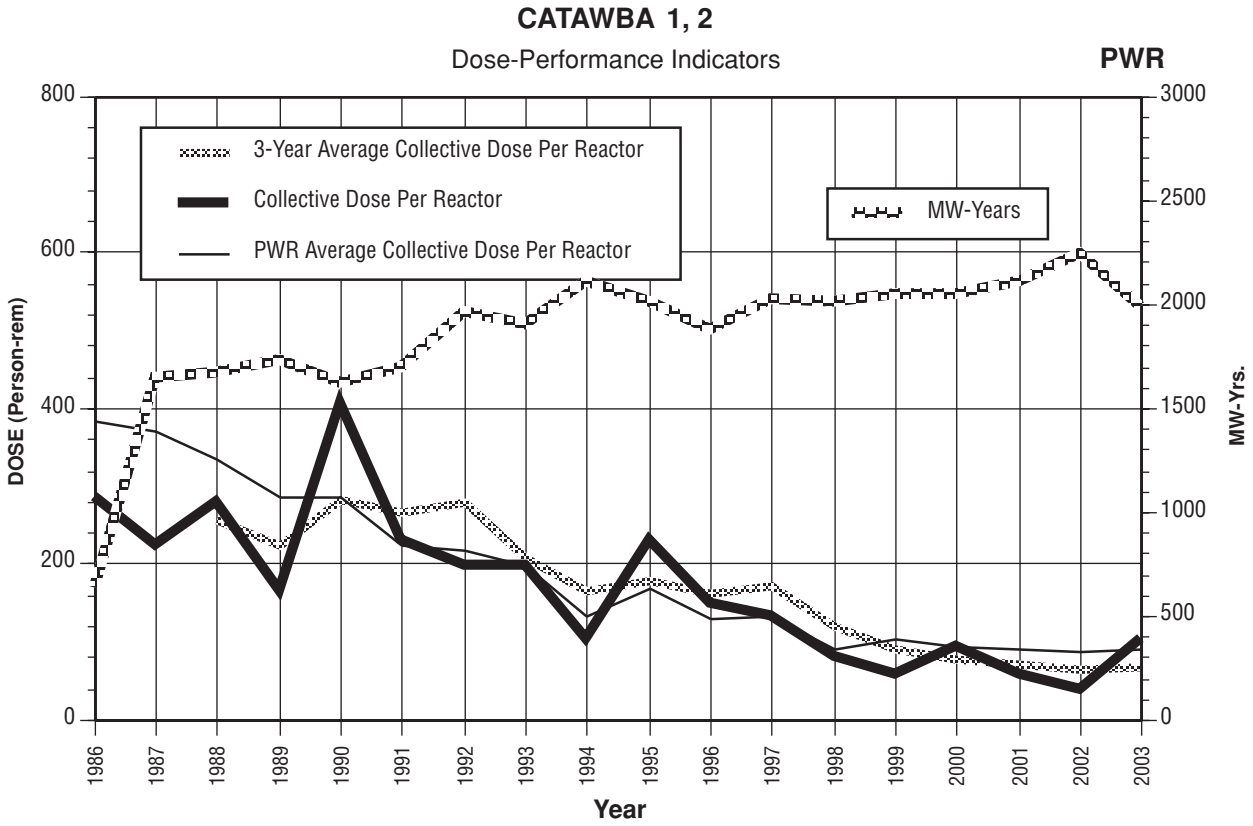
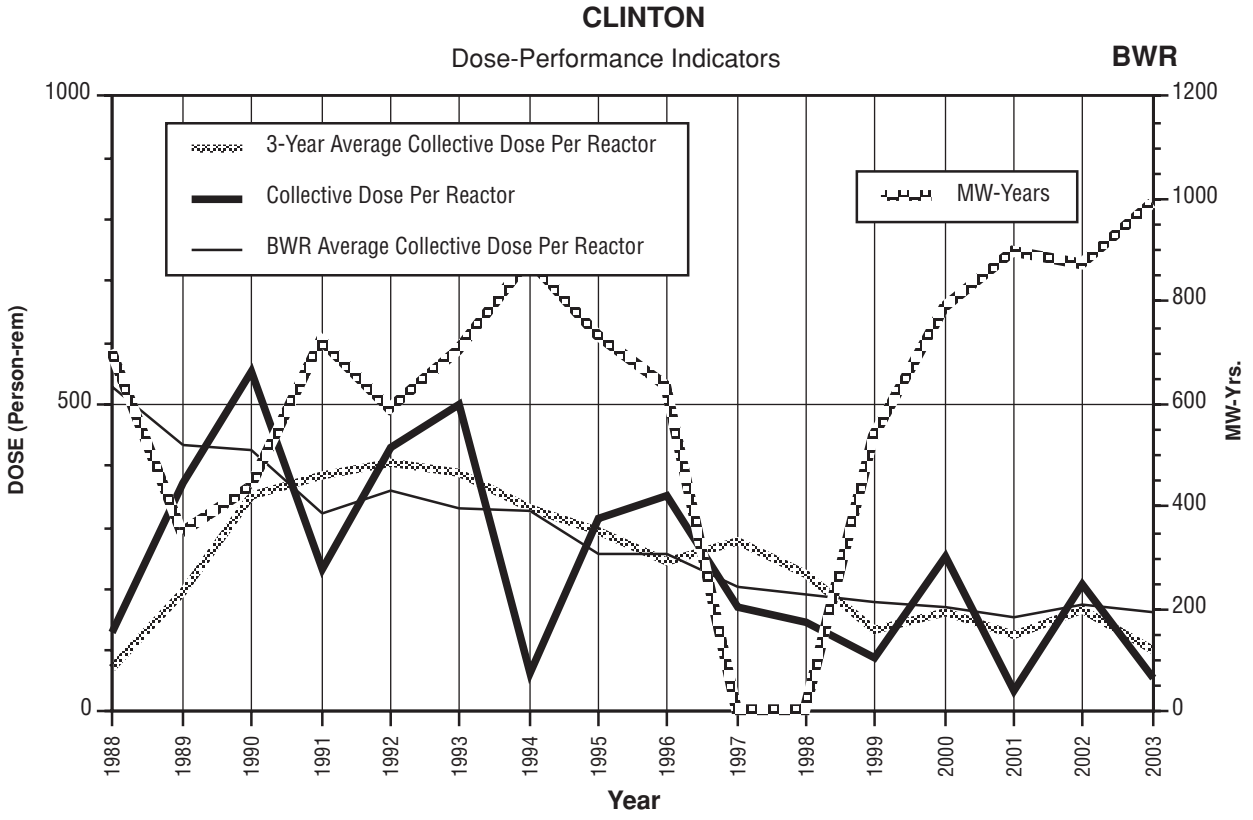
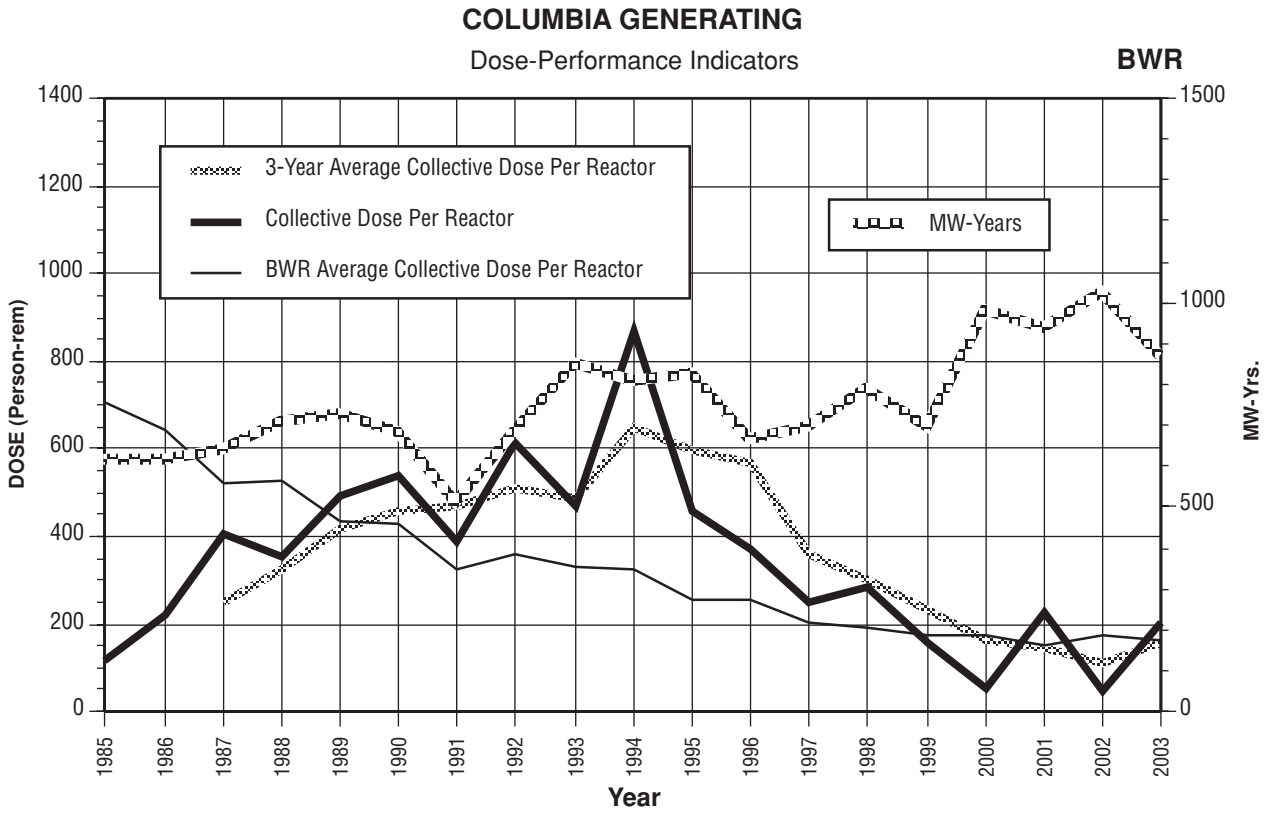
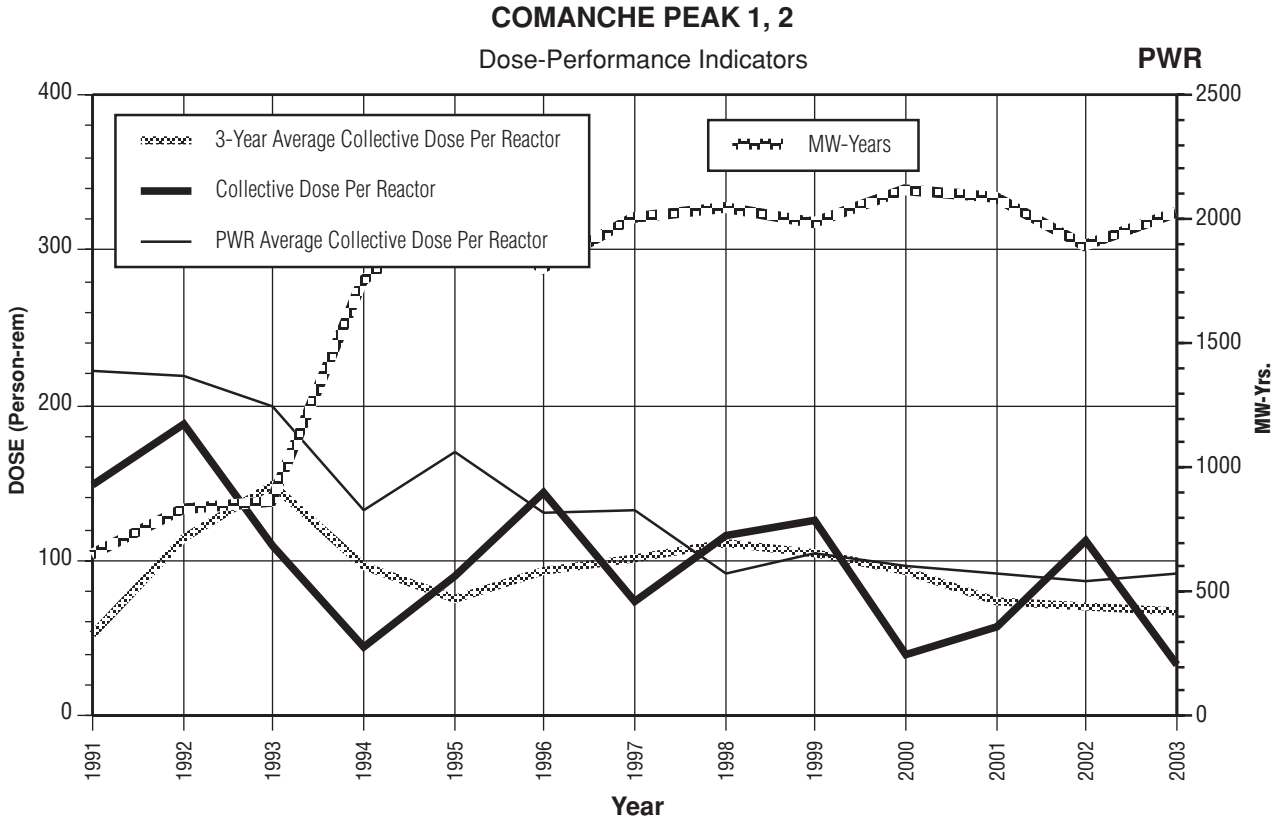
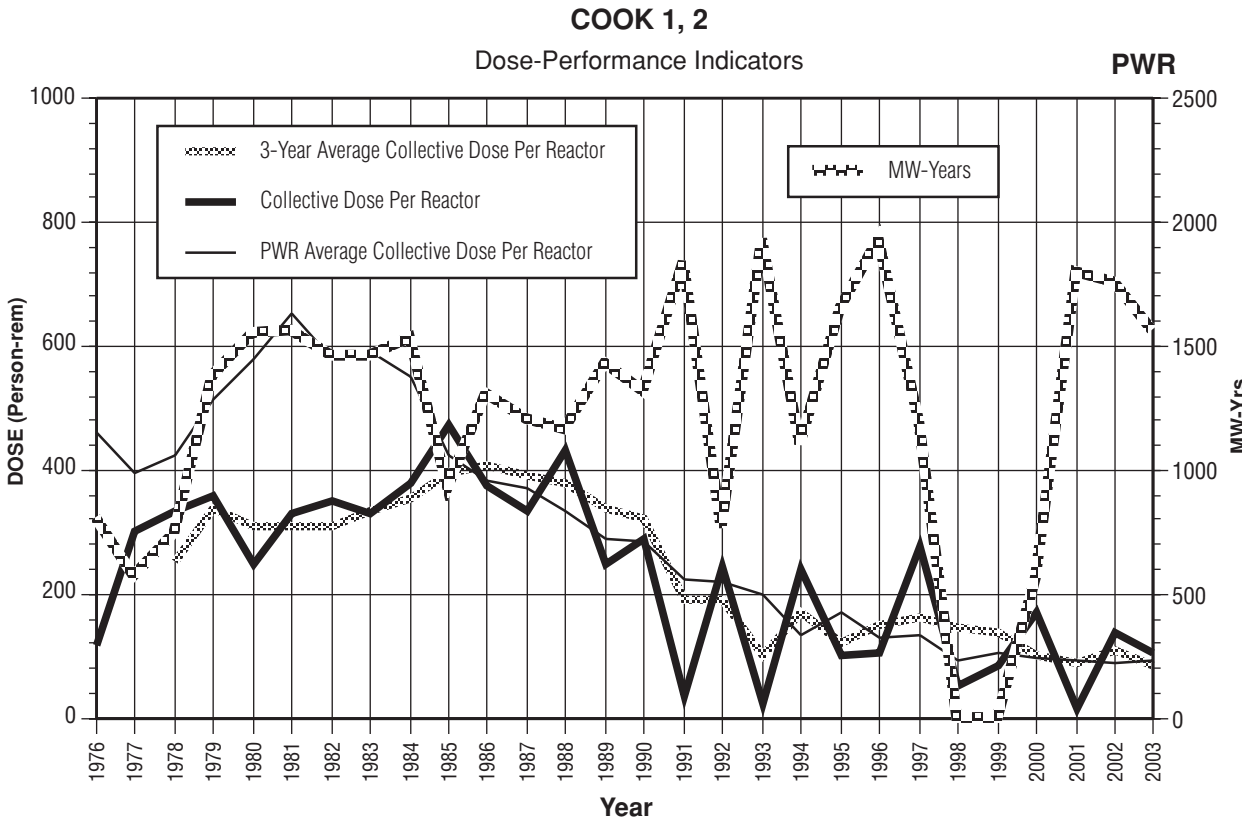
2001
2002
2003

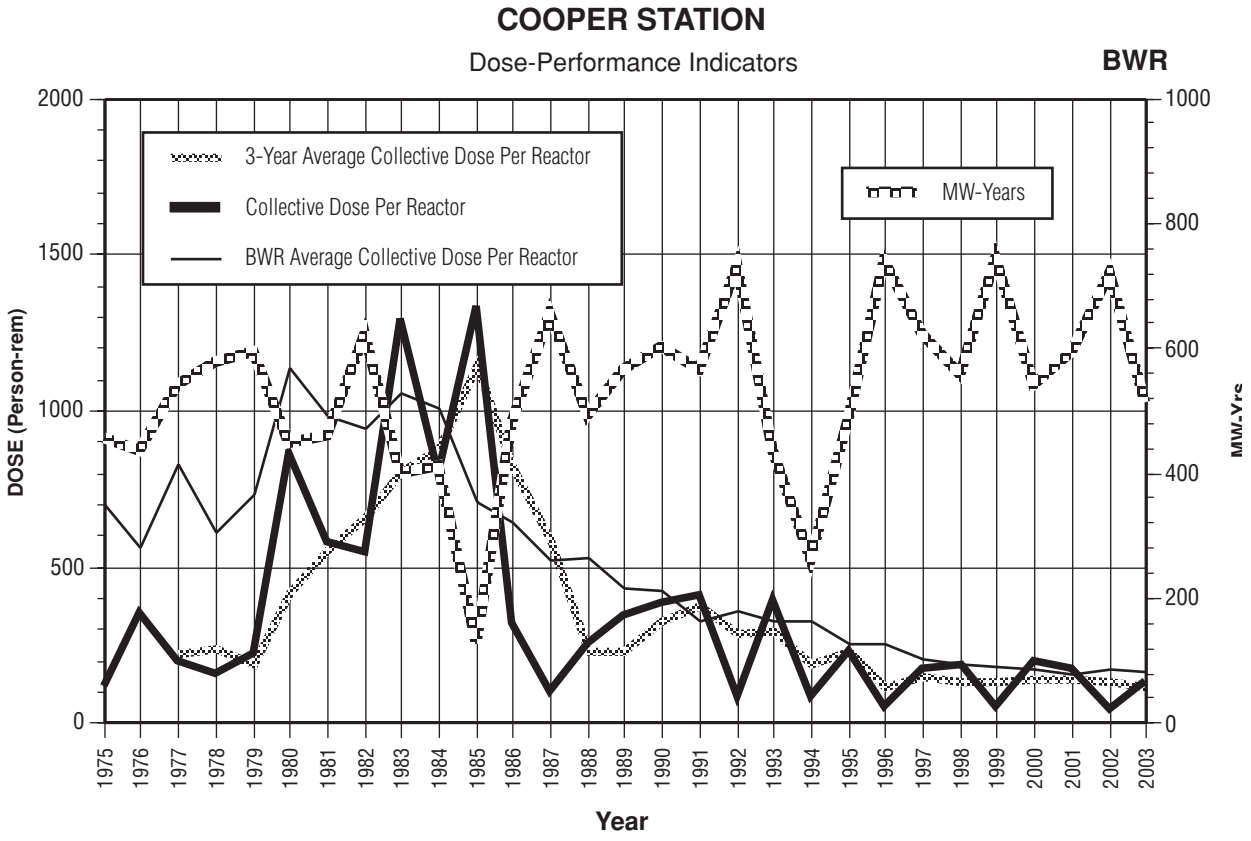

CATAWBA 1, 2
Dose-Performance Indicators
PWR
3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
PWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year
0
200
400
600
800
0
500
1000
1500
2000
2500
3000
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003

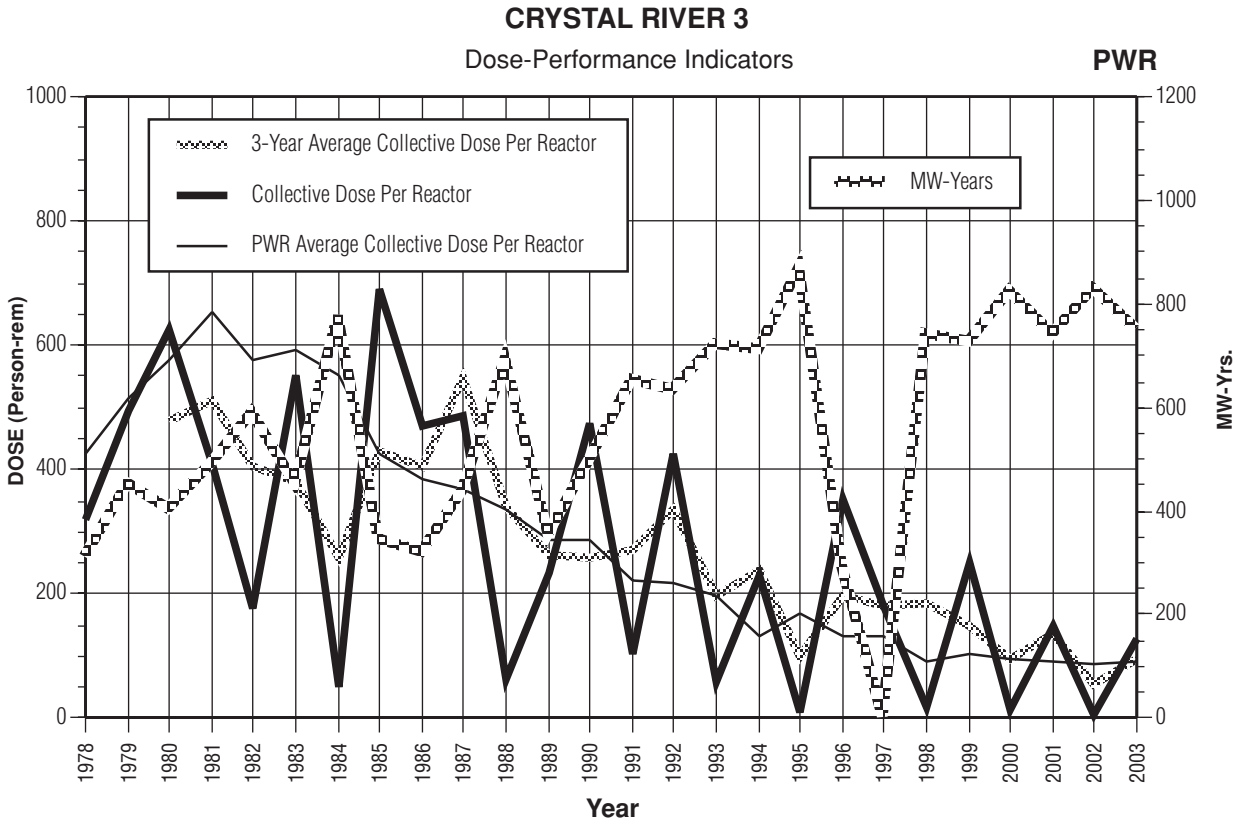

CLINTON
Dose-Performance Indicators
BWR
3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
BWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year
0
500
1000
0
200
400
600
800
1000
1200
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003

