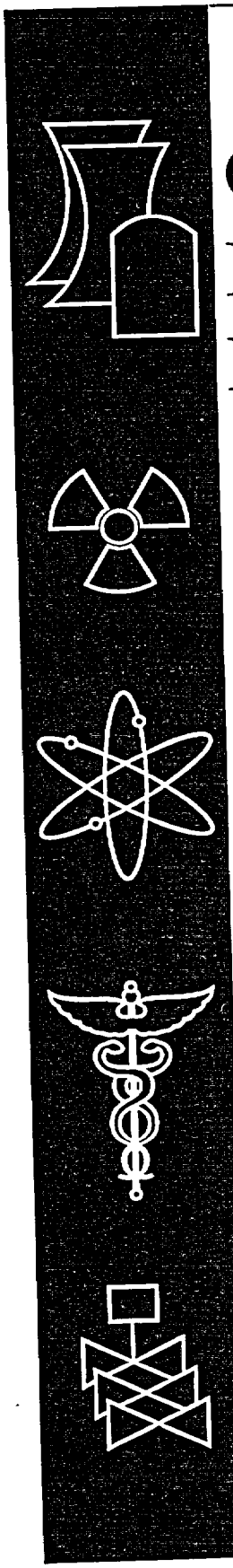
NUREG-0713
Vol. 23



Occupational Radiation Exposure at Commercial Nuclear Power Reactors and Other Facilities 2001

Thirty-Fourth Annual Report

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

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NUREG-0713
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Prepared by:
S.A. Burrows and D.A. Hagemeyer*

*Science Applications International Corporation
301 Laboratory Road
Oak Ridge, TN 37830

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Division of Systems Analysis and Regulatory Effectiveness
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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.
NUREG-0323	Occupational Radiation Exposure at Light Water Cooled Power Reactors, 1969-1976, U.S. Nuclear Regulatory Commission, March 1978.
NUREG-0482	Occupational Radiation Exposure at Light Water Cooled Power Reactors, 1977, U.S. Nuclear Regulatory Commission, May 1979.
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.
NUREG-0713	Occupational Radiation Exposure at Commercial Nuclear Power Reactors 1982, Vol. 4, U S. Nuclear Regulatory Commission, December 1983.
NUREG-0713	Occupational Radiation Exposure at Commercial Nuclear Power Reactors 1983, Vol. 5, U.S. Nuclear Regulatory Commission, March 1985.
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.
NUREG-0713	Occupational Radiation Exposure at Commercial Nuclear Power Reactors and Other Facilities 1986, Vol. 8, U.S. Nuclear Regulatory Commission, August 1989.
NUREG-0713	Occupational Radiation Exposure at Commercial, Nuclear Power Reactors and Other Facilities 1987, Vol. 9, U.S. Nuclear Regulatory Commission, November 1990.
NUREG-0713	Occupational Radiation Exposure at Commercial Nuclear Power Reactors and Other Facilities 1988, Vol. 10, U.S. Nuclear Regulatory Commission, July 1991
NUREG-0713	Occupational Radiation Exposure at Commercial Nuclear Power Reactors and Other Facilities 1989, Vol. 11, U S. Nuclear Regulatory Commission, April 1992.
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.
NUREG-0713	Occupational Radiation Exposure at Commercial Nuclear Power Reactors and Other Facilities 1995, Vol. 17, U S. Nuclear Regulatory Commission, January 1997.
NUREG-0713	Occupational Radiation Exposure at Commercial Nuclear Power Reactors and Other Facilities 1996, Vol. 18, U.S. Nuclear Regulatory Commission, February 1998.
NUREG-0713	Occupational Radiation Exposure at Commercial Nuclear Power Reactors and Other Facilities 1997, Vol. 19, U.S. Nuclear Regulatory Commission, November 1998
NUREG-0713	Occupational Radiation Exposure at Commercial Nuclear Power Reactors and Other Facilities 1998, Vol. 20, U S. Nuclear Regulatory Commission, November 1999.
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

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 2001 annual reports submitted by six 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, only six categories will be considered in this report.

Annual reports for 2001 were received from a total of **272** NRC licensees, of which **104** were operators of nuclear power reactors in commercial operation. Compilations of the reports submitted by the 272 licensees indicated that **118,834** individuals were monitored, **60,750** of whom received a measurable dose (Table 3.1). The collective dose incurred by these individuals was **14,746** person-rem, which represents an **7% decrease** from the 2000 value. The number of workers receiving a measurable dose also decreased, resulting in an average measurable dose of **0.24** rem for 2001. 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 2001, the annual collective dose per reactor for light water reactor (LWR) licensees was **107** person-rem. This represents a 12% decrease from the value reported for 2000 (122). The annual collective dose per reactor for boiling water reactors (BWRs) was **138** person-rem and, for pressurized water reactors (PWRs), it was **91** person-rem.