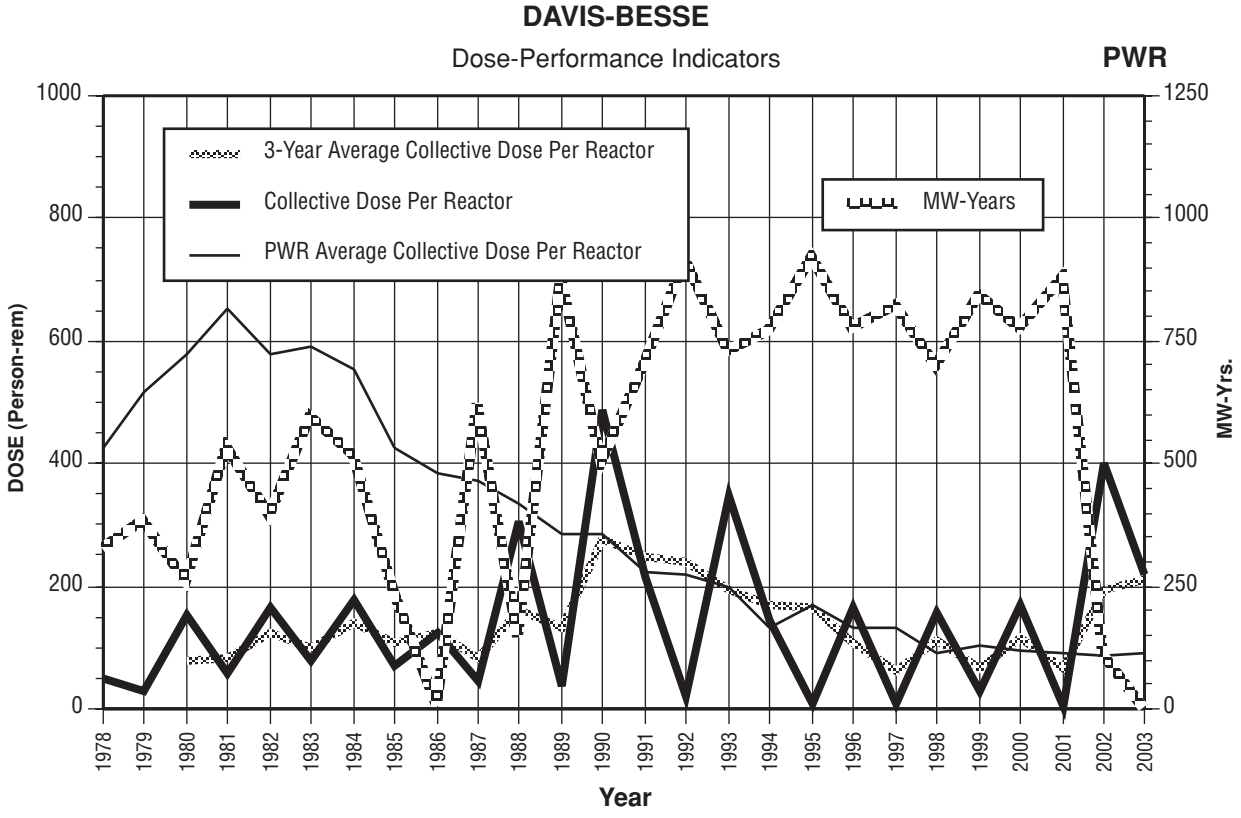

COLUMBIA GENERATING
Dose-Performance Indicators
BWR
3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
BWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year
0
200
400
600
800
1000
1200
1400
500
1000
1500
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003

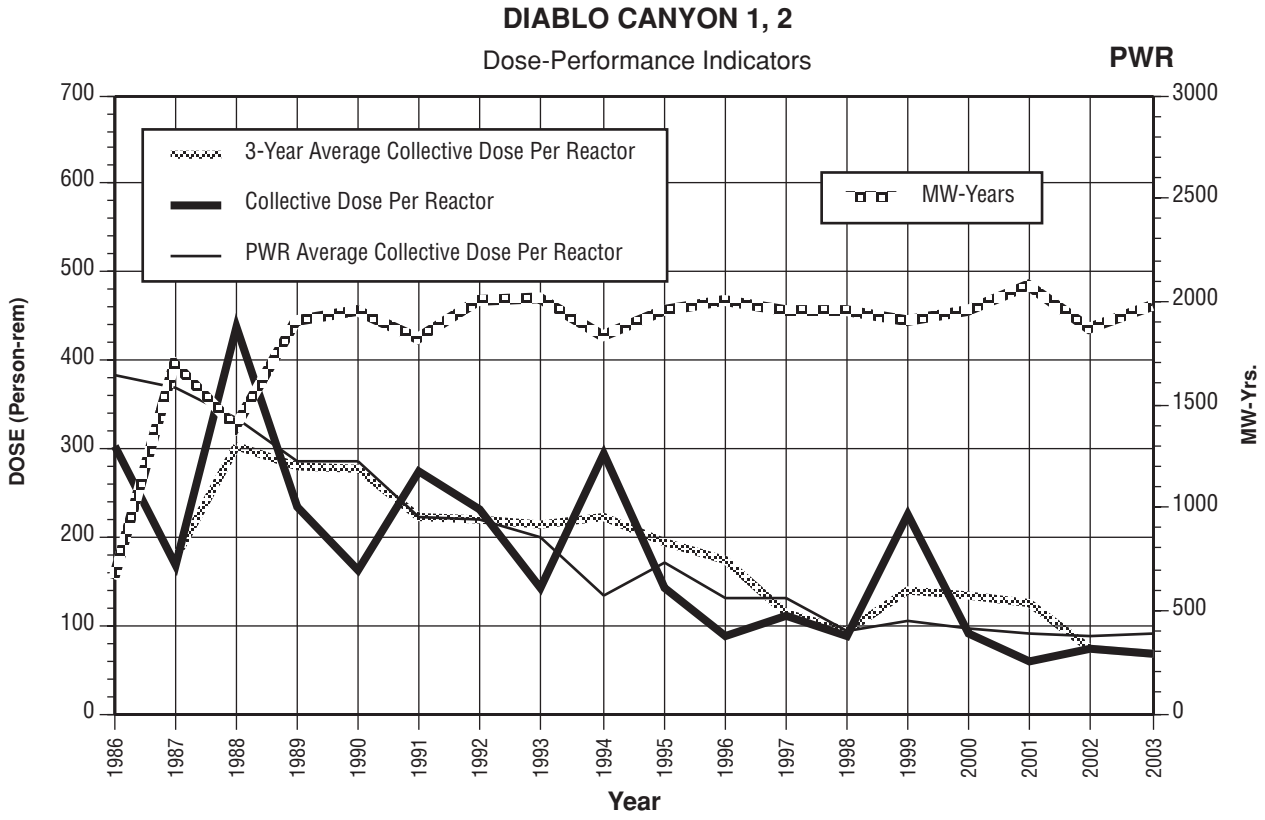

COMANCHE PEAK 1, 2
Dose-Performance Indicators
PWR
3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
PWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year
0
100
200
300
400
500
1000
1500
2000
2500
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003

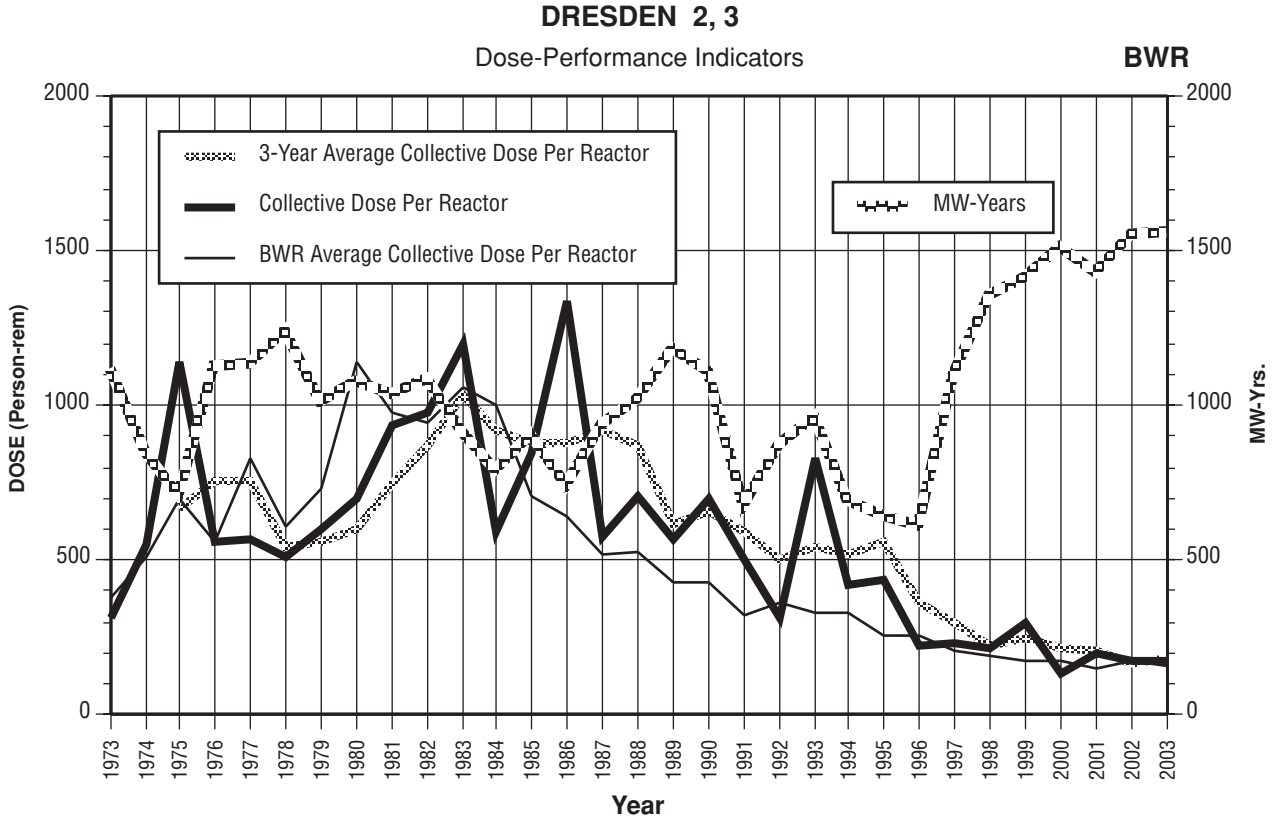

COOK 1, 2
Dose-Performance Indicators
PWR
3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
PWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs
Year

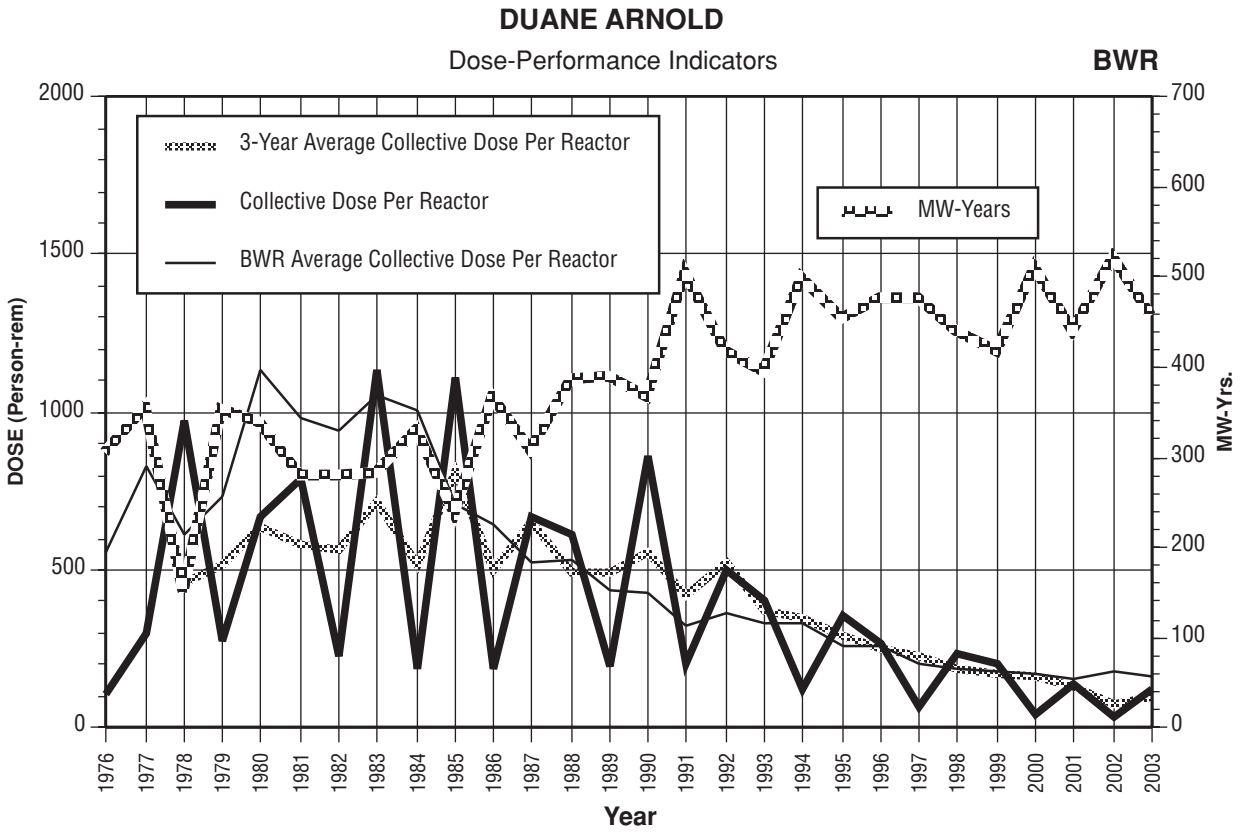

COOPER STATION
Dose-Performance Indicators
BWR
3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
BWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs
Year

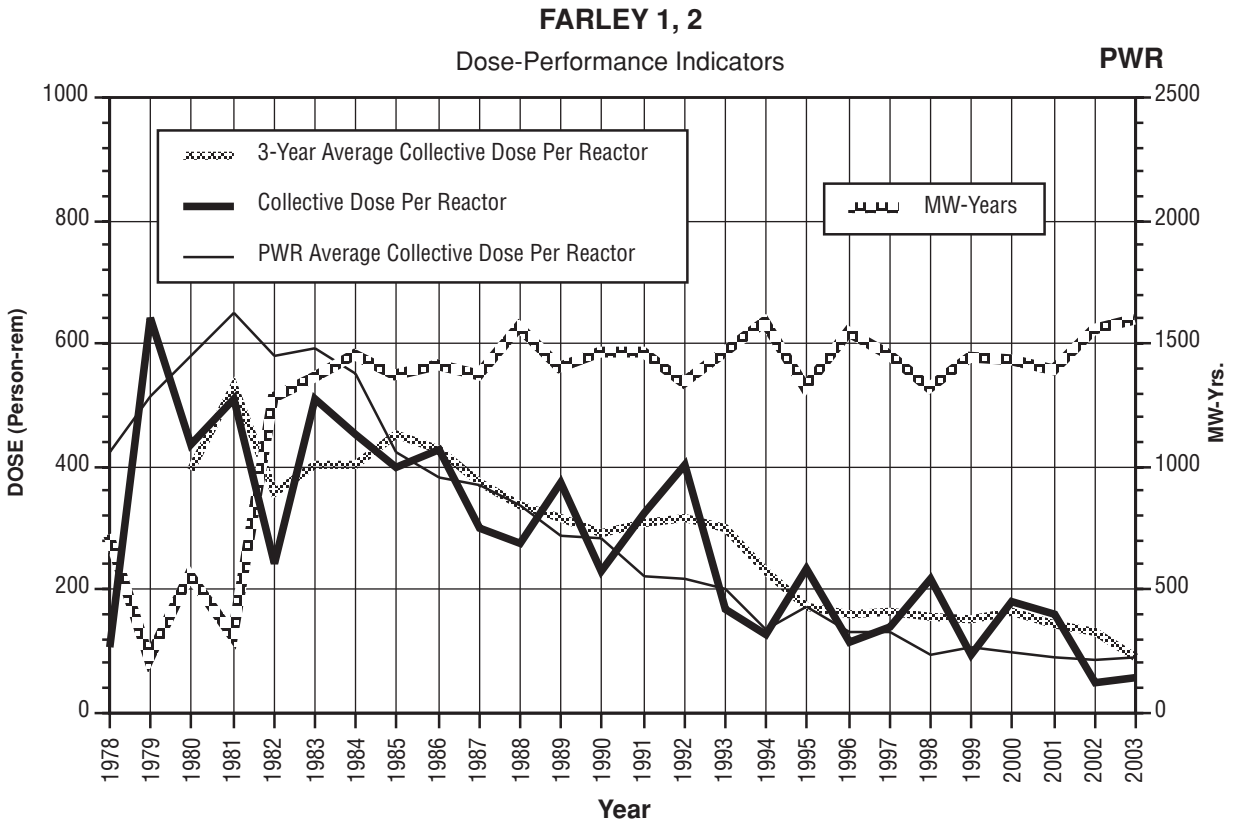

CRYSTAL RIVER 3
Dose-Performance Indicators
PWR
3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
PWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year

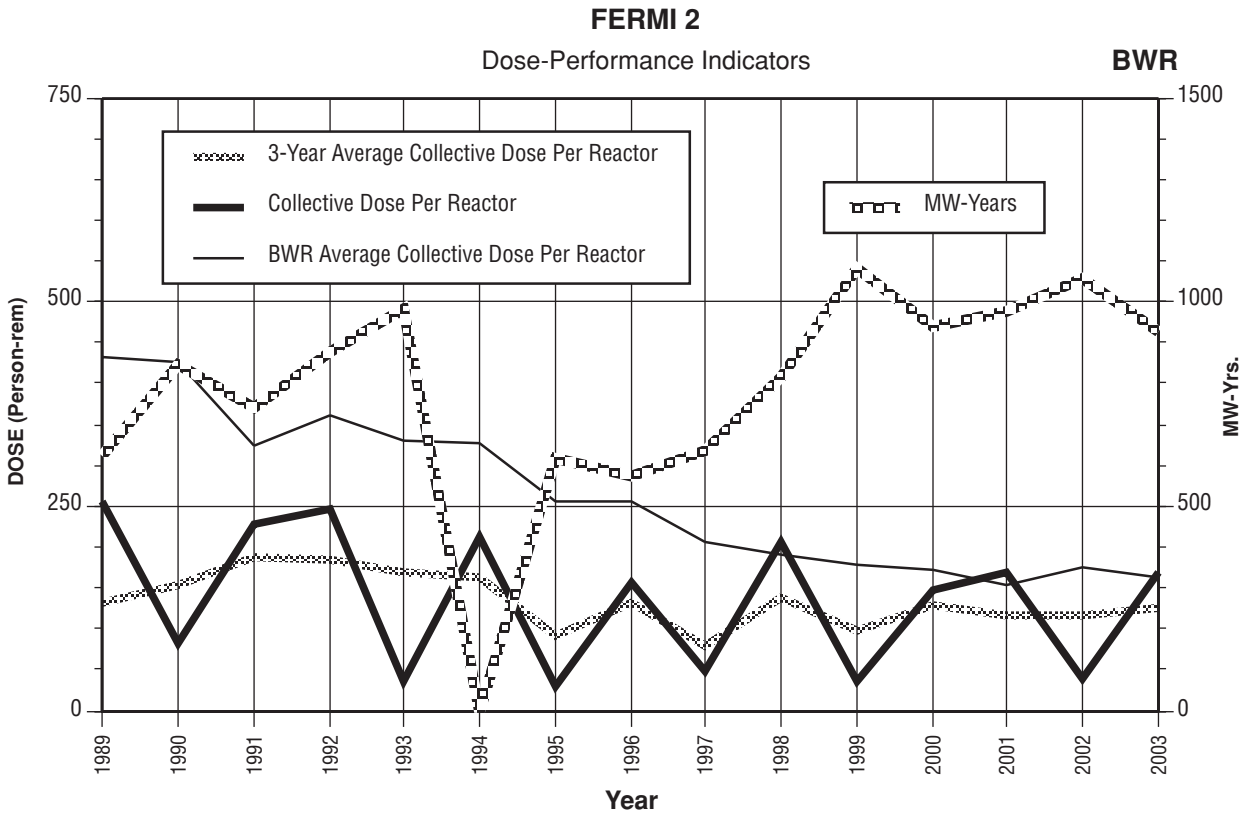

DAVIS-BESSE
Dose-Performance Indicators
PWR
3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
PWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year

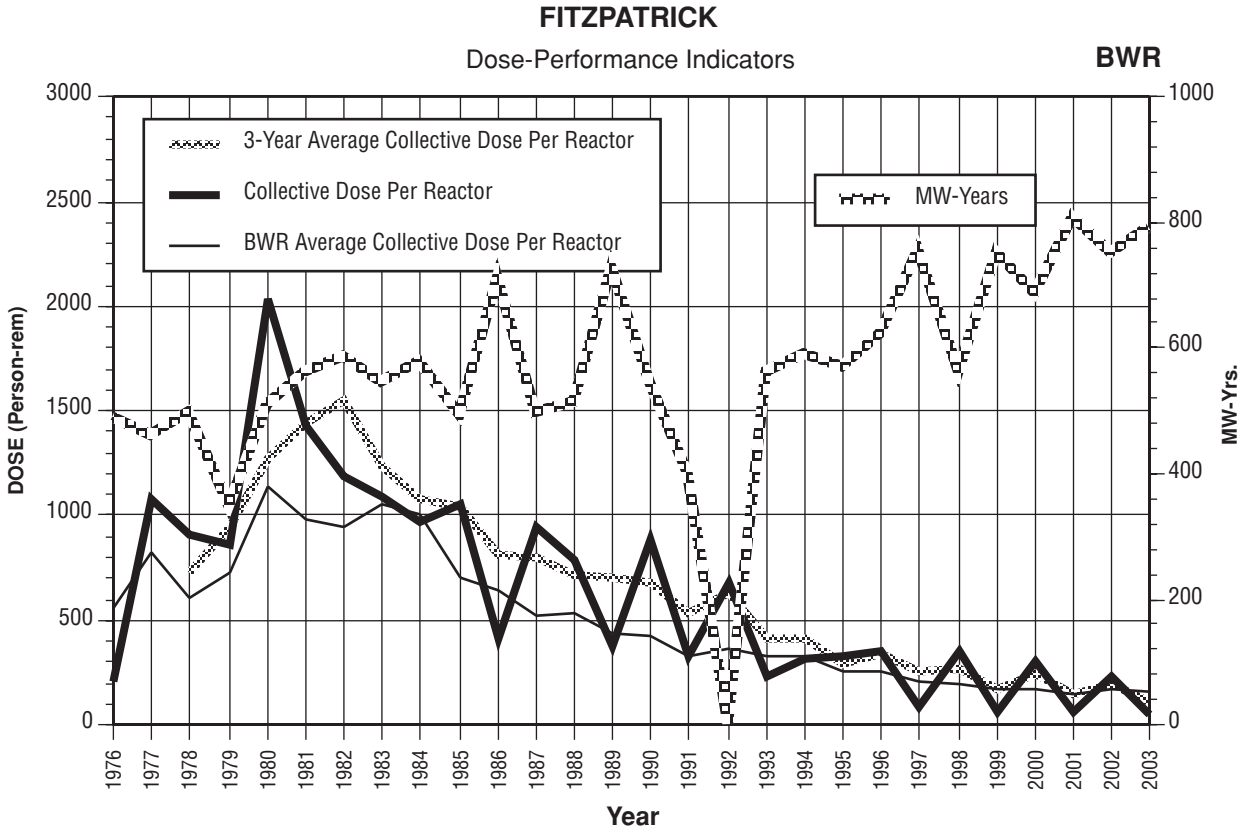

DIABLO CANYON 1, 2
Dose-Performance Indicators
PWR
3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
PWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year


DRESDEN 2, 3
Dose-Performance Indicators
BWR
3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
BWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year


DUANE ARNOLD
Dose-Performance Indicators
BWR
3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
BWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year


FARLEY 1, 2
Dose-Performance Indicators
PWR
3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
PWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year


FERMI 2
Dose-Performance Indicators
BWR
3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
BWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year
750
500
250
0
1500
1000
500
0
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003


FITZPATRICK
Dose-Performance Indicators
BWR
3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
BWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year
3000
2500
2000
1500
1000
500
0
1000
800
600
400
200
0
1976
1977
1978
1979
1980
1981
1982
1983
1984
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2000
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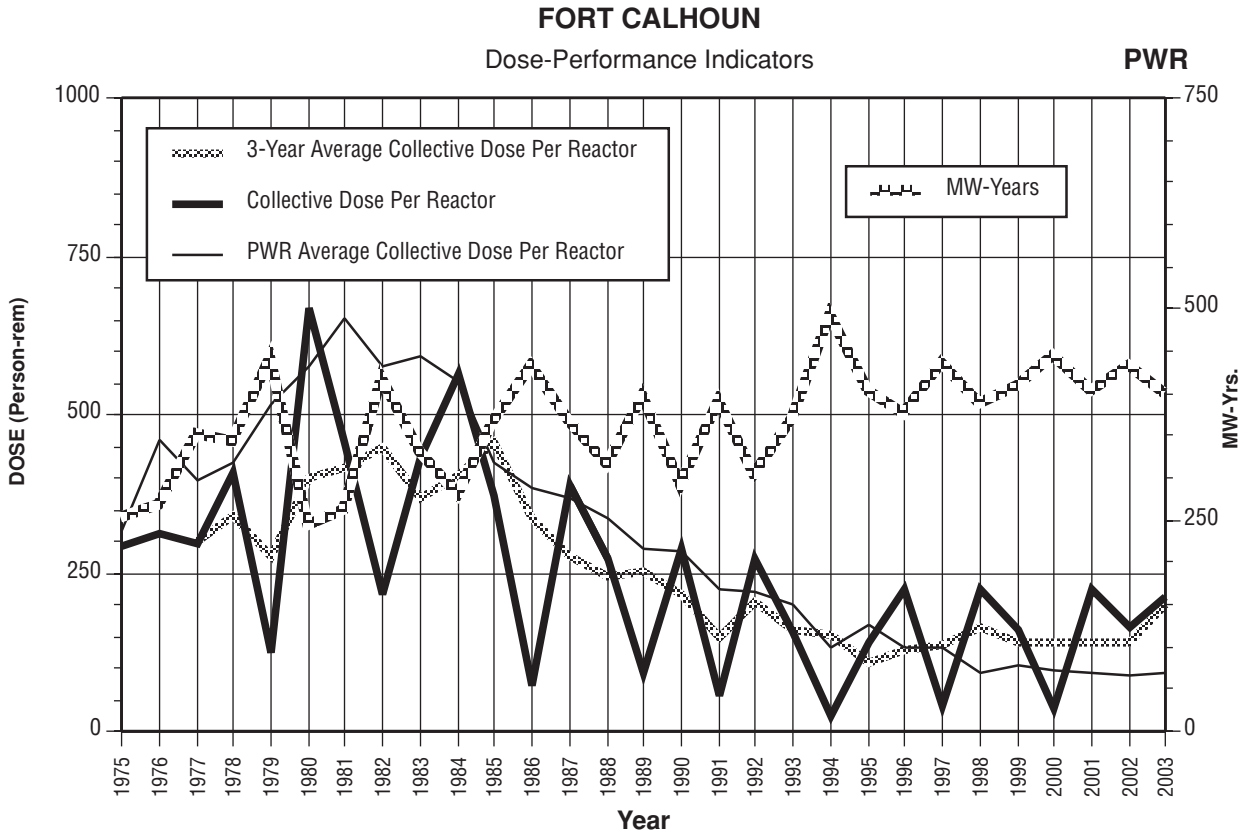
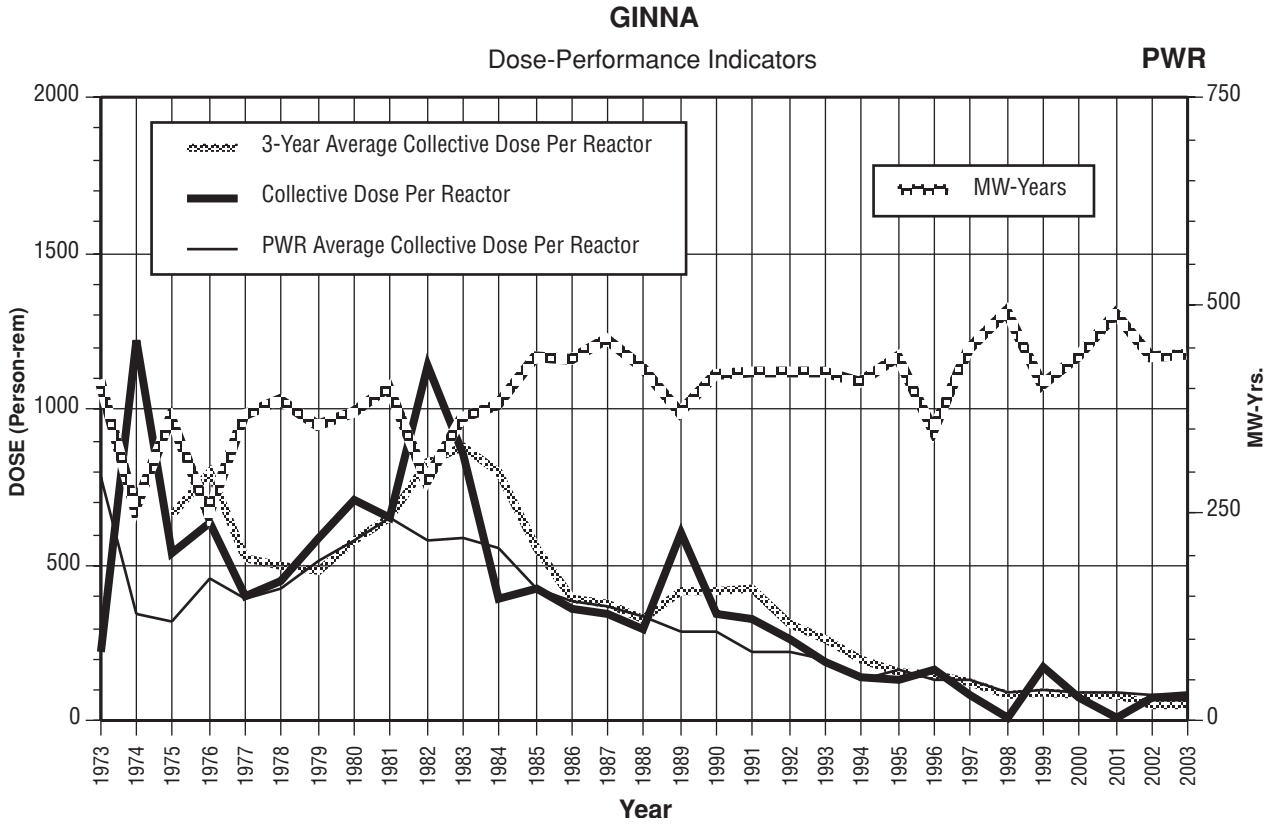
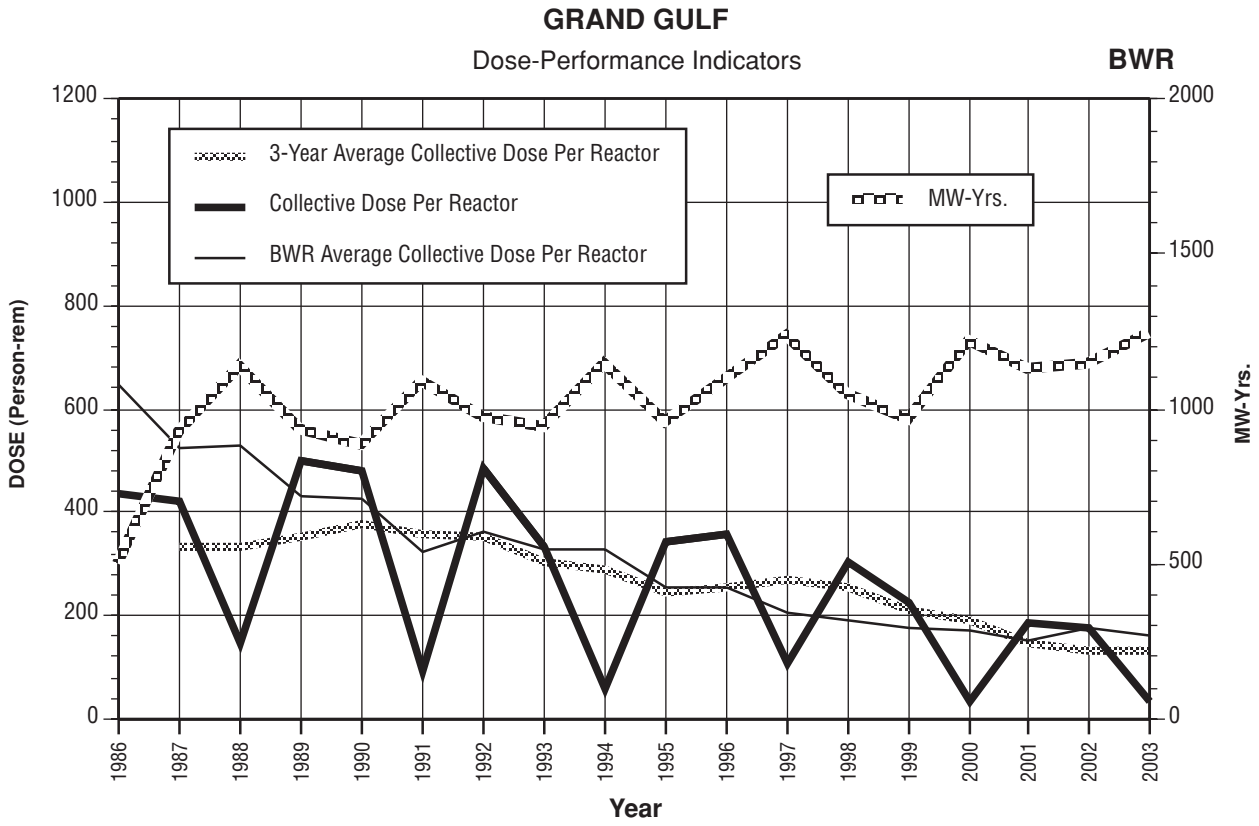
2002
2003


FORT CALHOUN
Dose-Performance Indicators
PWR
3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
PWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year


GINNA
Dose-Performance Indicators
PWR
3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
PWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year


GRAND GULF
Dose-Performance Indicators
BWR
3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
BWR Average Collective Dose Per Reactor
MW-Yrs.
DOSE (Person-rem)
MW-Yrs.
Year
0
200
400
600
800
1000
1200
0
500
1000
1500
2000
1986
1987
1988
1989
1990
1991
1992
1993
1994
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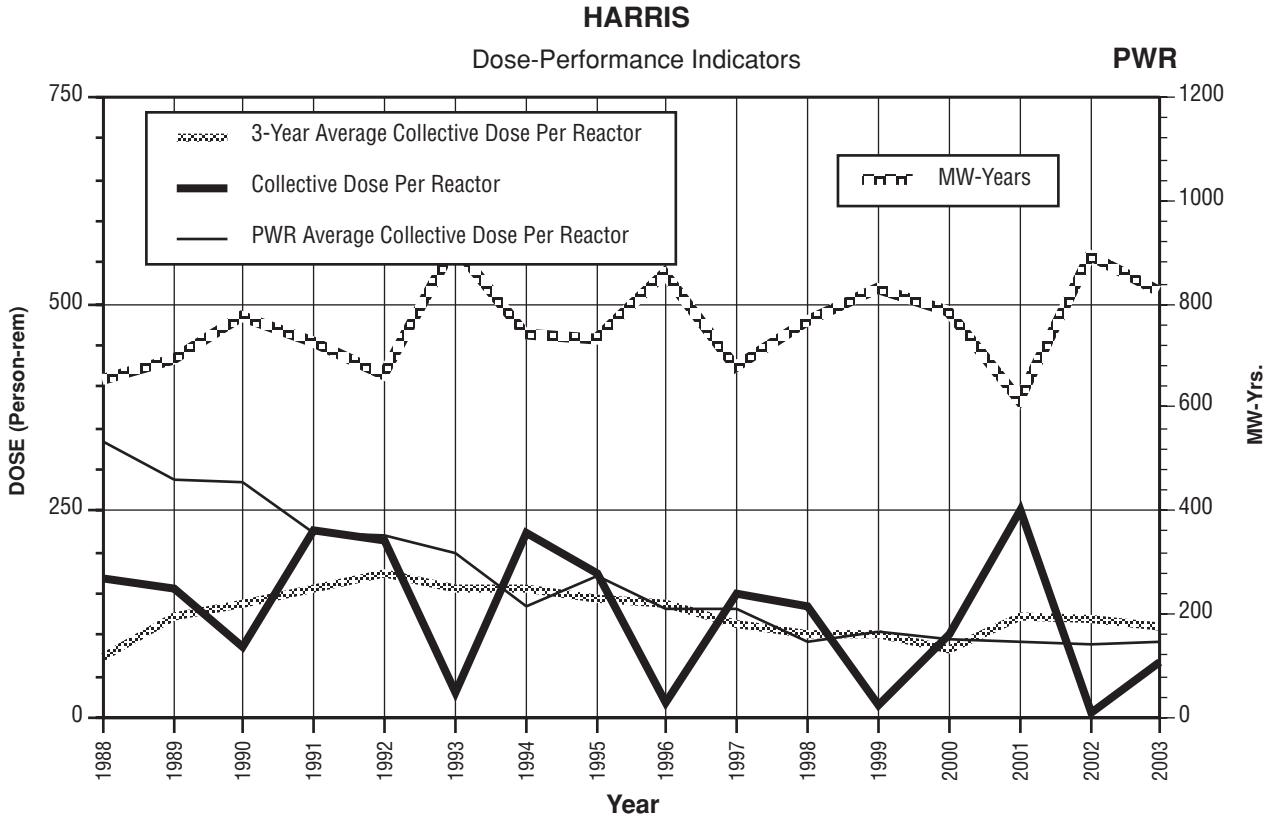
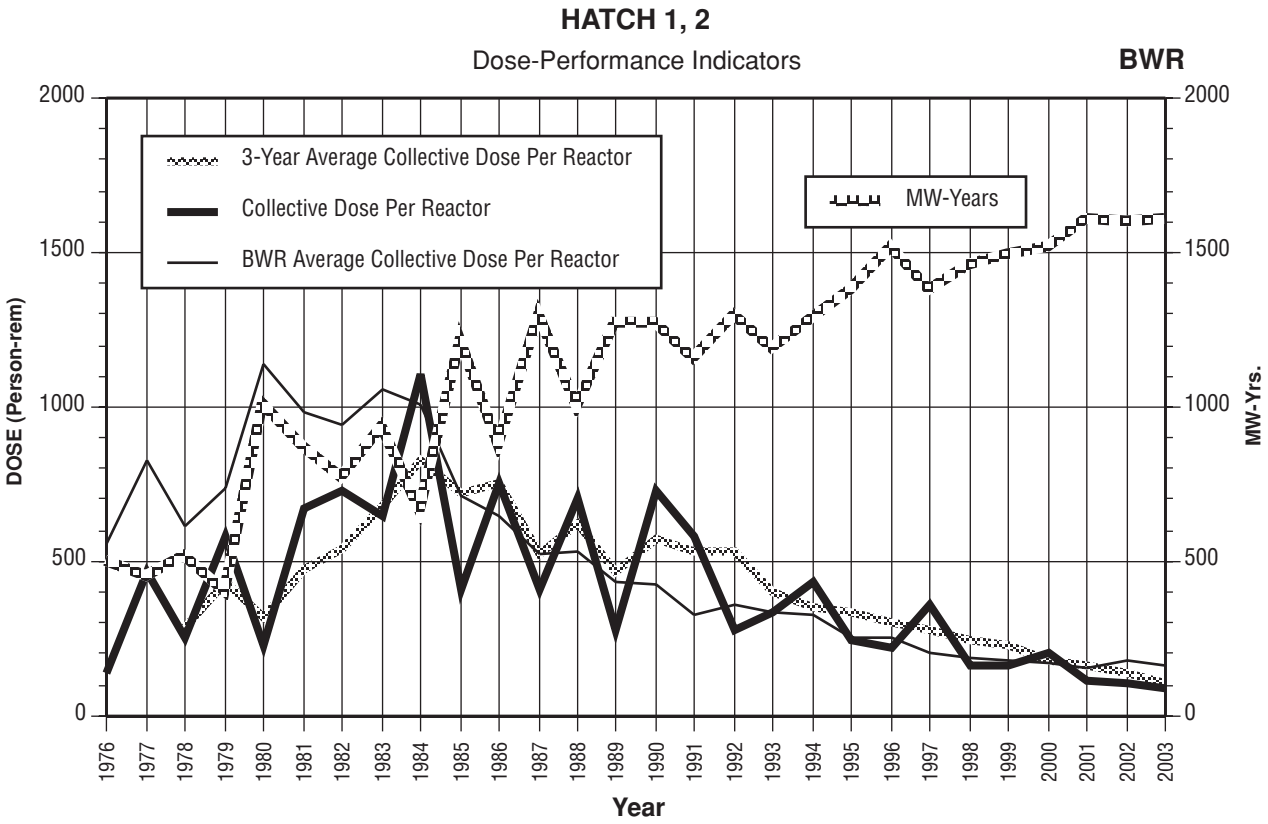
1998
1999
2000
2001
2002
2003


HARRIS
Dose-Performance Indicators
PWR
3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
PWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year
0
250
500
750
0
200
400
600
800
1000
1200
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003


HATCH 1, 2
Dose-Performance Indicators
BWR
3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
BWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year
0
500
1000
1500
2000
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
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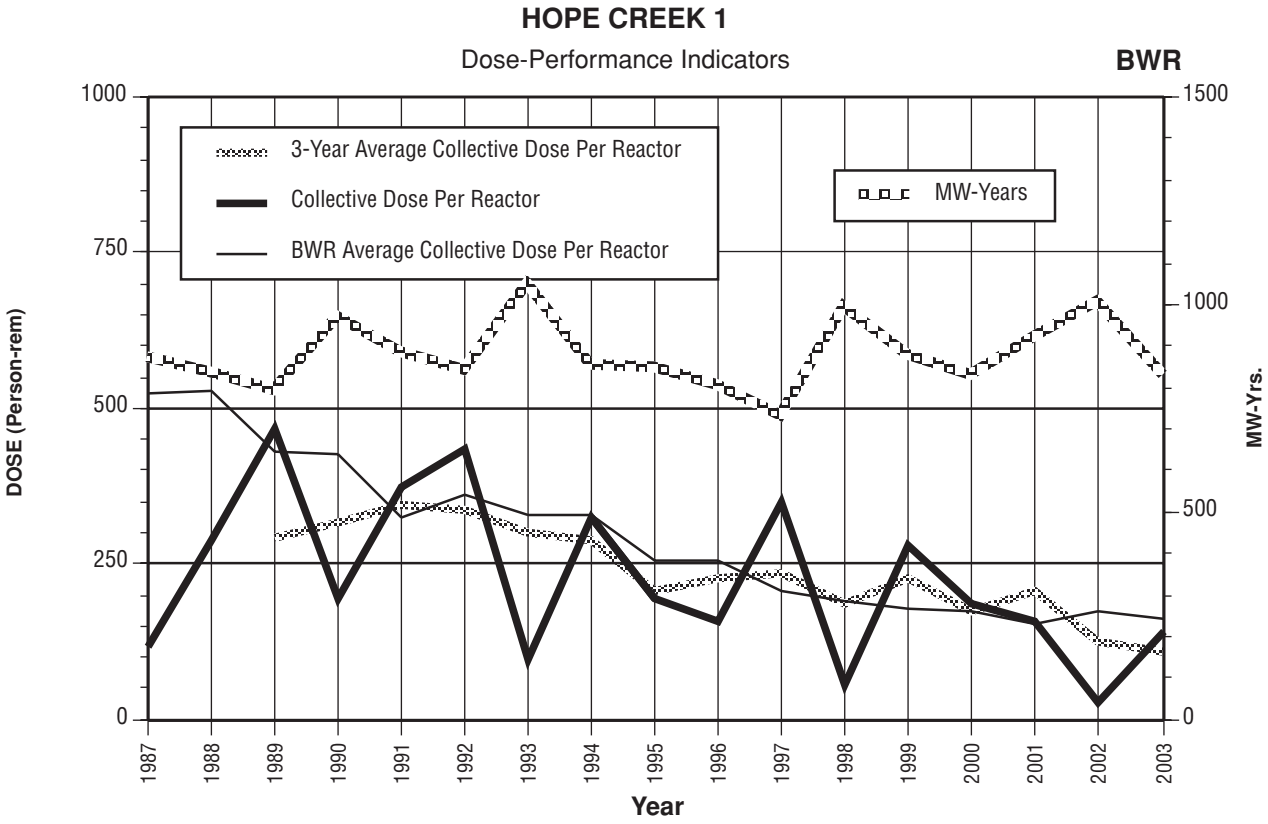
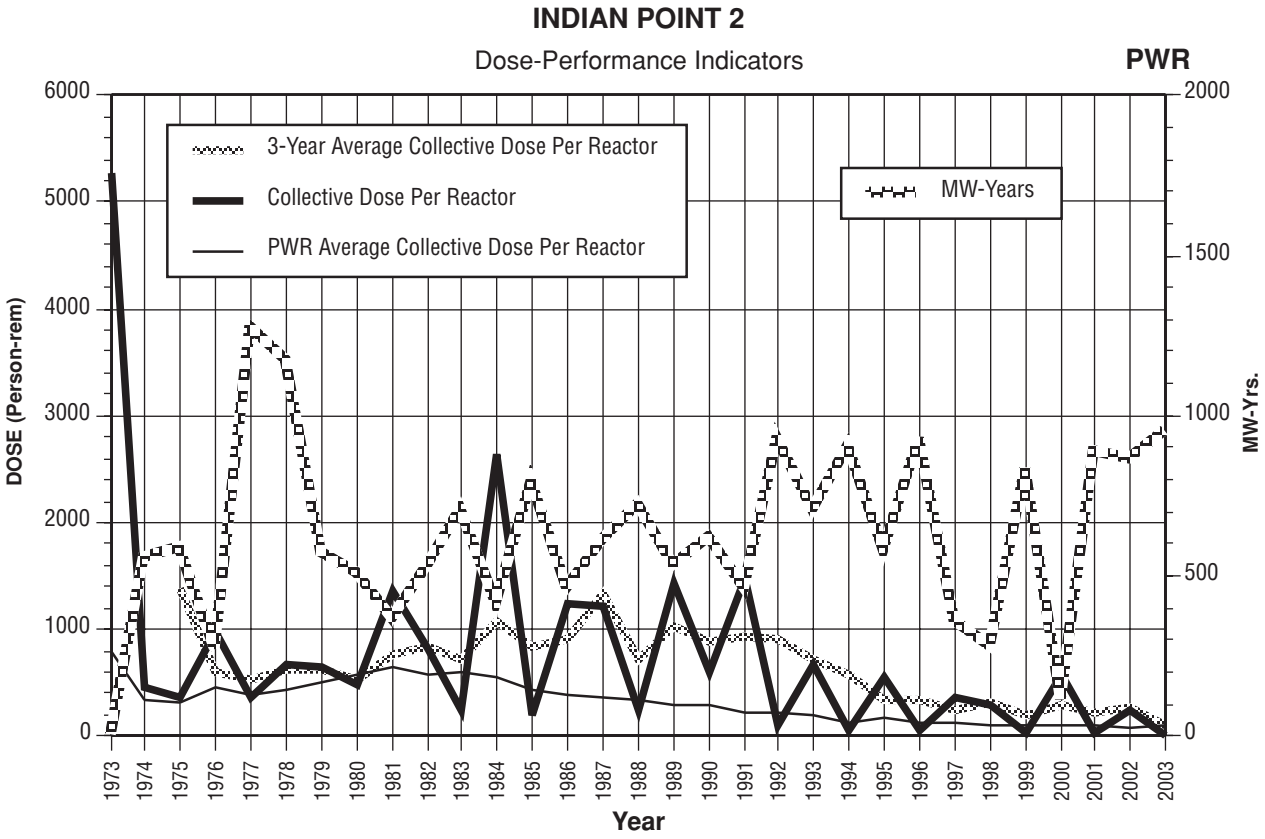
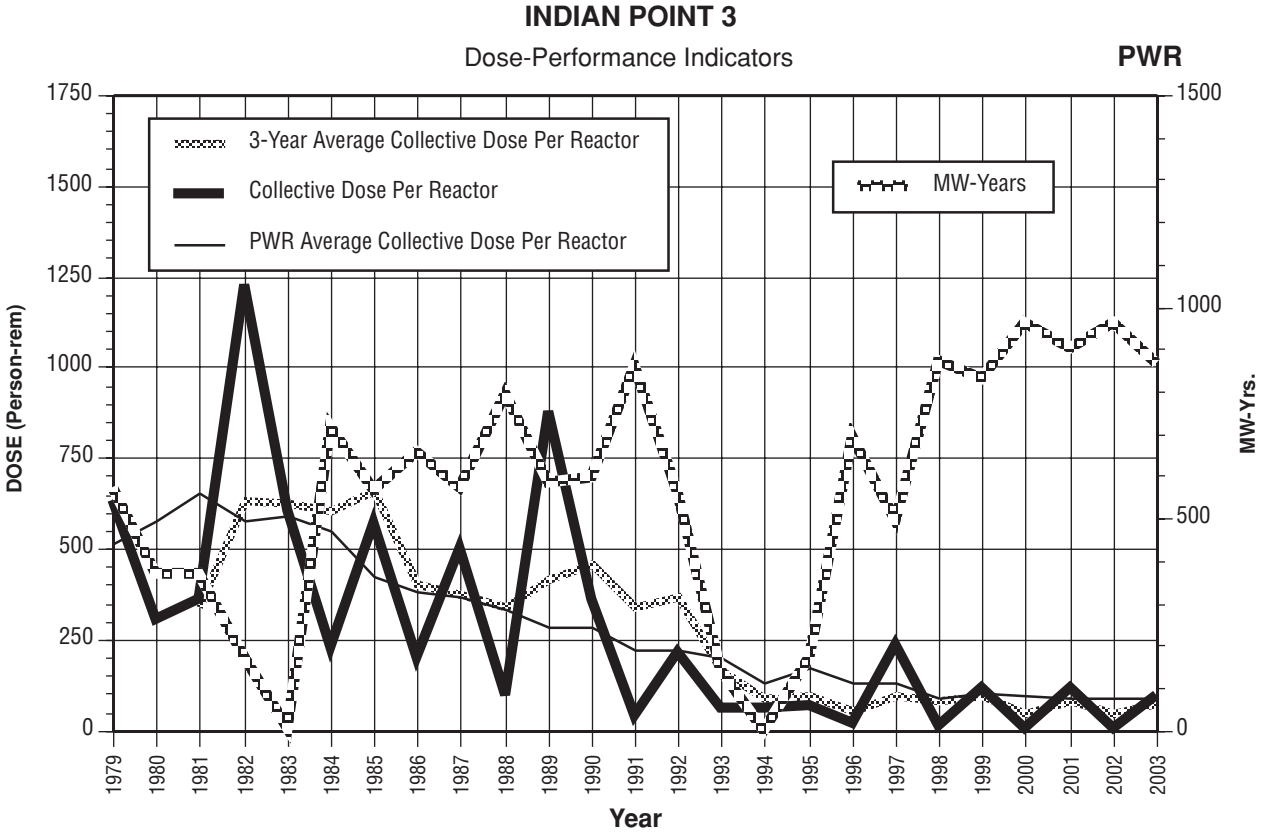
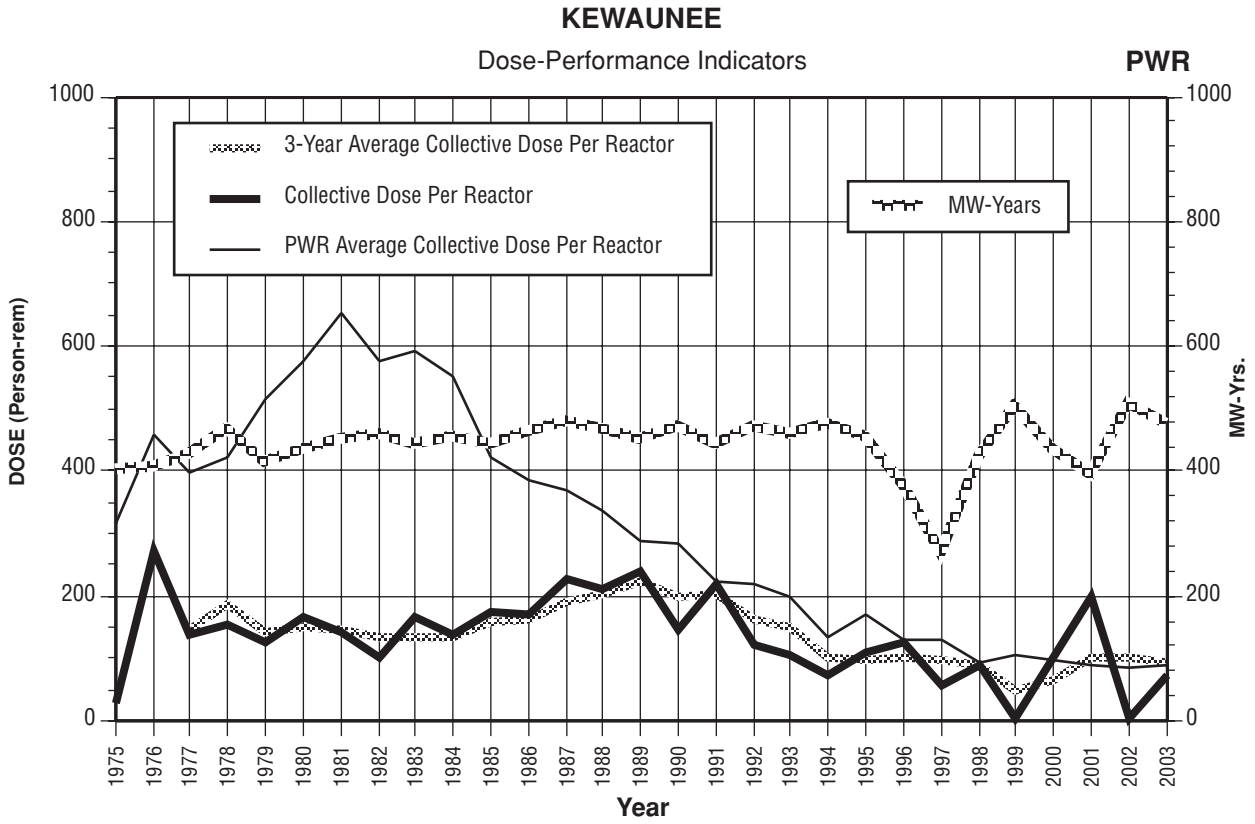
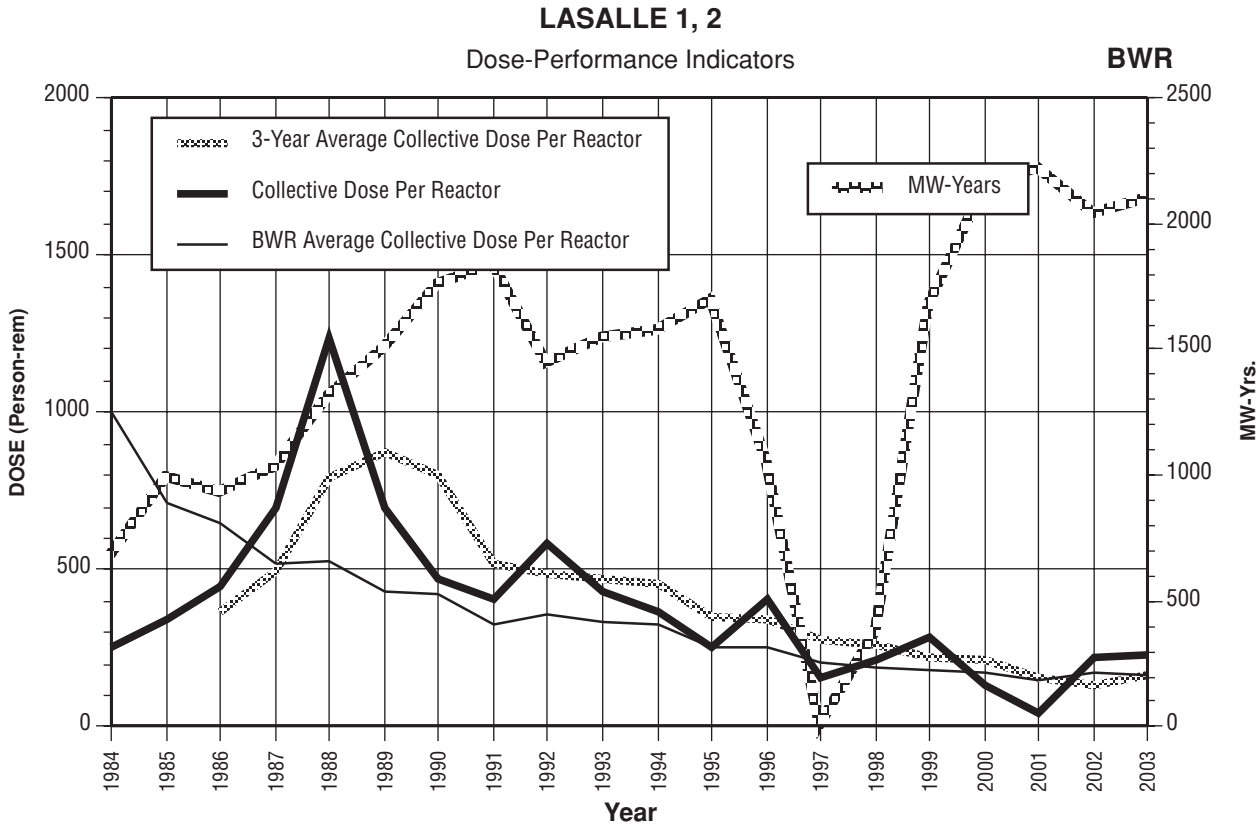
1999
2000
2001
2002
2003