Analyses of transient worker data indicate that **22,301** 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 2001, the average measurable dose per worker for all licensees calculated from reported data was **0.19** rem. The corrected dose distribution resulted in an average measurable dose per worker for all licensees of **0.24** rem.

[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.

[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

The NRC currently has a 5-year contract with Science Applications International Corporation (SAIC) to assist the NRC Staff in the preparation of the NUREG-0713 series. Mr. Charles Hinson (NRR) assisted in the preparation of this NUREG, serving as the NRC Technical reviewer. SAIC will be suggesting changes in the presentation of certain data in these reports. Readers should be alert to these changes, and the NRC welcomes responses, especially where these changes can be improved upon.

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

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

LIST OF FIGURES

LIST OF FIGURES (Continued)

LIST OF TABLES

LIST OF TABLES (Continued)

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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 trends, of the effectiveness of the overall NRC/licensee radiation protection and as low as reasonably achievable (ALARA) efforts by certain 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 provide for the monitoring of transient workers who may affect dose distribution statistics through multiple counting.

4. 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?).

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

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

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

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

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FOREWORD

NUREG-0713, Volume 23, summarizes the 2001 occupational radiation exposure data maintained in the U.S. Nuclear Regulatory Commission's Radiation Exposure Information Reporting System. Certain classes of licensees are required to annually report individual exposure in accordance with 10 CFR 20.2206.

The occupational radiation exposure data contained in this volume of NUREG-0713 is a compilation of the annual reports received from 272 licensees required to submit annual reports. The collective dose incurred by these individuals was 14,746 person-rem, which represents an 7% decrease from the 2000 value.

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

[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.

of Energy (DOE), is collected and published by DOE's Office of Safety and Health, a division of Environment, Safety and Health, in Germantown, Maryland.

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, or they may be purchased from the National Technical Information Service, as shown in the Reference section.

In May of 1991, the revised 10 CFR 20 "Standards for Protection Against Radiation; Final Rule" was published in the Federal Register. 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. This report is the eighth compilation of radiation exposure information collected under the revised 10 CFR 20. Certain sections of the report have been modified to account for the change in the reporting of exposure information. Readers are encouraged to comment on these changes.

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. 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:

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The NRC radiation exposure information web URL address is:

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

REIRS Project Manager
Office of Nuclear Regulatory Research
U.S. Nuclear Regulatory Commission
Washington, DC 20555

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. 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 2001 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 to report 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 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 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 August 2002, there are 32 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 feels that monitoring devices should be provided.

For licensees submitting under the revised 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. The revised 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 2001 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 2001 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 six 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. Agreement State licensees do not submit such 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) 1993 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 collective dose above 1.5 rem divided by the total annual collective dose. The UNSCEAR 1993 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

TABLE 3.1

Average Annual Exposure Data for Certain Categories of NRC Licensees 1992 - 2001

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	1992	246	6,703	4,265	1,864	0 28	0 44
	1993	176	4,721	3,007	1,596	0 34	0 53
	1994	139	2,886	2,007	1,415	0 49	0 71
03310	1995	149	3,761	2,651	1,443	0 38	0 54
03320	1996	148	3,766	2,639	1,449	0.38	0.55
	1997	148	3,570	2,574	1,356	0 38	0.53
	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	123	3,778	3,161	2,111	0.56	0.67
Manufacturing and Distribution	1992	67	5,210	2,250	784	0.15	0 35
	1993	58	4,913	2,254	680	0.14	0 30
	1994	44	2,941	1,251	580	0 20	0 46
	1995	36	2,666	1,222	595	0 22	0 49
02500	1996	38	2,631	1,241	556	0 21	0.45
03211	1997	33	1,154	665	397	0 34	0.60
03212	1998	31	1,986	654	402	0 20	0.61
03214	1999	39	2,181	836	419	0 19	0 50
	2000	39	2,461	1,188	415	0 17	0 35
	2001	34	1,829	1,210	351	0 19	0 29
Low-Level Waste Disposal**	1992	2	467	82	37	0 08	0 45
	1993	2	432	76	21	0 05	0 27
	1994	2	202	83	22	0 11	0 27
	1995	2	212	56	8	0 04	0.15
03231	1996	2	165	67	8	0 05	0 12
	1997	2	185	50	5	0 03	0.11
	1998	1	27	13	1	0 05	0 10
Independent Spent Fuel Storage	1992	2	290	85	11	0.04	0.13
	1993	2	135	52	14	0 10	0.26
	1994	1	158	89	42	0 27	0 47
	1995	1	104	49	51	0 49	1 04
23100	1996	1	97	53	54	0.56	1 02
23200	1997	1	55	24	6	0 11	0 24
	1998	1	53	21	3	0 05	0 12
	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
Fuel Cycle Licenses - Fabrication Processing and Uranium Enrich.	1992	11	8,439	5,061	545	0 06	0.11
	1993	8	9,649	2,611	339	0 04	0.13
	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
21200	1999	9	9,693	3,927	1,020	0 11	0 26
21210	2000	9	9,336	4,649	1,339	0.14	0 29
	2001	9	8,145	3,980	1,162	0.14	0 29
Commercial Light Water Reactors***	1992	110	181,889	94,172	29,297	0.16	0 31
	1993	108	169,259	86,193	26,364	0.16	0 31
	1994	109	139,390	71,613	21,704	0.16	0 30
	1995	109	132,266	70,821	21,688	0 16	0 31
41111	1996	109	126,402	68,305	18,883	0.15	0 28
	1997	109	126,781	68,372	17,149	0.14	0 25
	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
Grand Totals and Averages	1992	438	202,998	105,915	32,537	0 16	0.31
	1993	354	189,109	94,193	29,013	0 15	0.31
	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	272	118,834	60,750	14,746	0 12	0 24