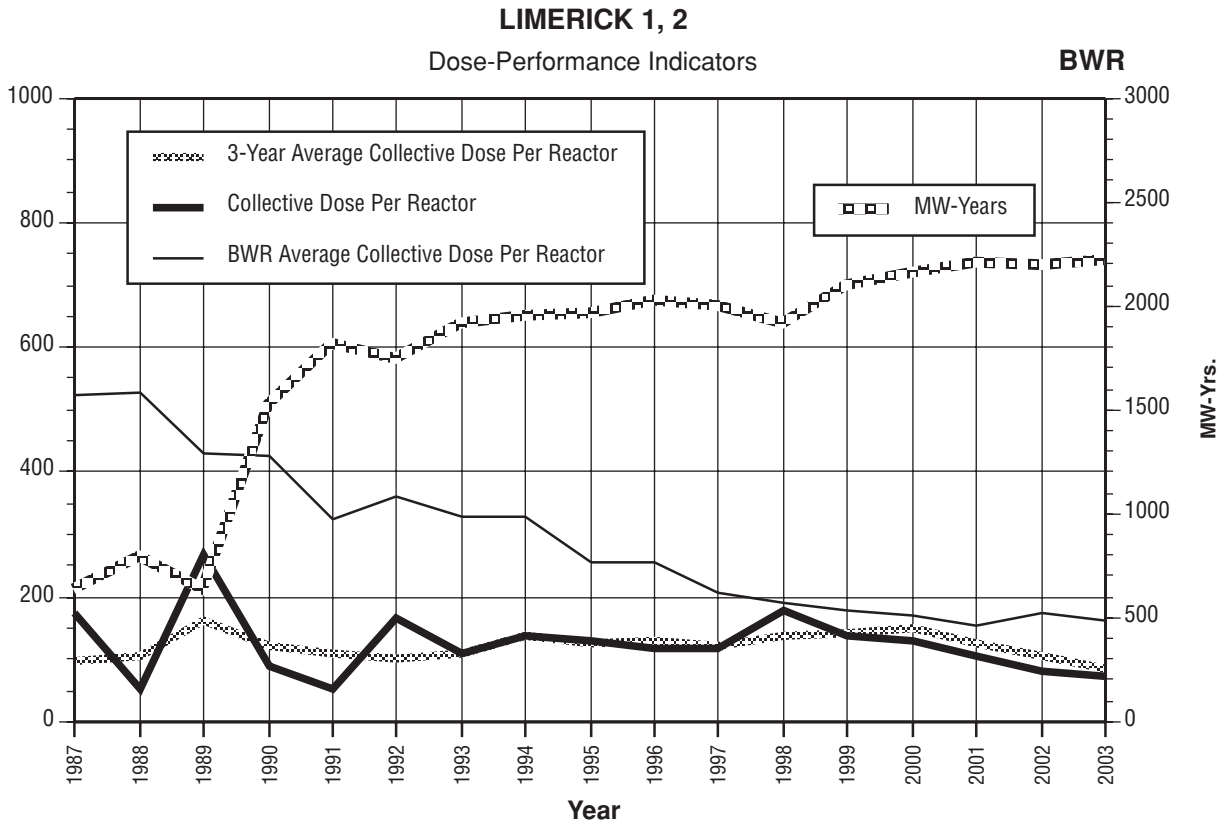

HOPE CREEK 1
Dose-Performance Indicators
BWR
3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
BWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year
0
250
500
750
1000
1500
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003

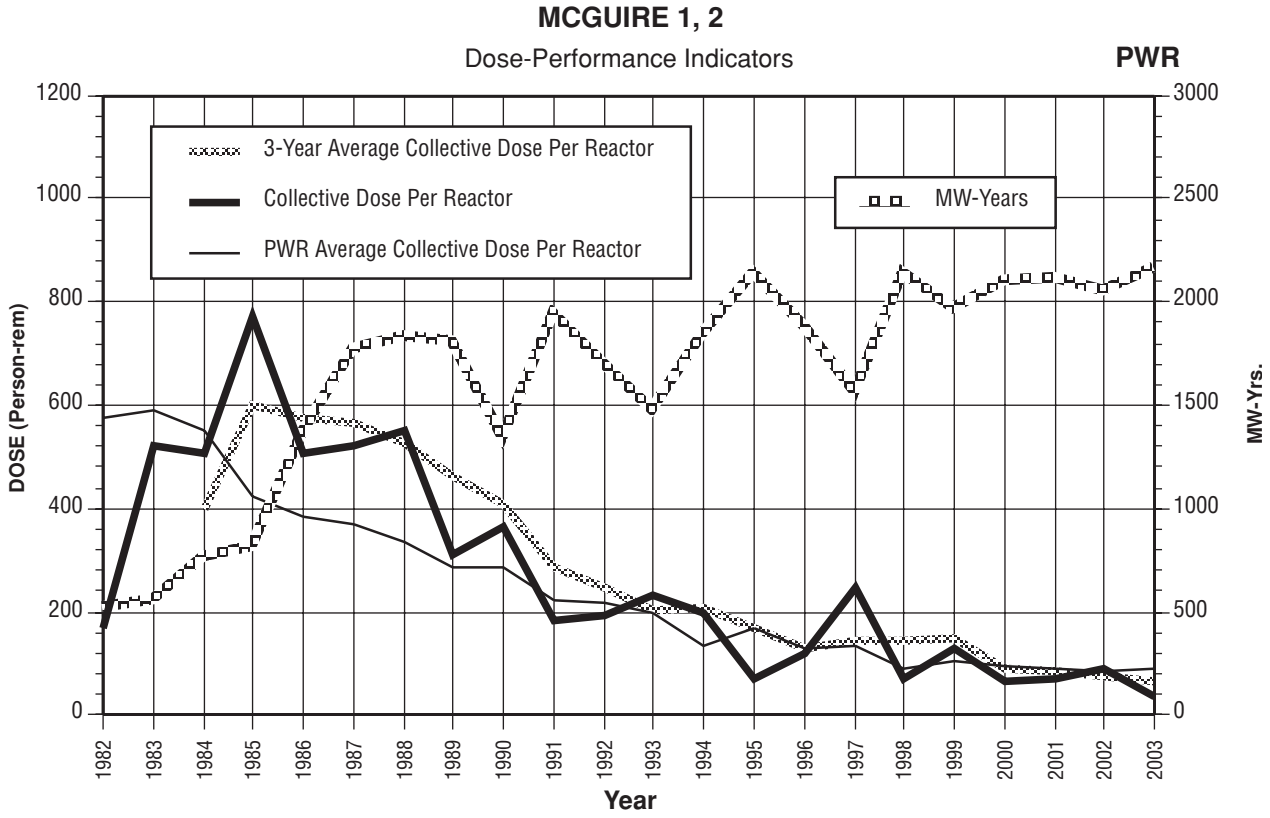

INDIAN POINT 2
Dose-Performance Indicators
PWR
3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
PWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year

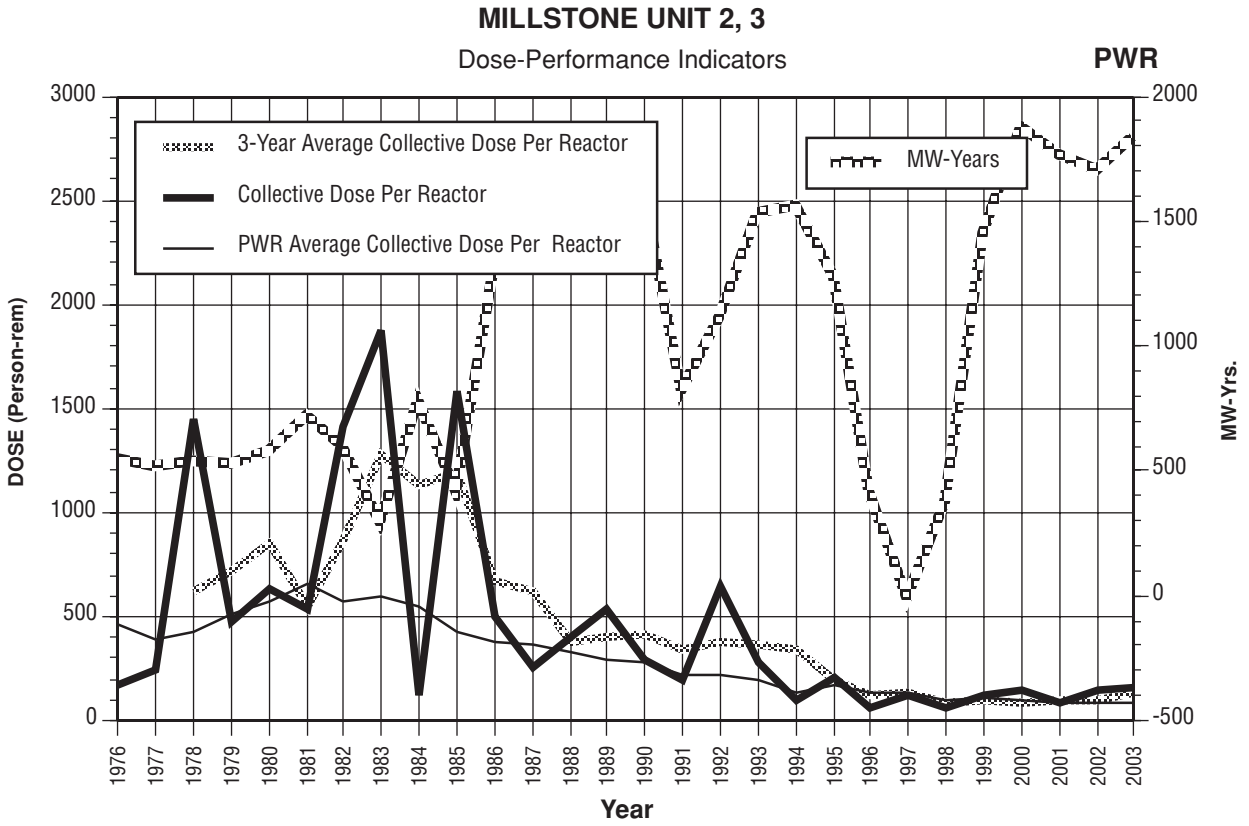

INDIAN POINT 3
Dose-Performance Indicators
PWR
3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
PWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year

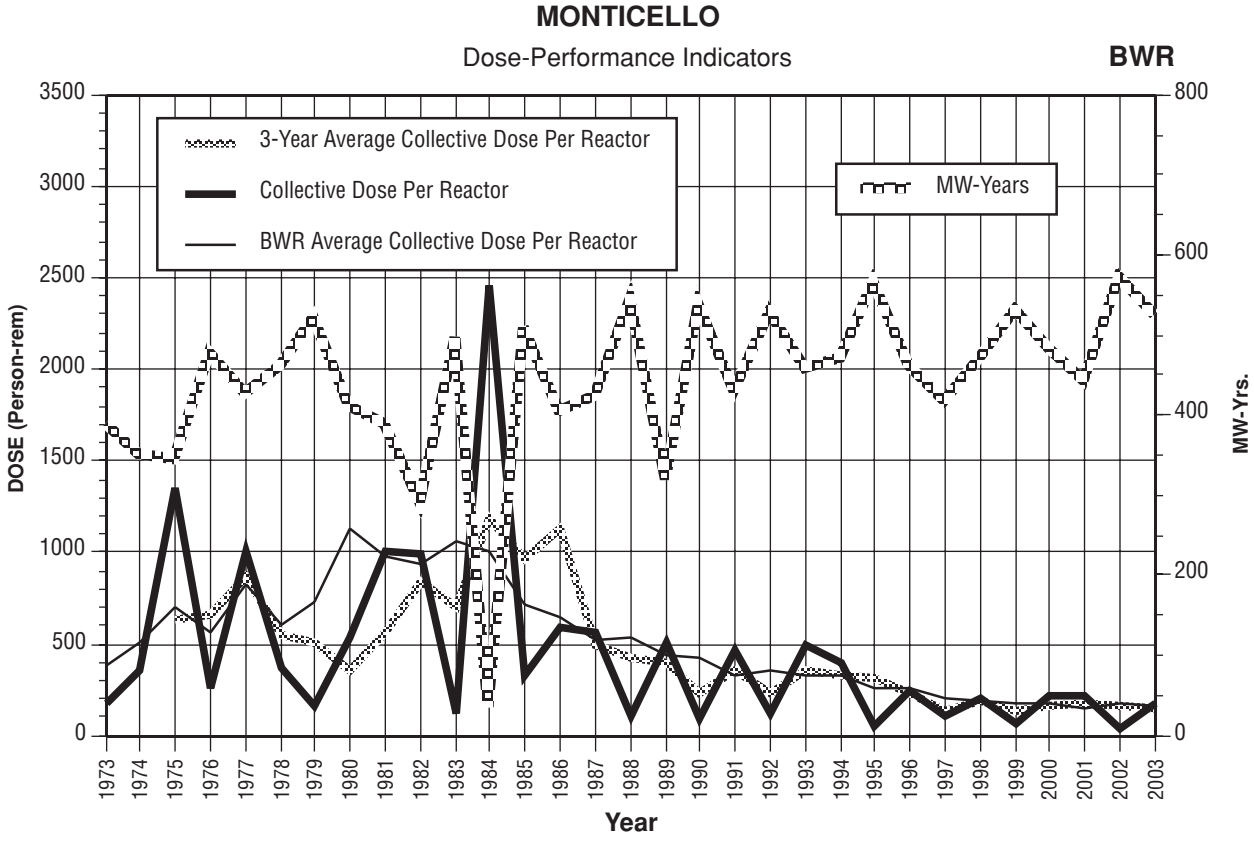

KEWAUNEE
Dose-Performance Indicators
PWR
3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
PWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year

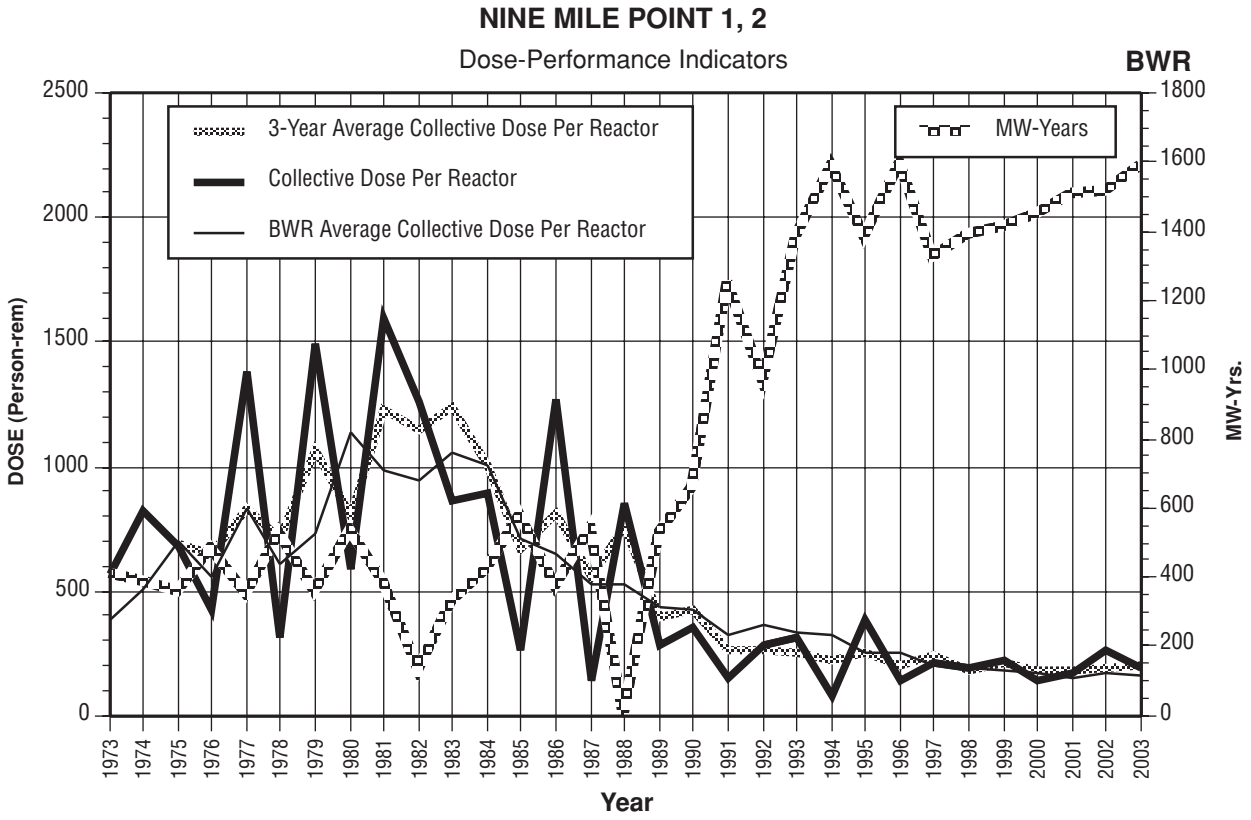

LASALLE 1, 2
Dose-Performance Indicators
BWR
3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
BWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year

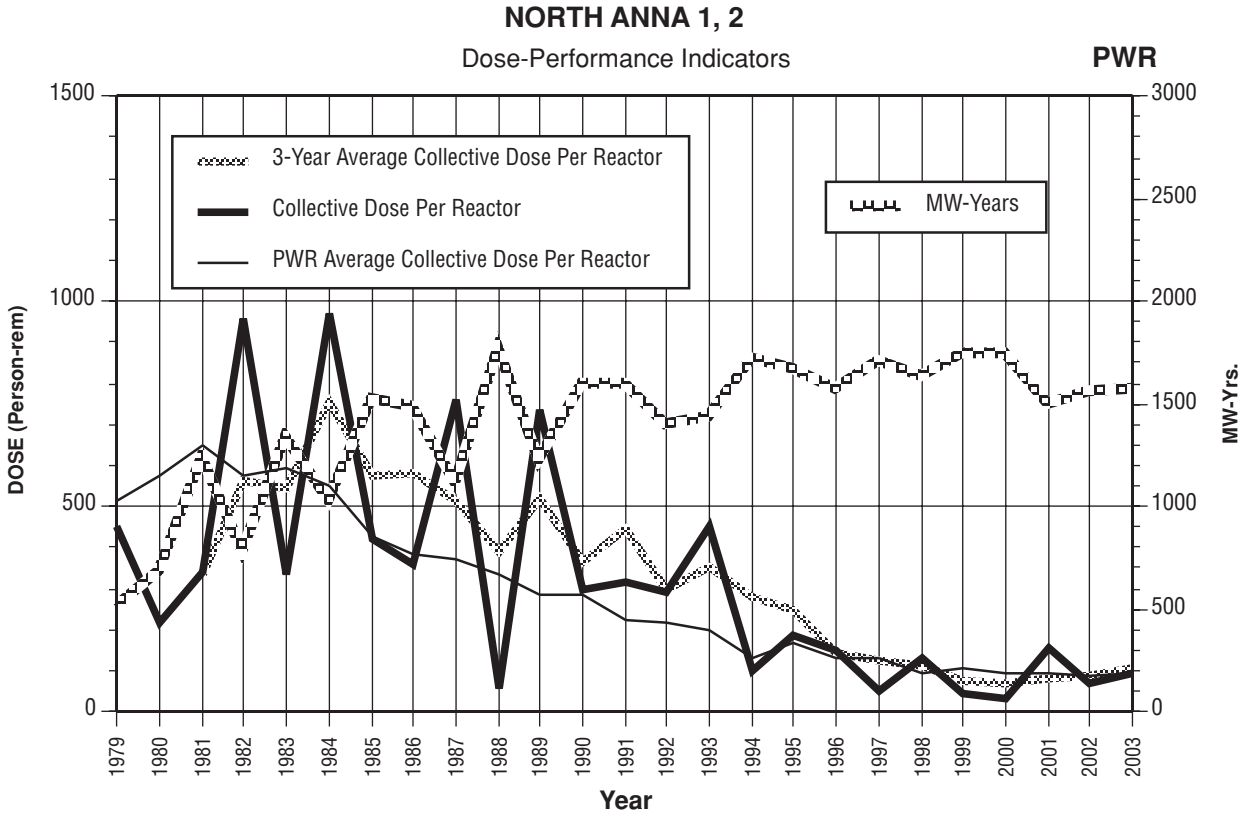

LIMERICK 1, 2
Dose-Performance Indicators
BWR
3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
BWR Average Collective Dose Per Reactor
MW-Years
MW-Yrs.
Year

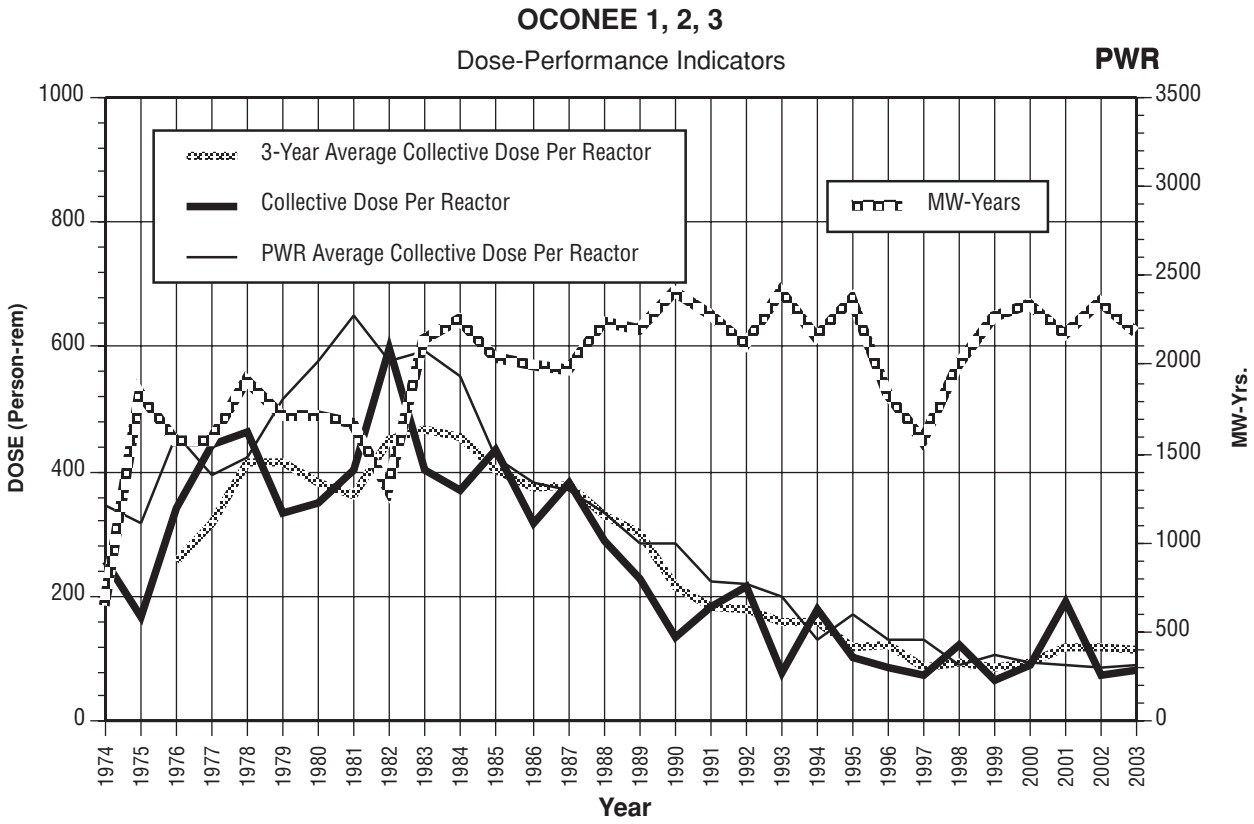

MCGUIRE 1, 2
Dose-Performance Indicators
PWR
3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
PWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year

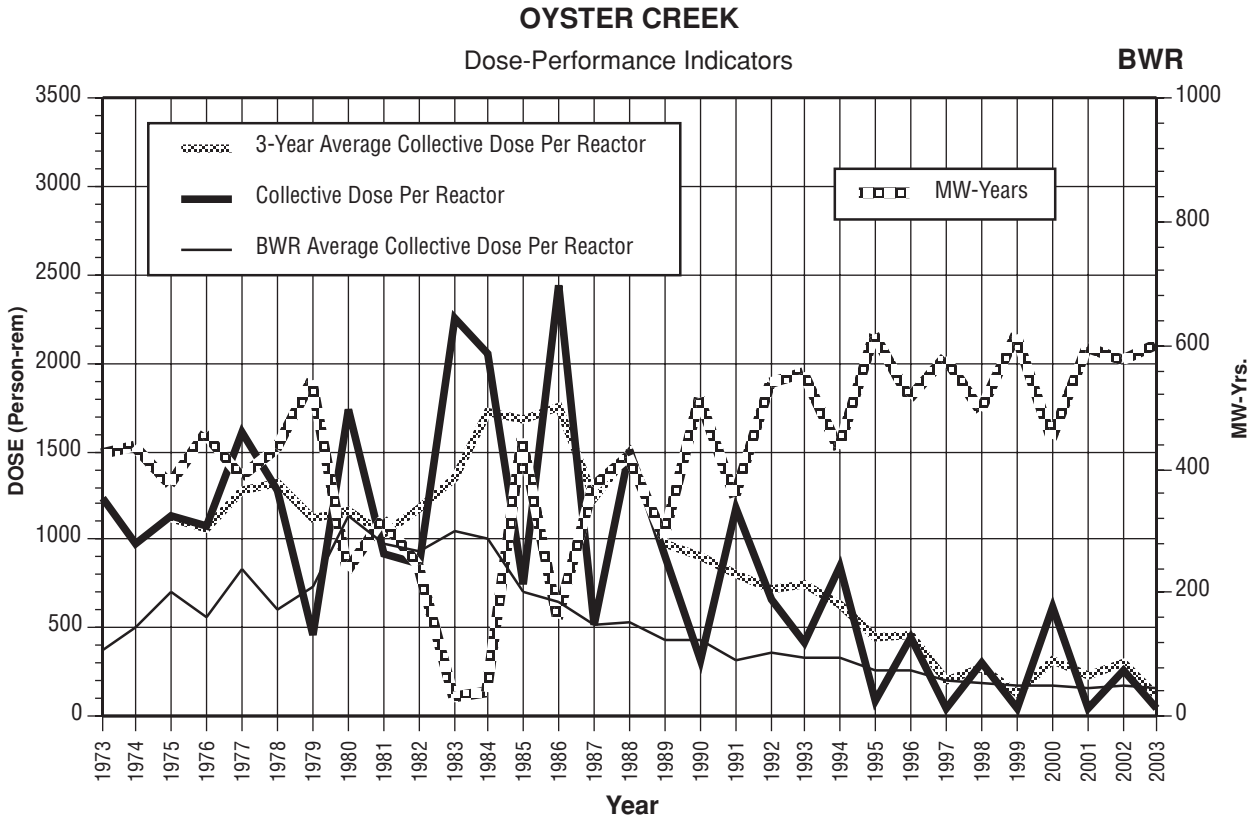

MILLSTONE UNIT 2, 3
Dose-Performance Indicators
PWR
3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
PWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year

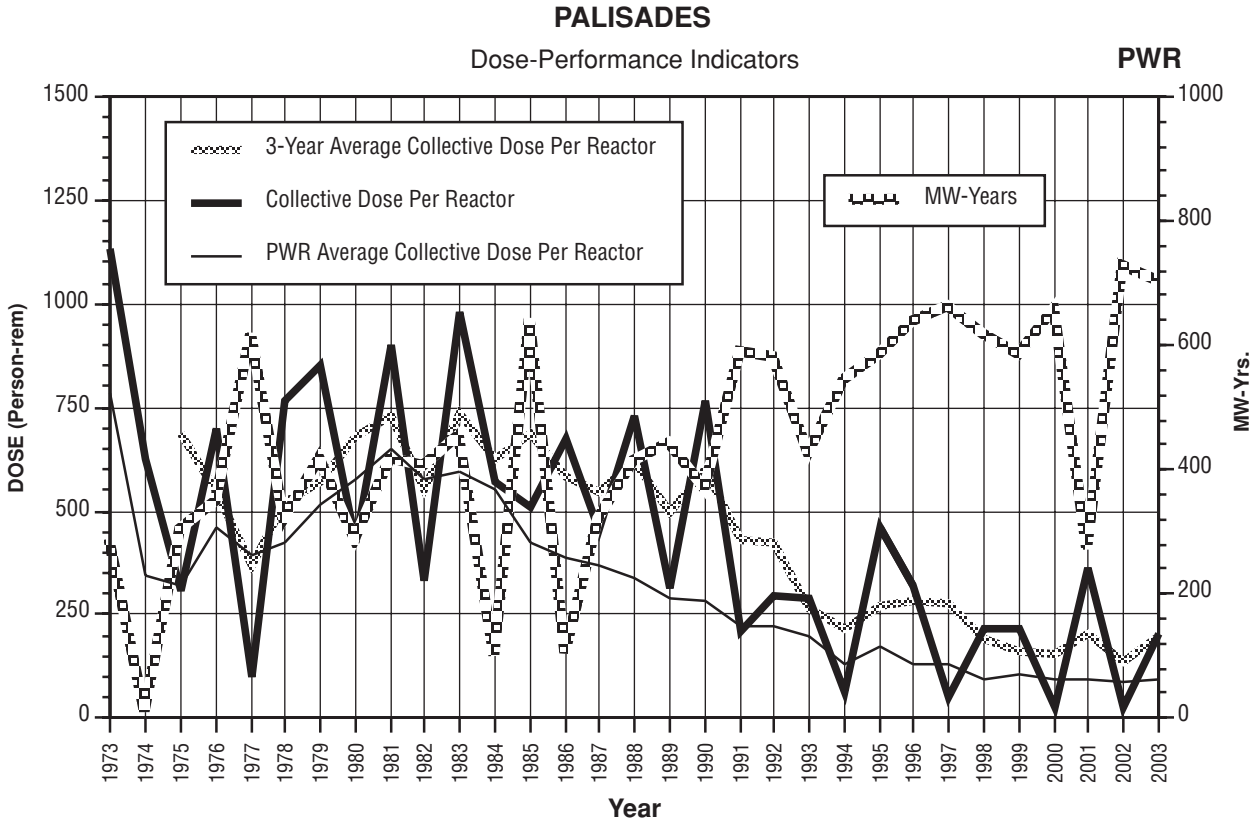

MONTICELLO
Dose-Performance Indicators
BWR
3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
BWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year

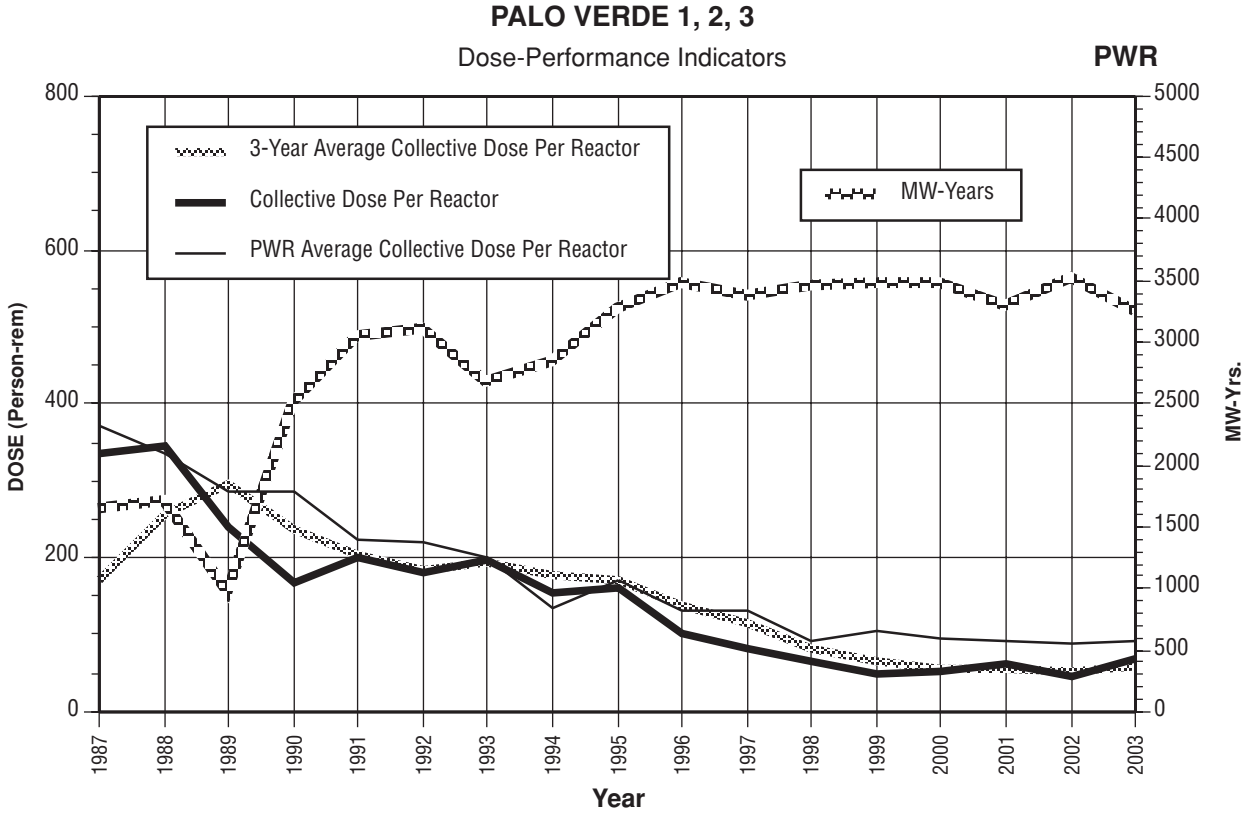

NINE MILE POINT 1, 2
Dose-Performance Indicators
BWR
3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
BWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year

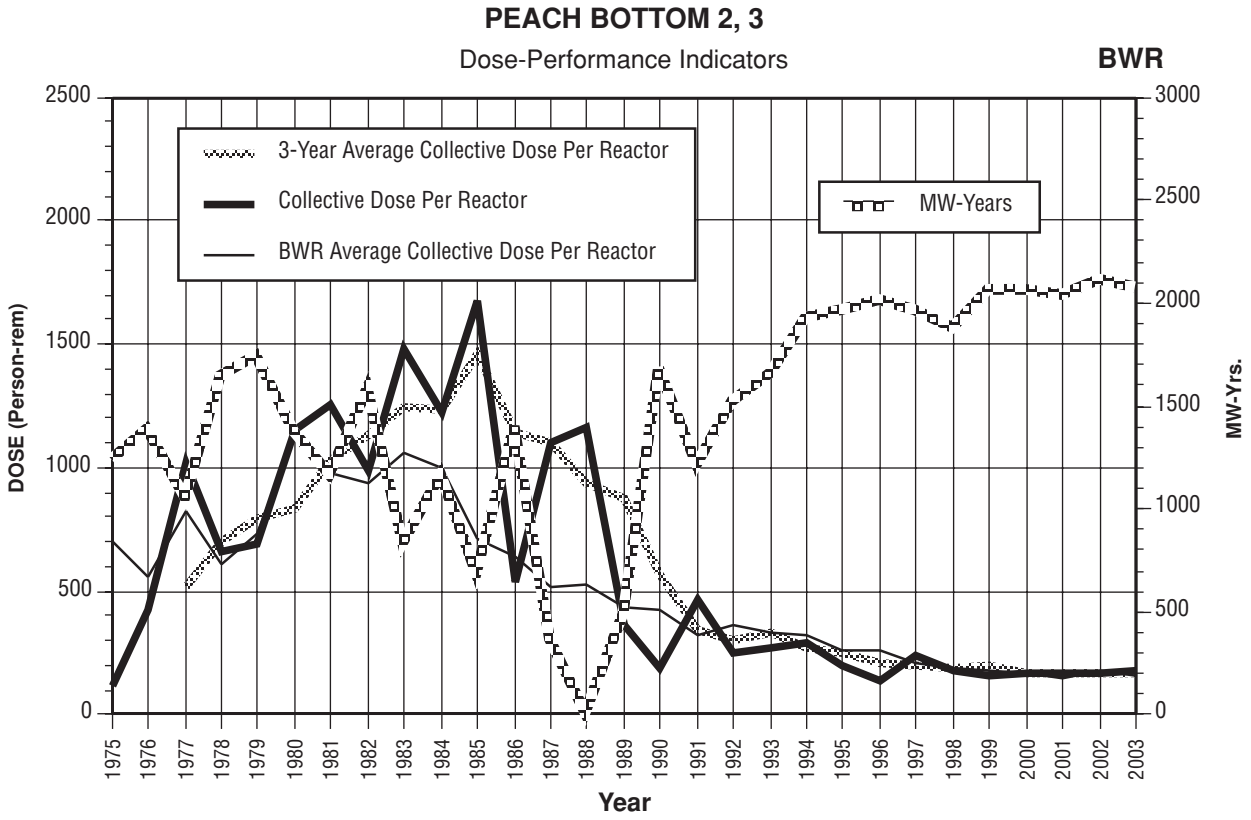

NORTH ANNA 1, 2
Dose-Performance Indicators
PWR
3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
PWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year

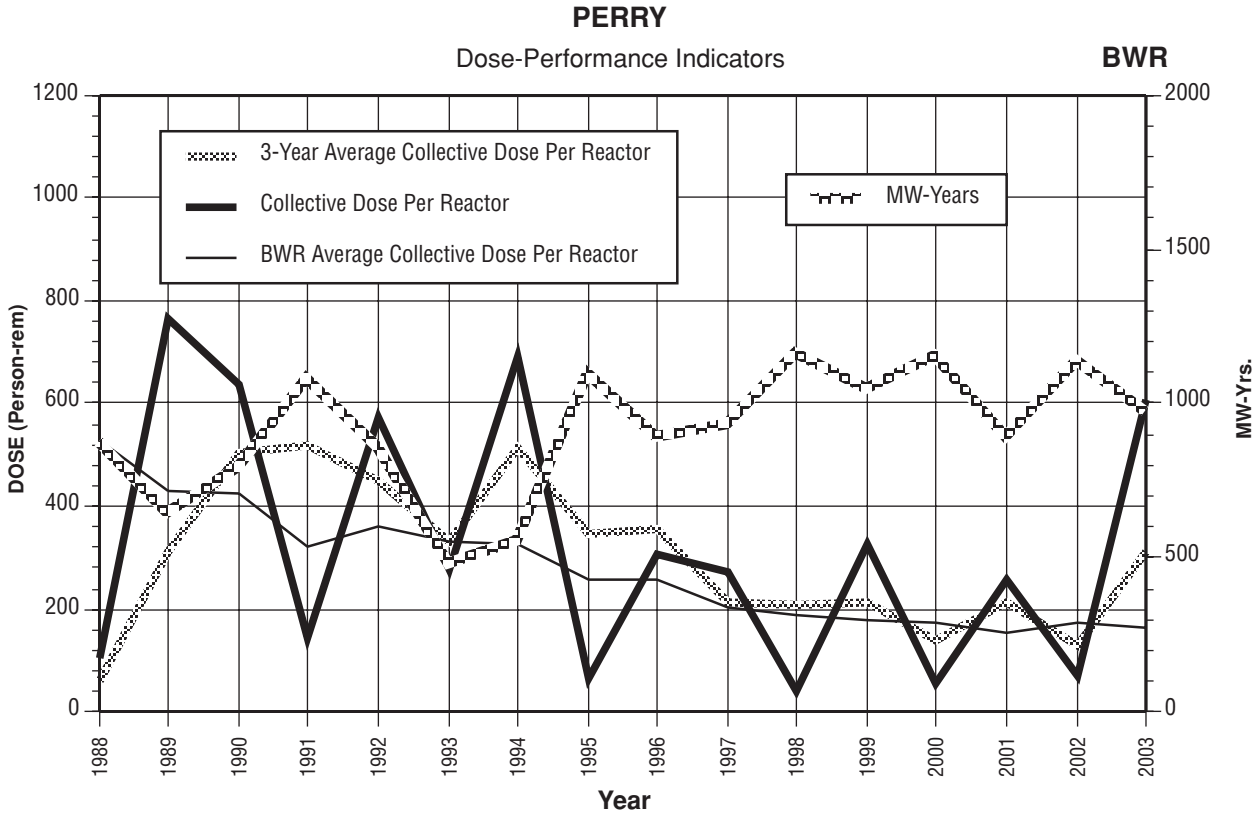

OCONEE 1, 2, 3
Dose-Performance Indicators
PWR
3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
PWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year

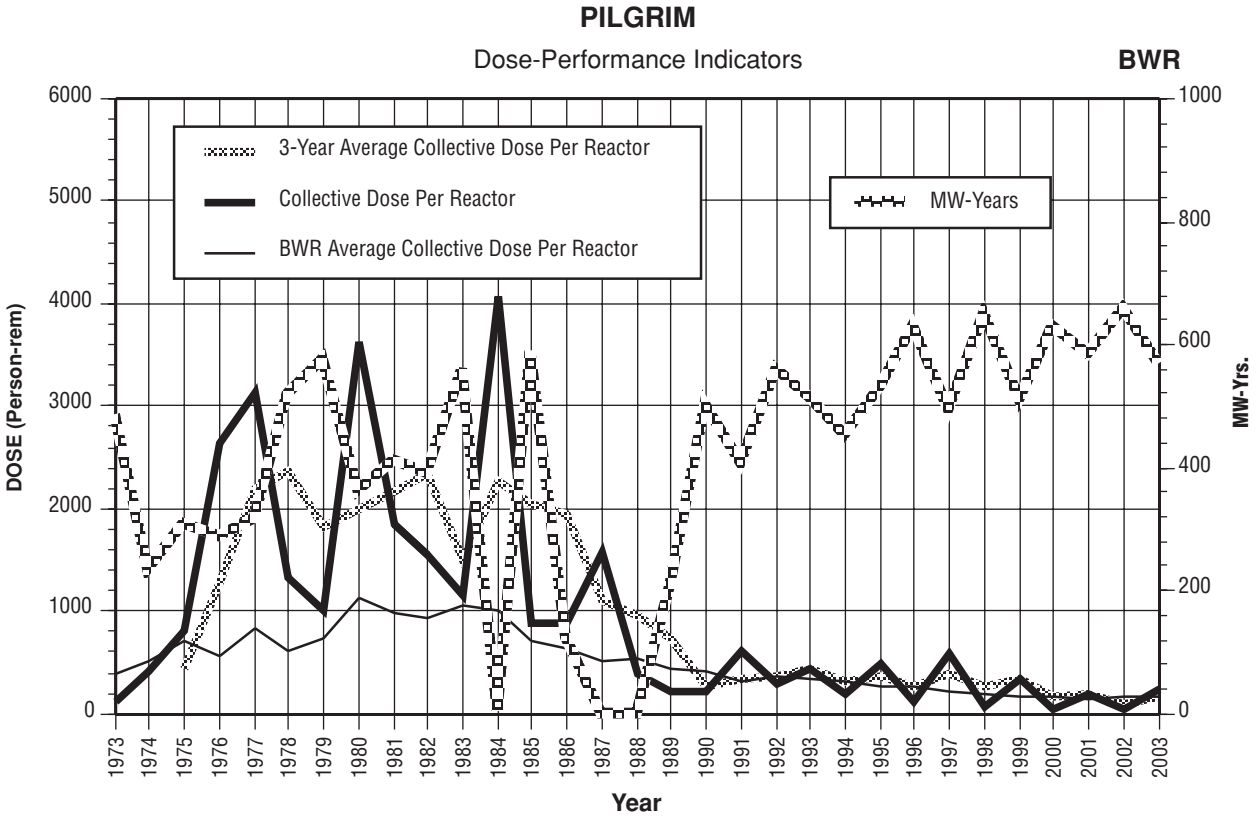

OYSTER CREEK
Dose-Performance Indicators
BWR
3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
BWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year


PALISADES
Dose-Performance Indicators
PWR
3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
PWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year


PALO VERDE 1, 2, 3
Dose-Performance Indicators
PWR
3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
PWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year


PEACH BOTTOM 2, 3
Dose-Performance Indicators
BWR
3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
BWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year


PERRY
Dose-Performance Indicators
BWR
3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
BWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year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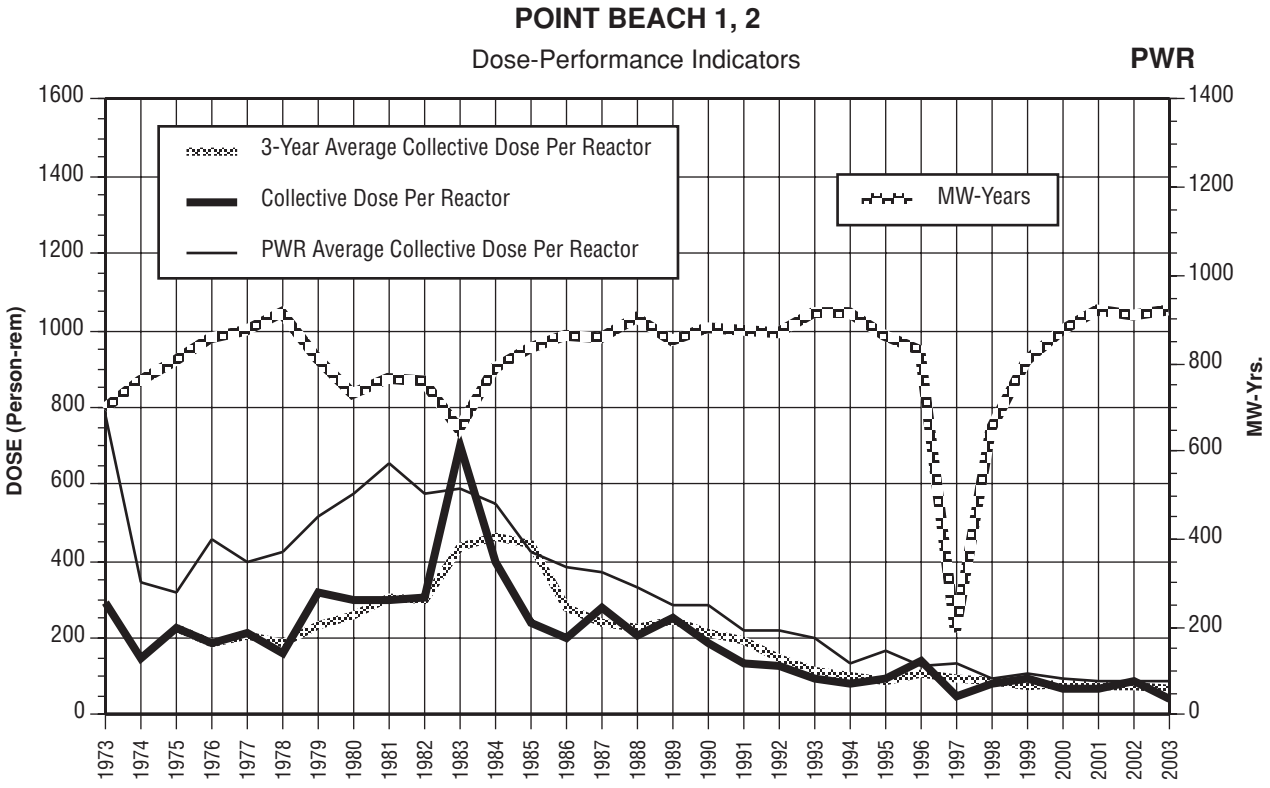
Dose-Performance Indicators
BWR
3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
BWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year


POINT BEACH 1, 2
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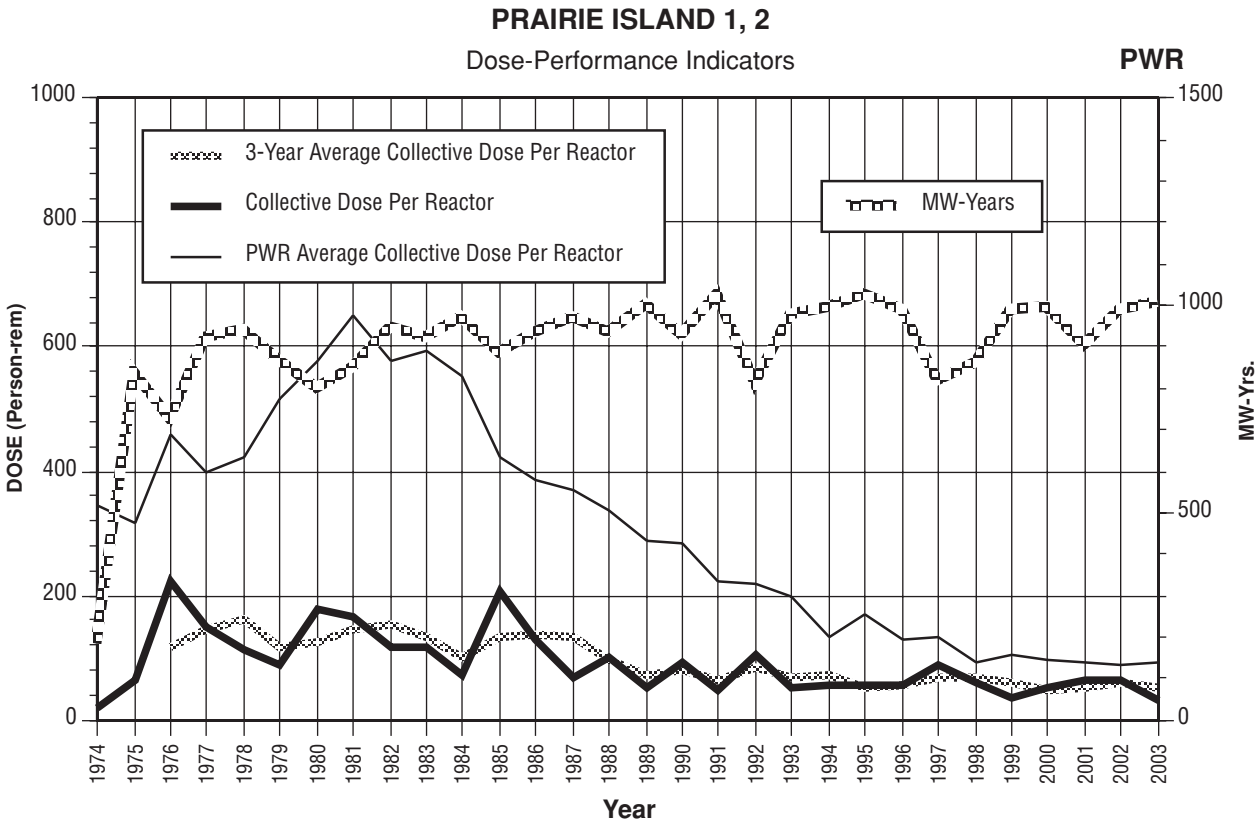
PWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.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Dose-Performance Indicators
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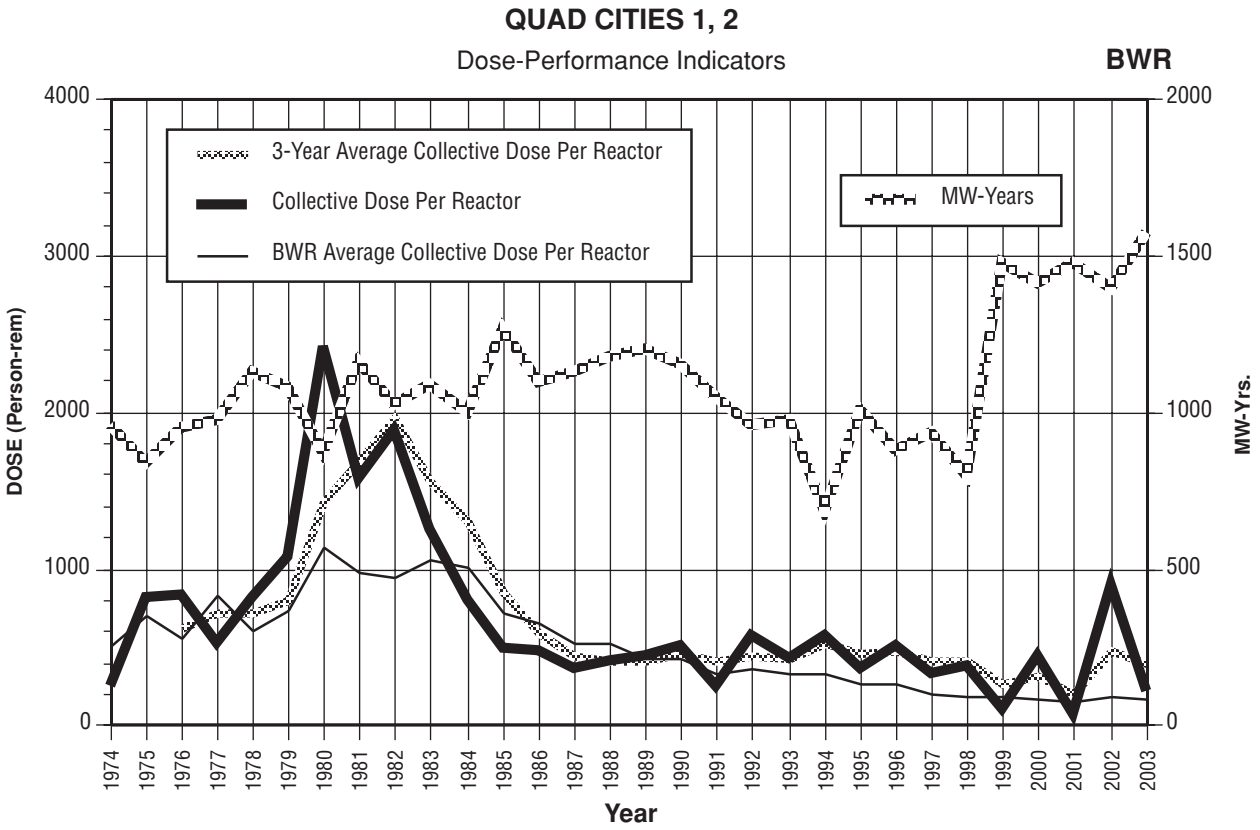
PWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year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Dose-Performance Indicators
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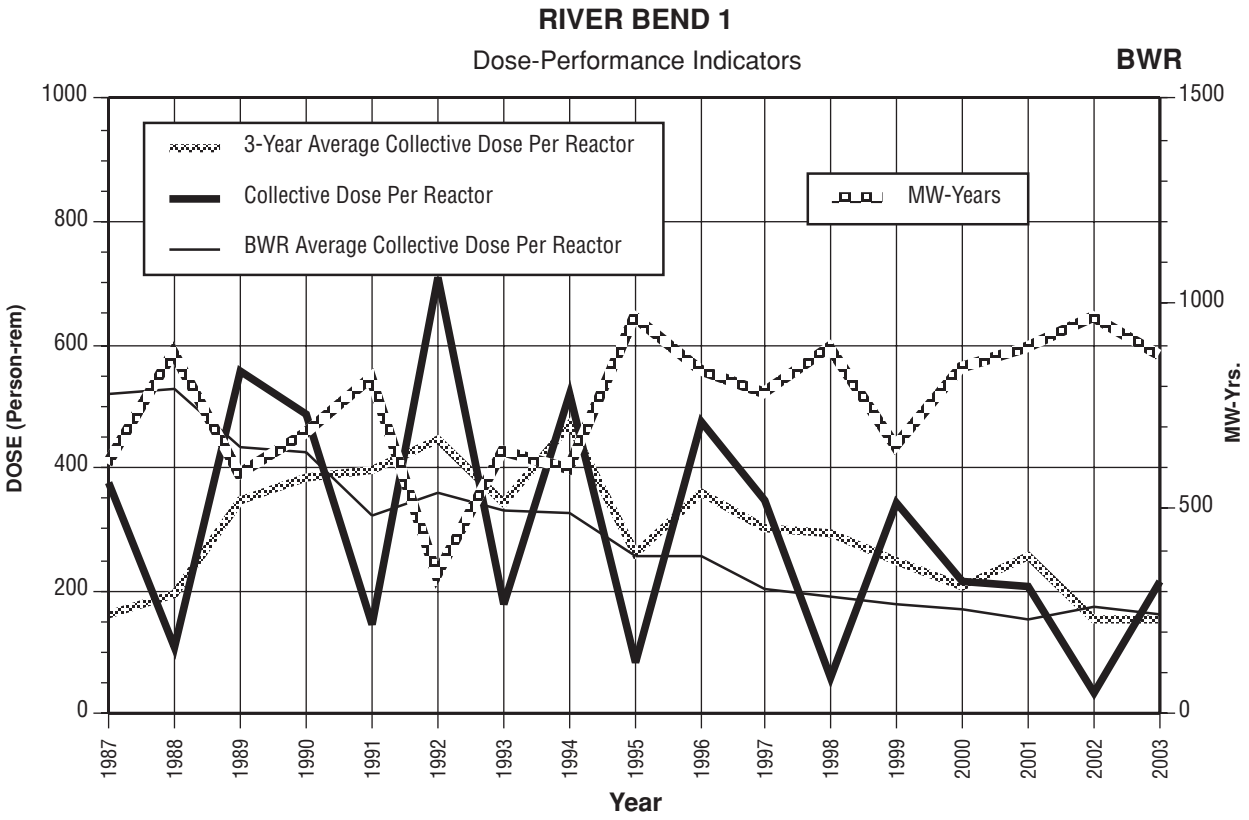
BWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year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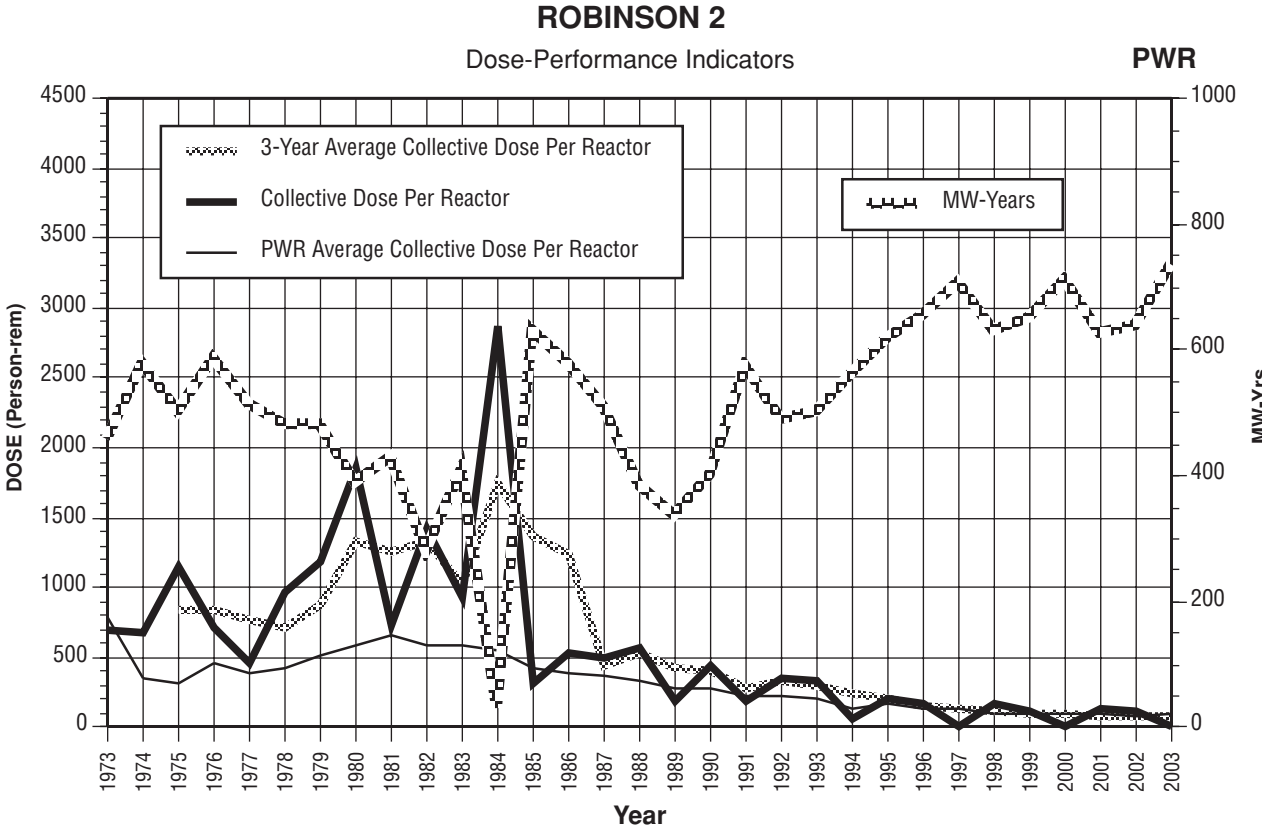
BWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year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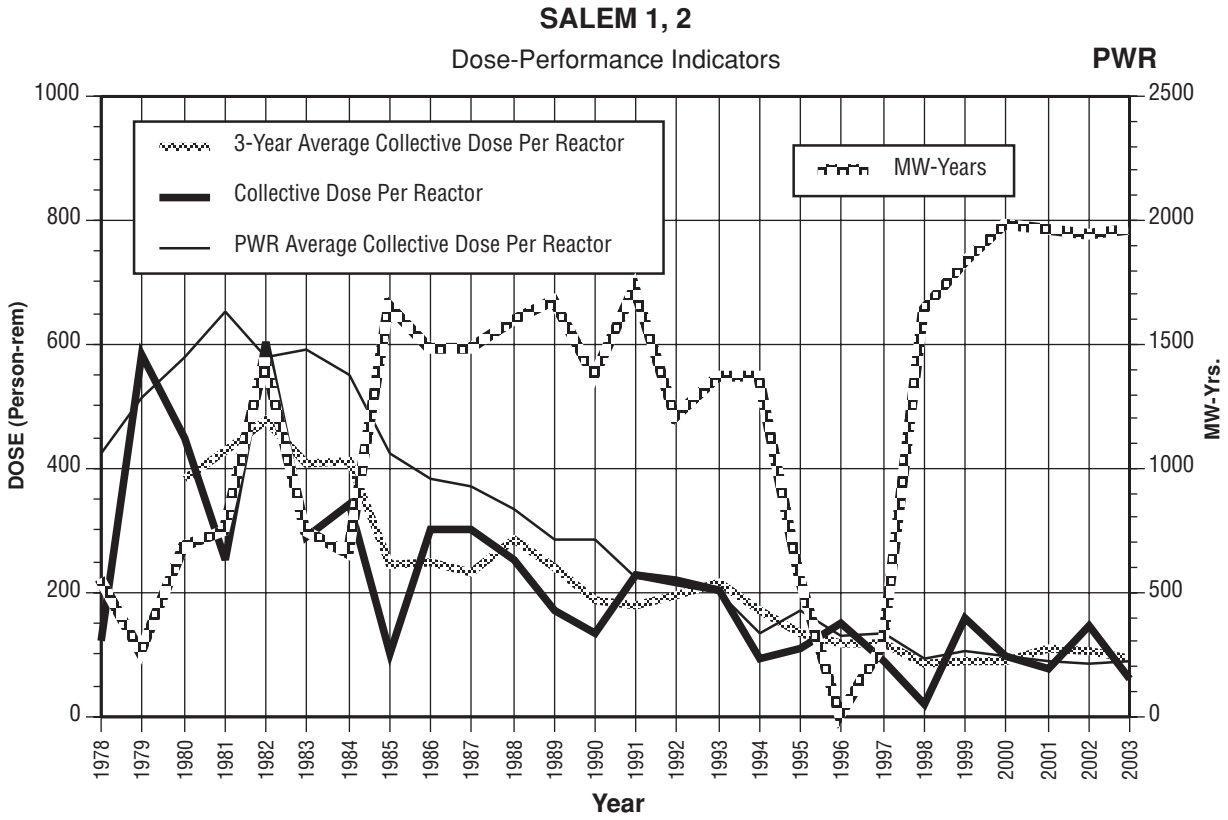
PWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
Year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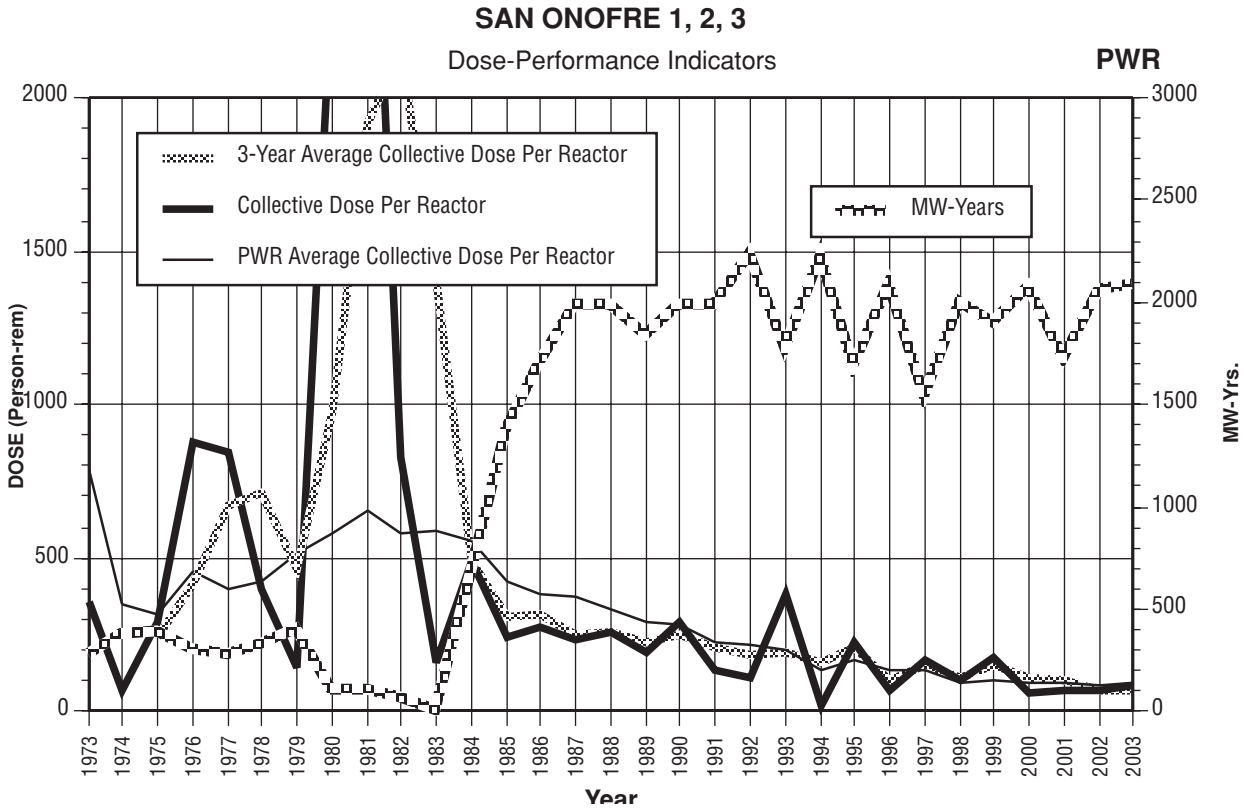
PWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year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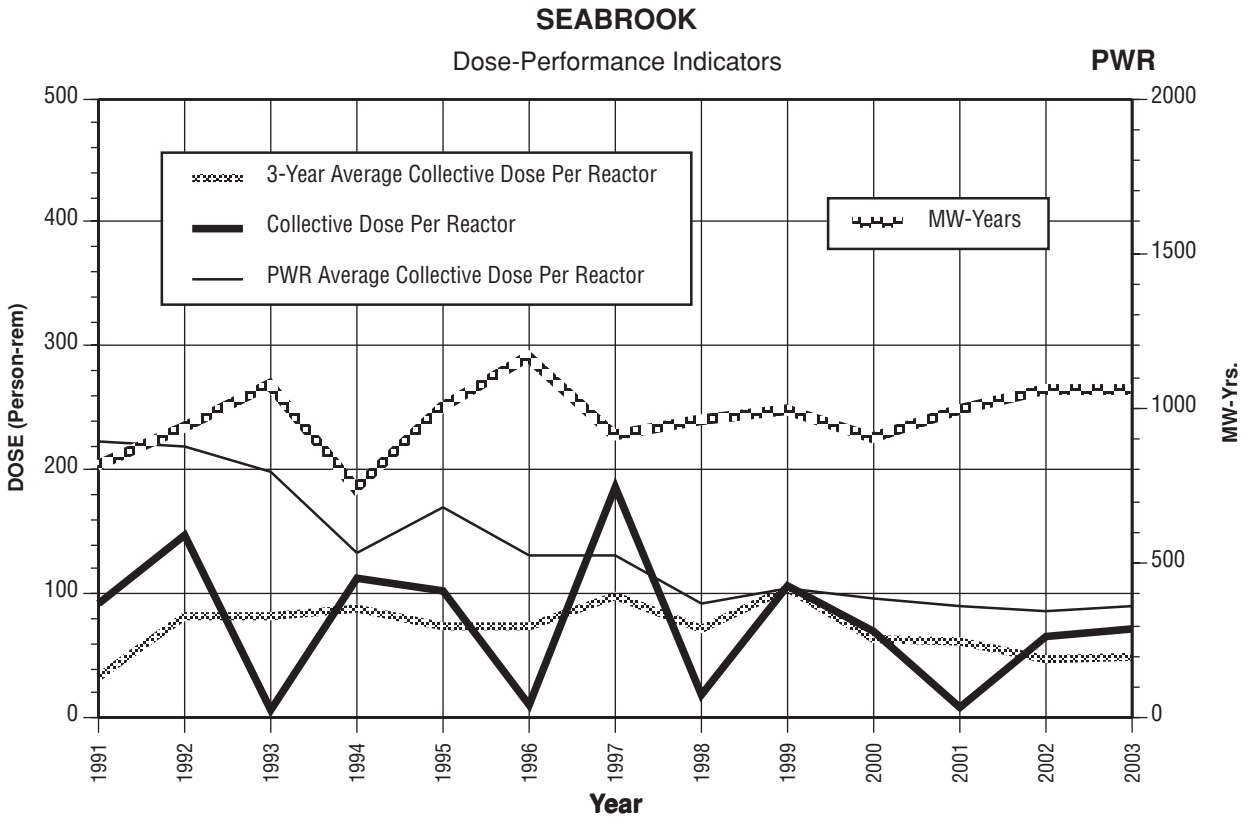
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year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3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
PWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year
0
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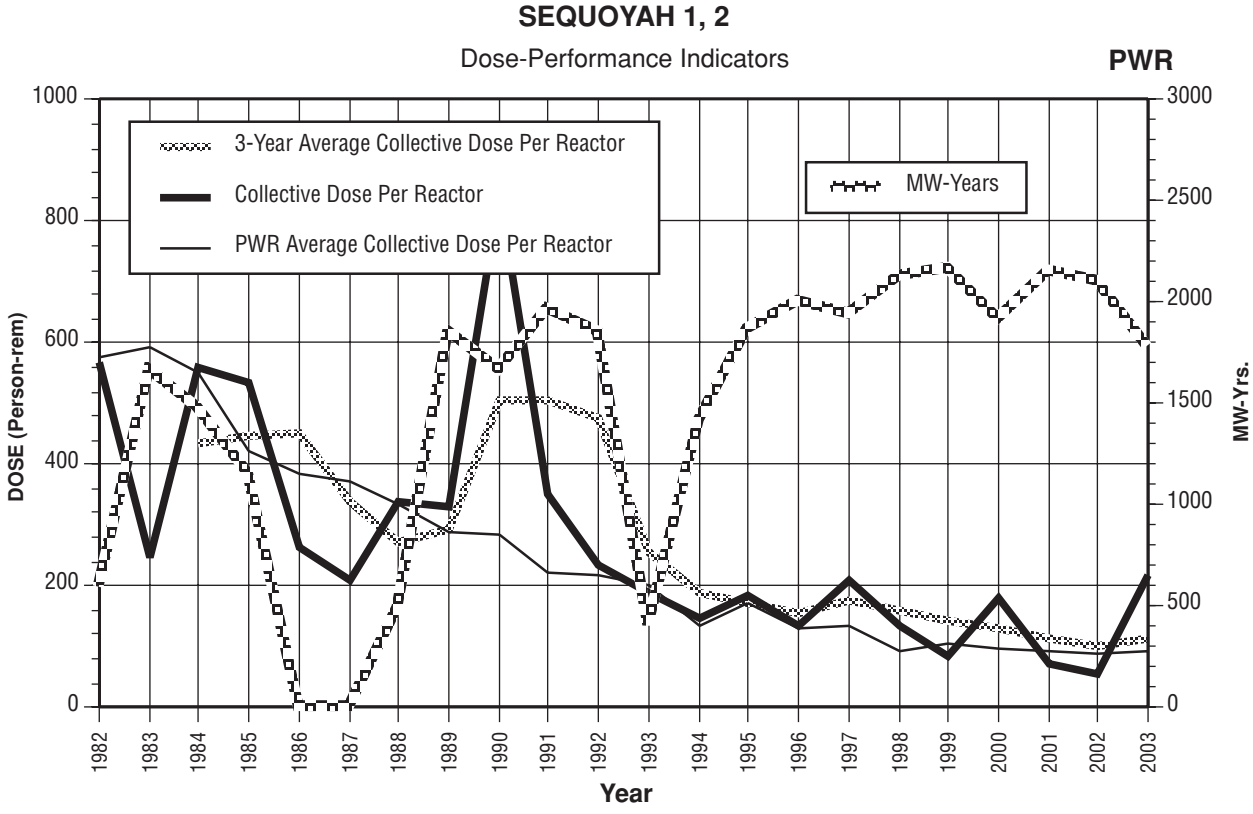
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Dose-Performance Indicators
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Collective Dose Per Reactor
PWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year
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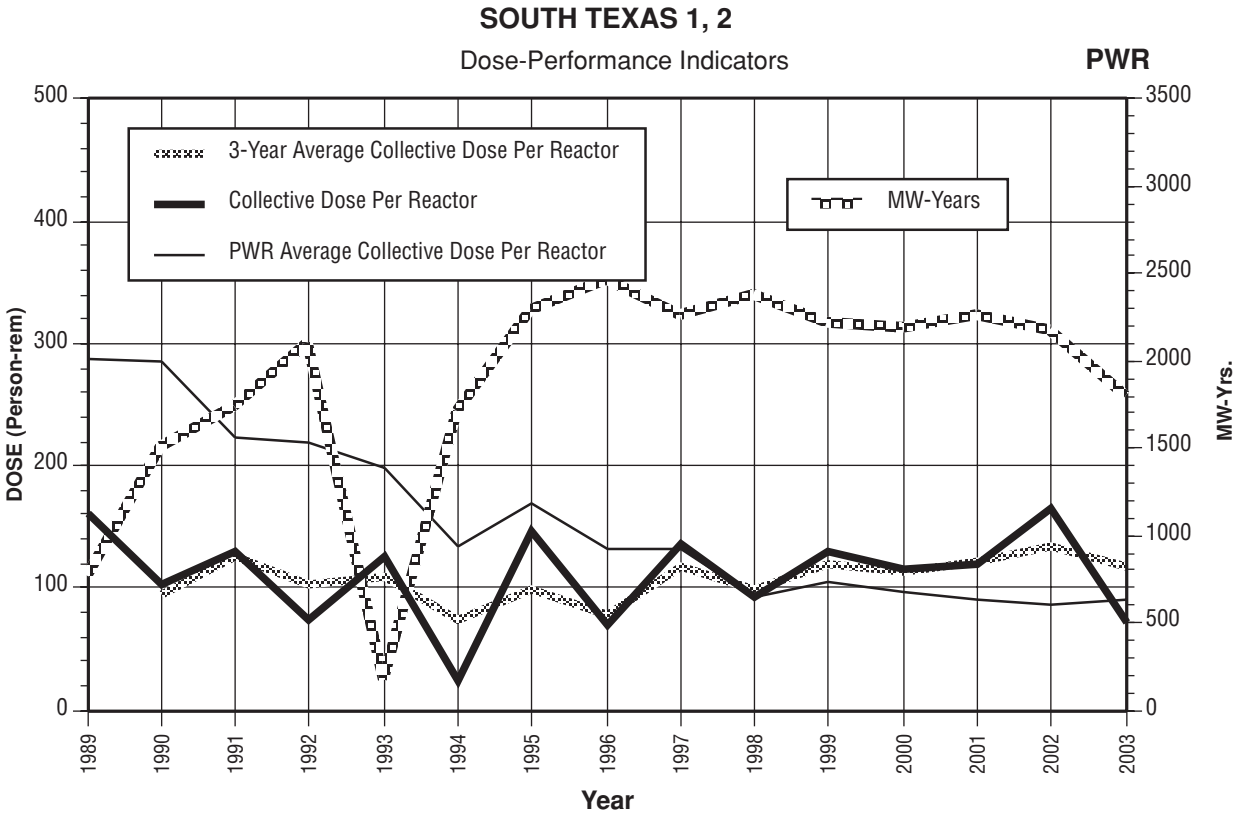
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3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
PWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year
0
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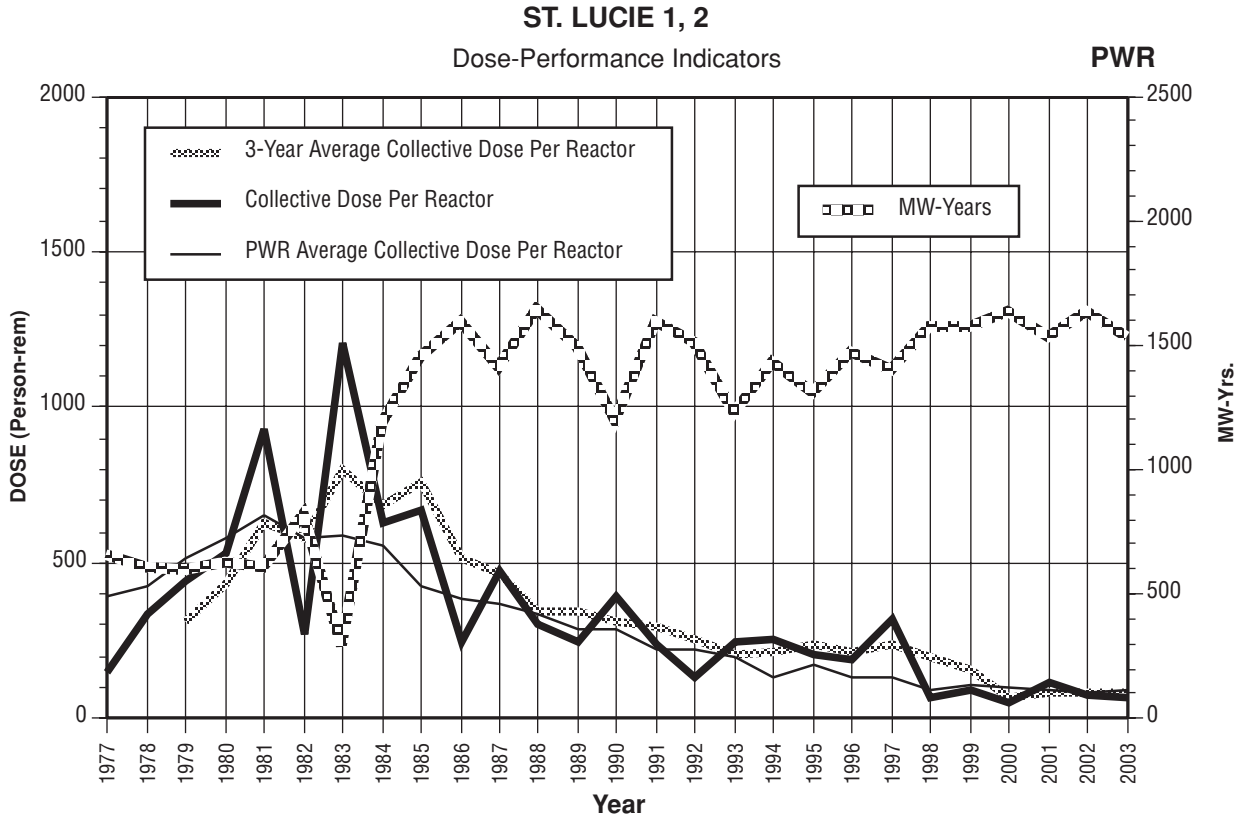
ST. LUCIE 1, 2
Dose-Performance Indicators
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3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
PWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year
0
500
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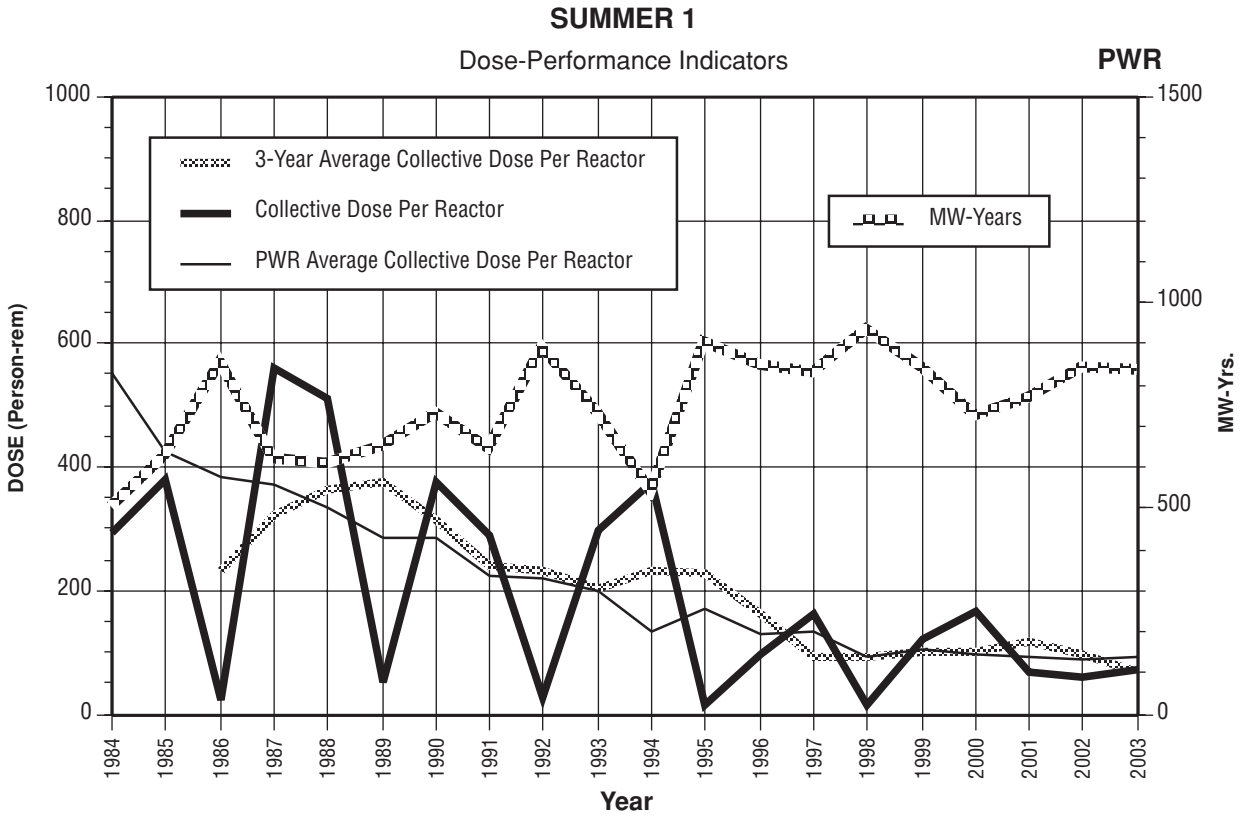
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Dose-Performance Indicators
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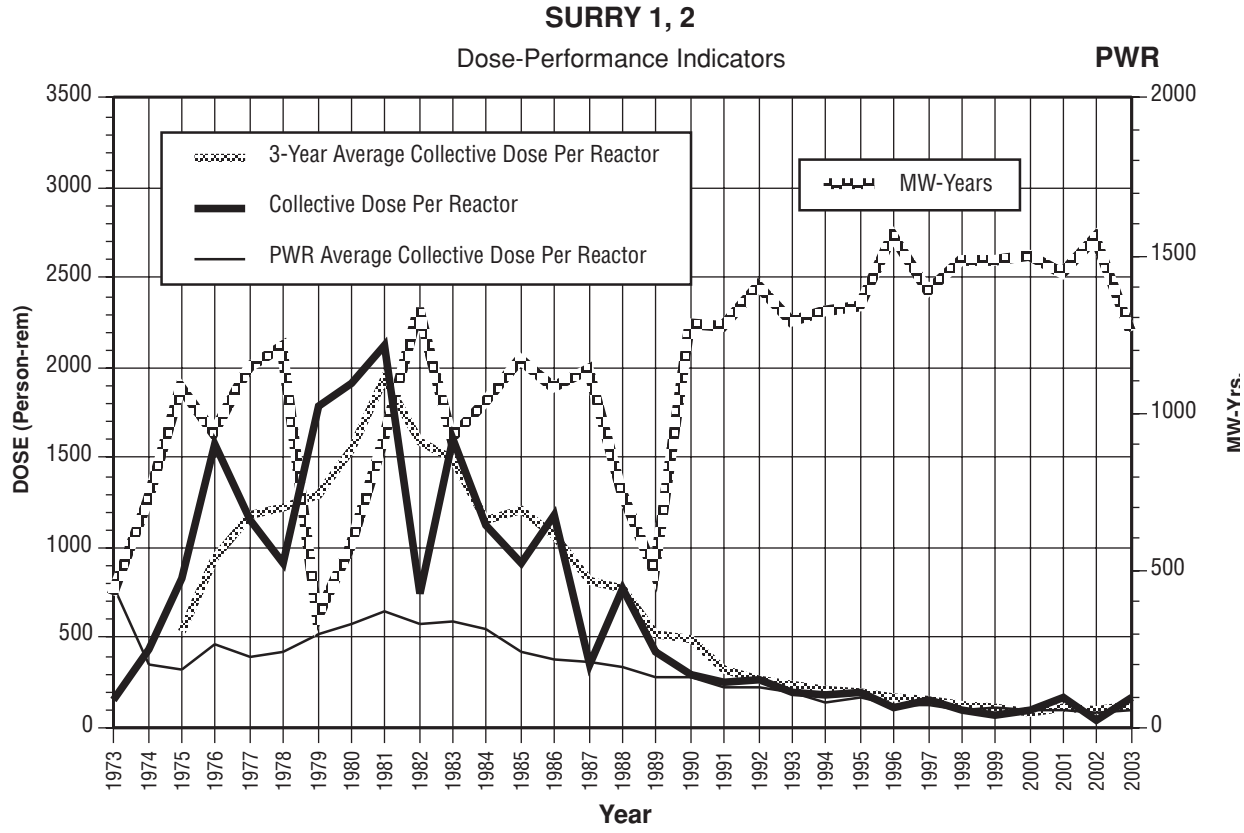
Collective Dose Per Reactor
PWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year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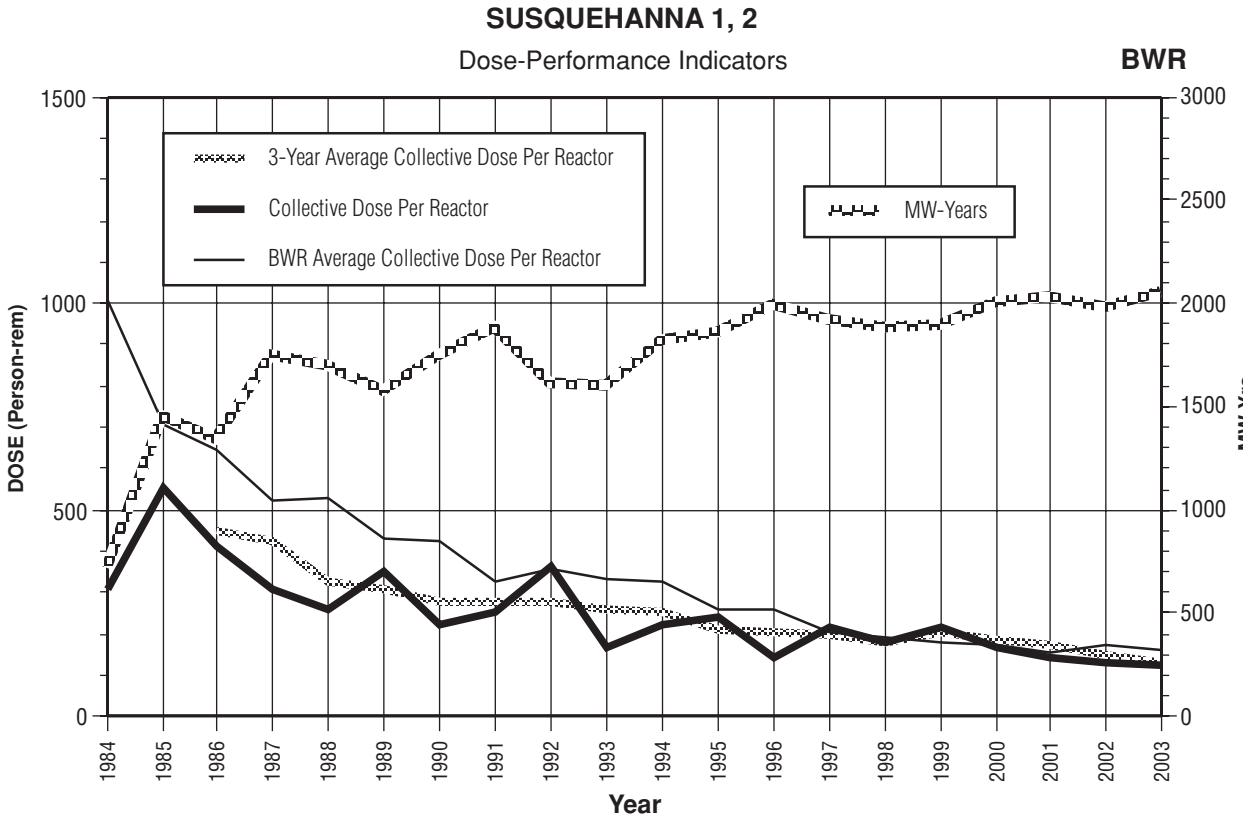
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year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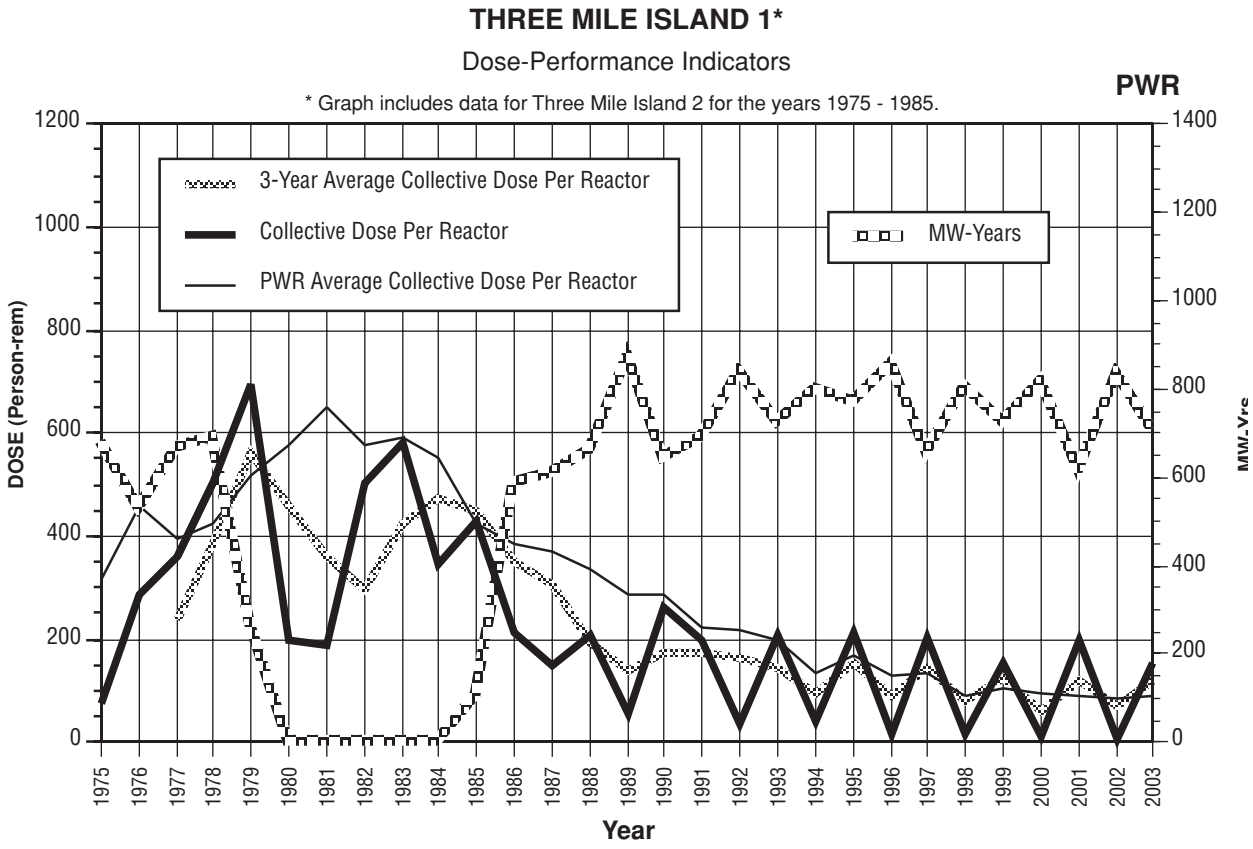
Collective Dose Per Reactor
BWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
Year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Dose-Performance Indicators
* Graph includes data for Three Mile Island 2 for the years 1975 - 1985.
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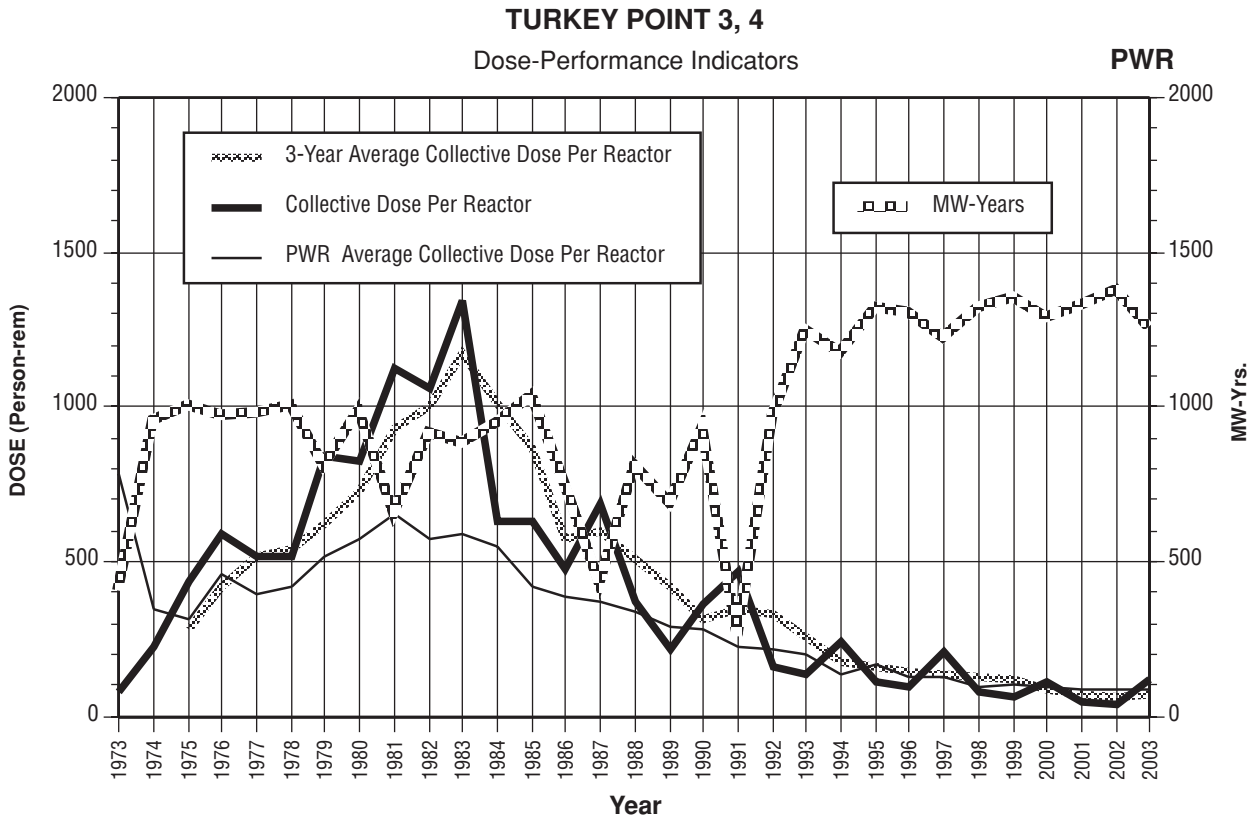
Collective Dose Per Reactor
PWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
Year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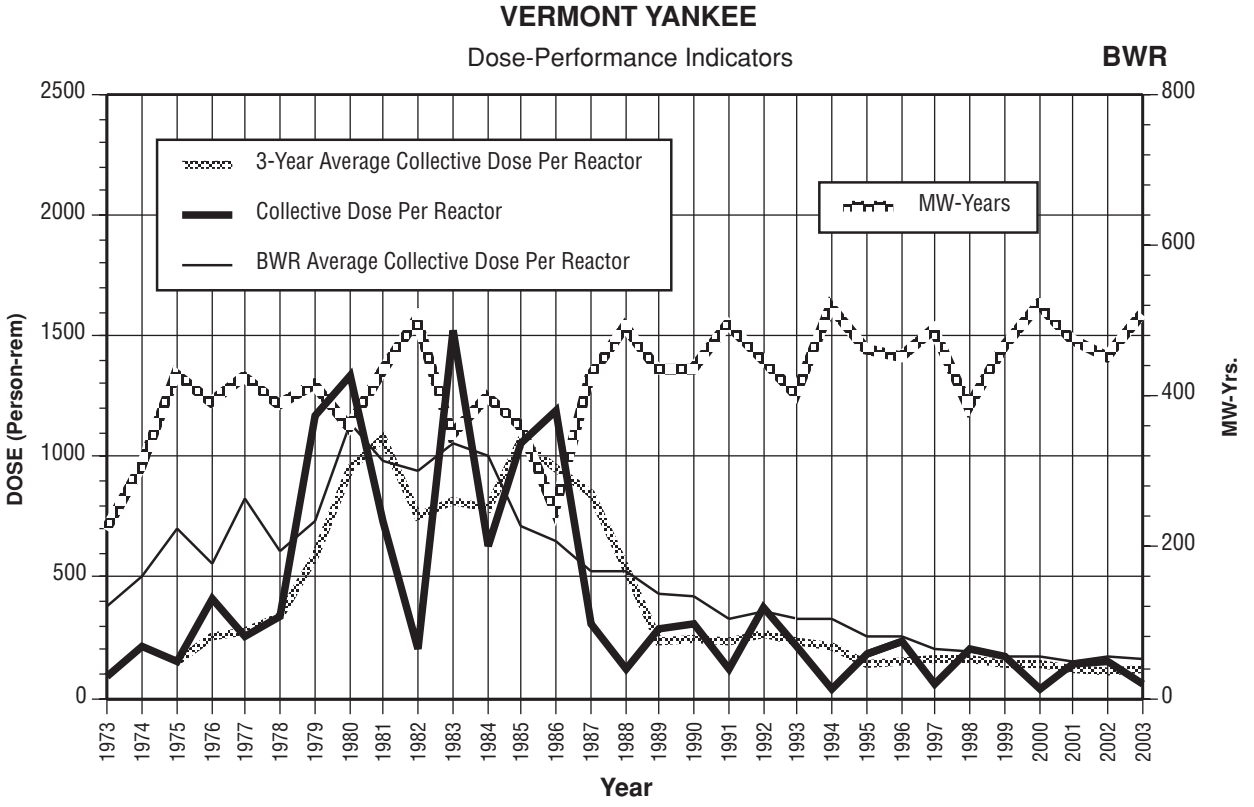
Collective Dose Per Reactor
PWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year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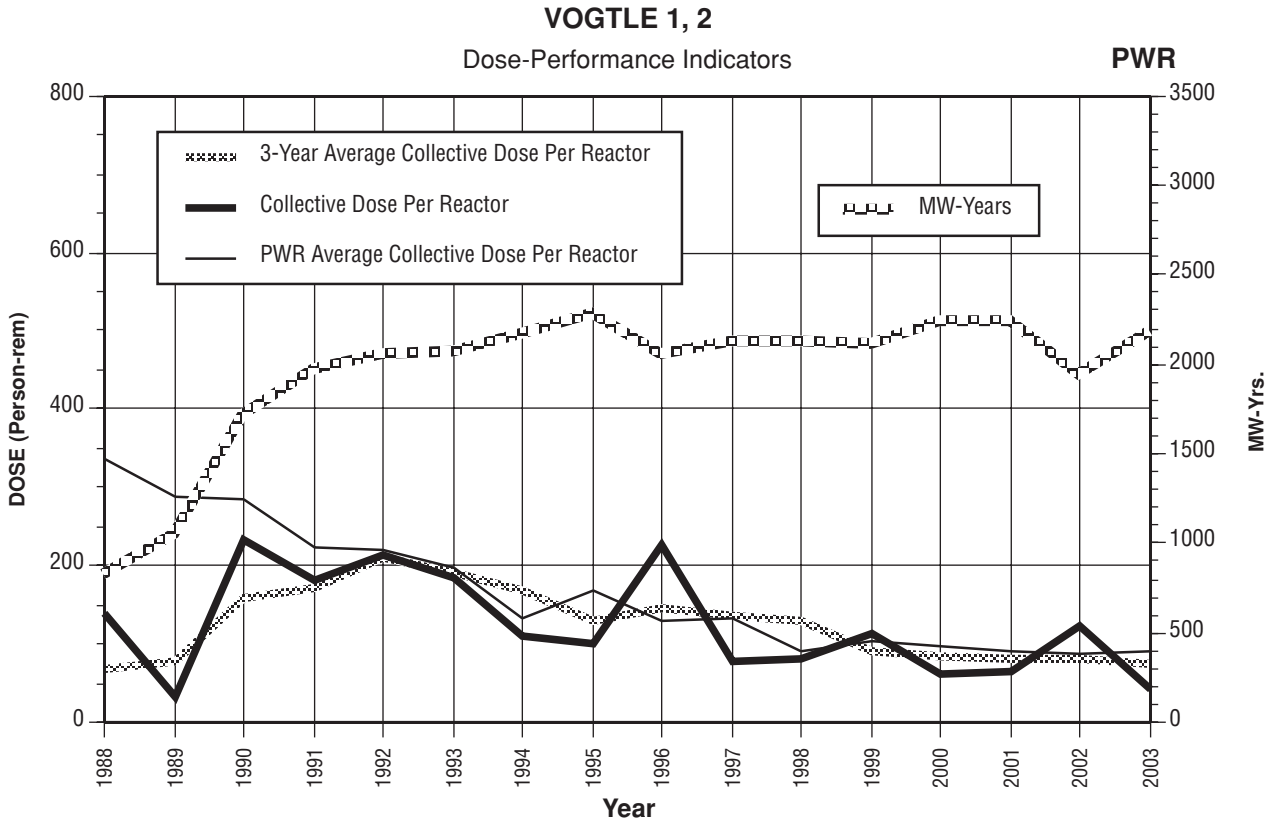
Collective Dose Per Reactor
BWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year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Collective Dose Per Reactor
PWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year
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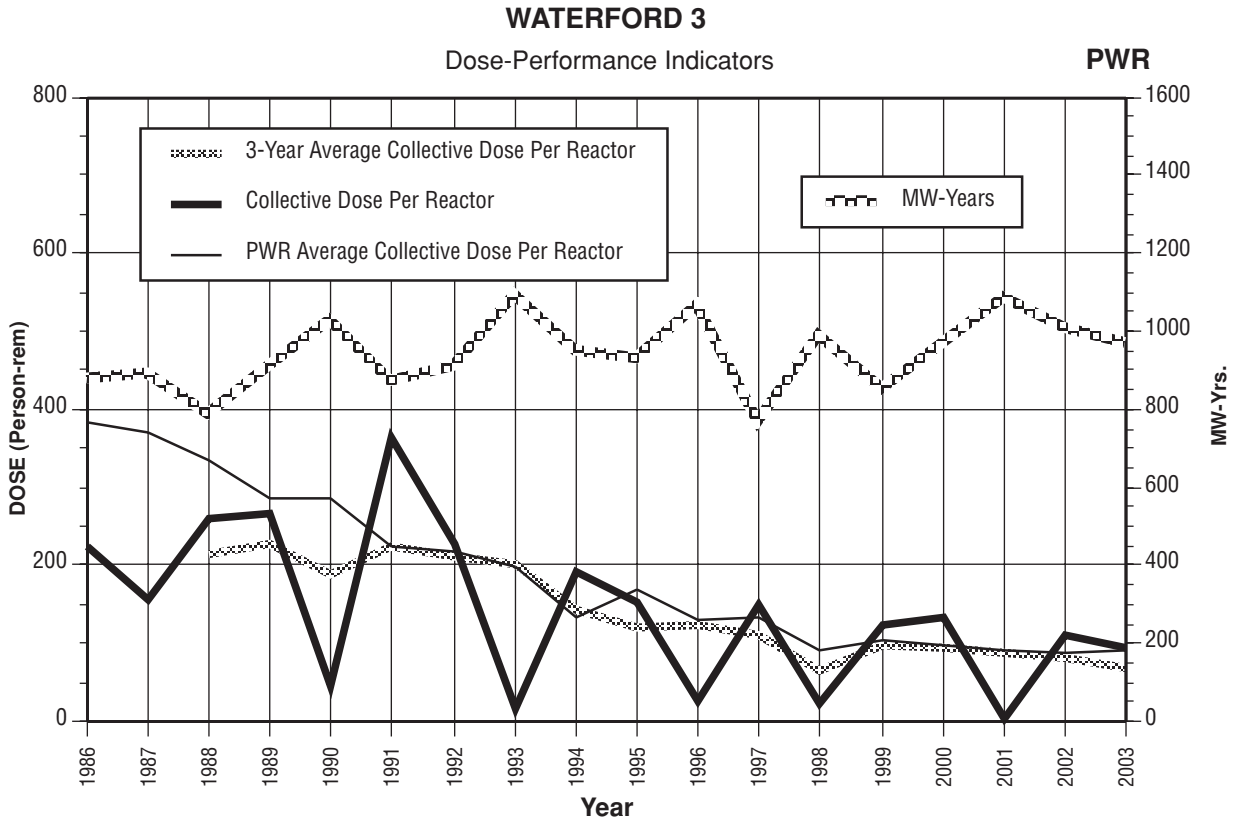
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Collective Dose Per Reactor
PWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year
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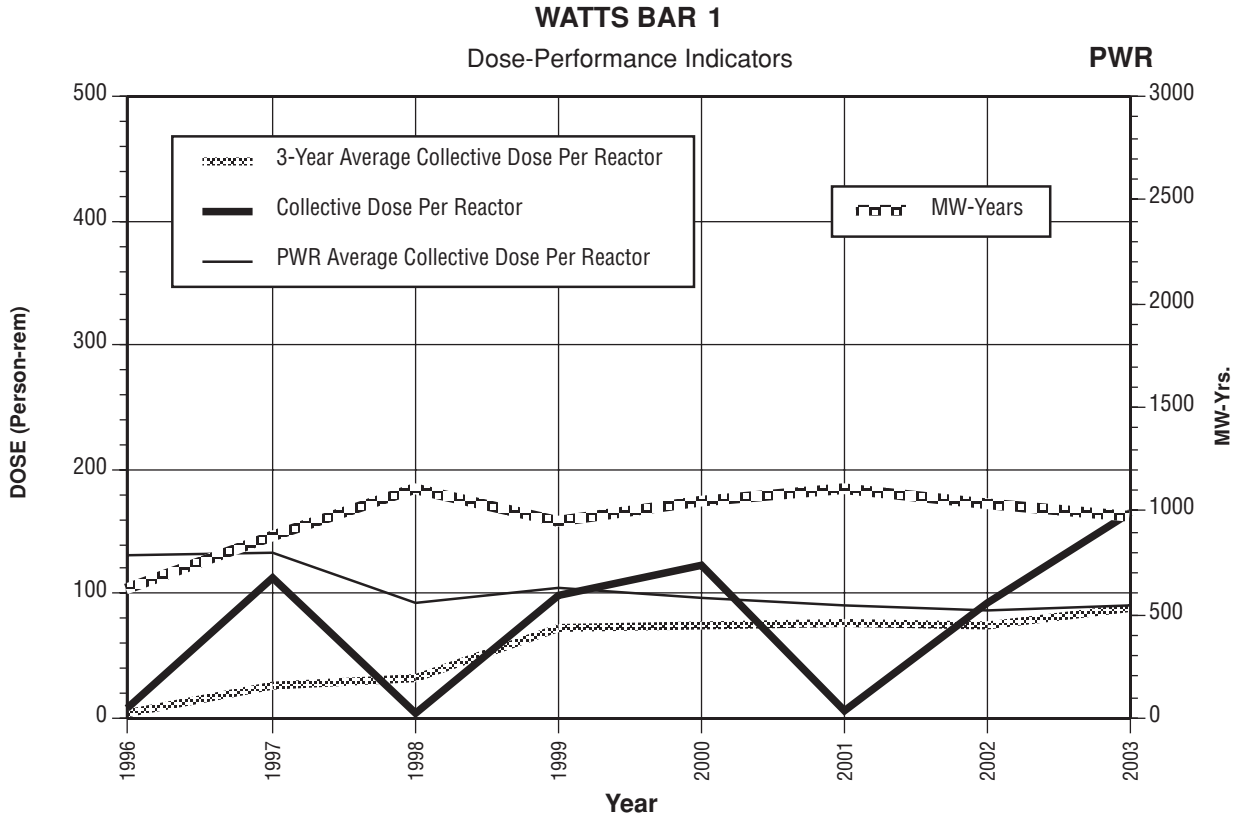
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Collective Dose Per Reactor
PWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year
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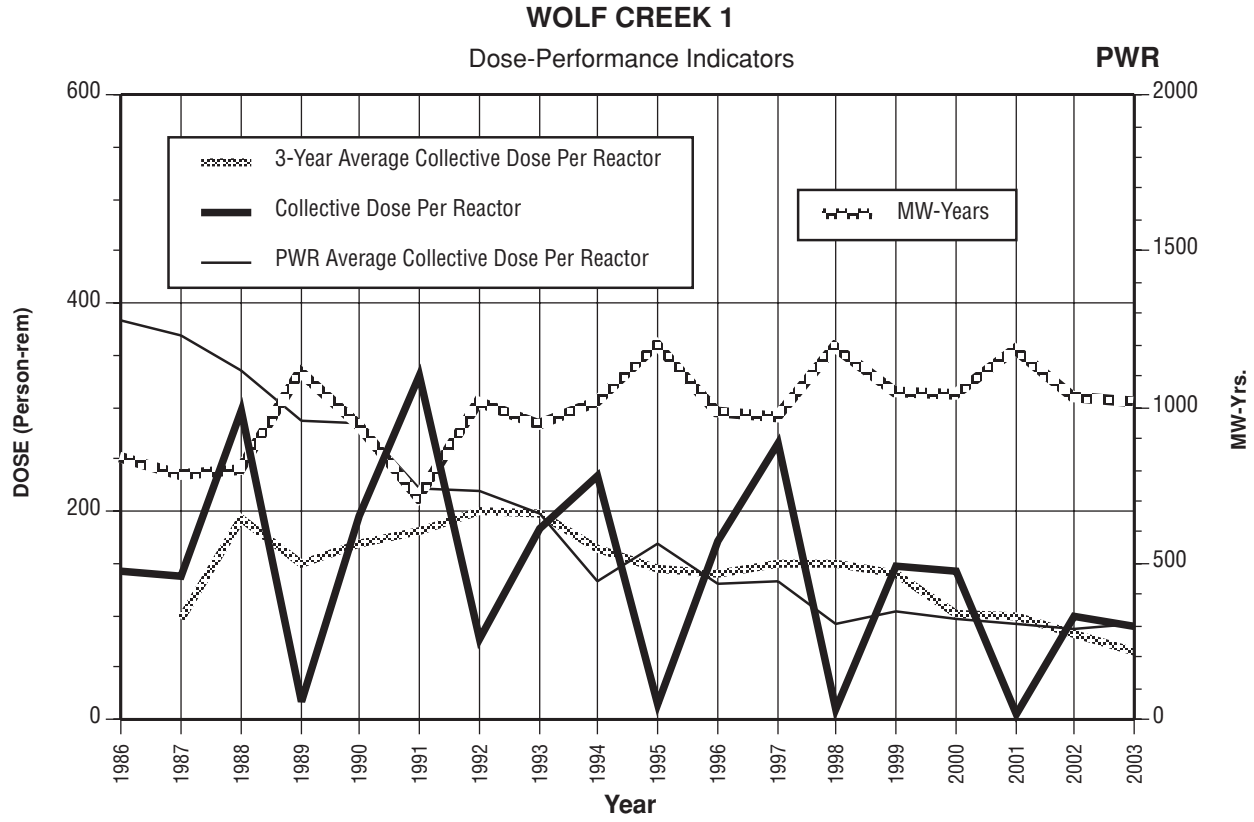
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Collective Dose Per Reactor
PWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
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11. ABSTRACT *(200 words or less)*

This report summarizes the 2003 occupational radiation exposure data that are maintained in the U.S. Nuclear Regulatory Commission's (NRC's) Radiation Exposure Information and Reporting System (REIRS) database. The bulk of the information contained in the report was compiled from the 2003 annual reports submitted by five of the seven categories of NRC licensees subject to the reporting requirements of 10 CFR 20.2206. Annual Reports of occupationsl radiation exposure for 2003 were received from 223 NRC licensees, of which 104 were operators of nuclear power plants in commercial operation.

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