* These categories consist only of NRC licensees Agreement State licensed organizations do not 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)

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 0.100 rem, 0.250 rem, 0.500 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 0.500 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. Eighty-nine percent of the reported workers with measurable doses were monitored by nuclear power facilities in 2001, where they received 75% of the total collective dose.

Under the regulatory limits of the revised 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 11 years, the percentage of workers with <2 rem has been ≥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 in 2001 (see Section 6).

TABLE 3.2
Distribution of Annual Collective TEDE by License Category
2001

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 (19)	177	68	2	6	1	1	1							256	79	5.913
Multiple Location (104)	440	858	506	450	299	238	472	148	71	40				3,522	3,082	2,105 033
Total (123)	617	926	508	456	300	239	473	148	71	40				3,778	3,161	2,110 946
MANUFACTURING AND DISTRIBUTION																
"A" - Broad (4)	265	115	49	51	21	26	53	36						616	351	232.367
Limited (30)	354	630	134	50	21	9	3	5	4	3				1,213	859	118.698
Total (34)	619	745	183	101	42	35	56	41	4	3				1,829	1,210	351.065
LOW-LEVEL WASTE DISPOSAL																
Total (0)**																
INDEPENDENT SPENT FUEL STORAGE																
Total (2)	47	64	23	19	1									154	107	13 088
FUEL CYCLE LICENSES* **																
Total (9)	4,165	2,177	832	451	151	84	140	83	55	7				8,145	3,980	1,162 262
COMMERCIAL POWER REACTORS***																
Boiling Water (35)	25,462	15,544	6,686	4,362	1,462	477	262	4						54,259	28,797	4,835 397
Pressurized Water (69)	47,744	21,917	9,392	4,869	1,468	583	485	59						86,517	38,773	6,273.155
Total (104)	73,206	37,461	16,078	9,231	2,930	1,060	747	63						140,776	67,570	11,108.552
GRAND TOTALS	**78,654**	**41,373**	**17,624**	**10,258**	**3,424**	**1,418**	**1,416**	**335**	**130**	**50**				**154,682**	**76,028**	**14,745.913**

* 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 2001. 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 - 2001

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	154,682	118,115	99.4% (734)	>99.99% (1)	0

* Licensees required to submit radiation exposure reports to the NRC under 10 CFR 20 2206

** Data for 1985-2001 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 1985-2001

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 123 radiography licensees in 2001. Table 3.4 summarizes the reported data for the two types of radiography licenses for 2001 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 25% 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 2001.

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
1999 - 2001

Year	Type of License	Number of Licensees	Number of Monitored Individuals	Workers With Measurable Dose	Collective Dose (person-rem)	Average Measurable Dose (rem)
1999	Single Location	21	266	50	7	0.14
	Multiple Locations	111	3,571	2,777	1,544	0.56
	Total	**132**	**3,837**	**2,827**	**1,551**	**0.55**
2000	Single Location	21	257	78	8	0.10
	Multiple Locations	108	3,111	2,464	1,520	0.62
	Total	**129**	**3,368**	**2,542**	**1,528**	**0.60**
2001	Single Location	19	256	79	6	0.07
	Multiple Locations	104	3,522	3,082	2,105	0.68
	Total	**123**	**3,778**	**3,161**	**2,111**	**0.67**

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 2001. The collective TEDE, the number of workers with measurable TEDE, and the average measurable TEDE increased from 2000 to 2001. The average measurable TEDE increased by 12% from 0.60 rem in 2000 to 0.67 rem in 2001. 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 20% to 40% of the collective dose delivered to individuals above 2 rem. Since 1999, there have been increases in the percentage of dose for each dose range above 0.500 rem.

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

TABLE 3.5
Annual Exposure Information for Manufacturers and Distributors
1999 - 2001

Year	Type of License	Number of Licensees	Number of Monitored Individuals	Workers With Measurable Dose	Collective Dose (person-rem)	Average Measurable Dose (rem)
1999	M & D - "A" - Broad	5	1,261	352	347	0.99
	M & D - Limited	34	920	484	72	0.15
	Total	**39**	**2,181**	**836**	**419**	**0.50**
2000	M & D - "A" - Broad	4	1,351	419	298	0.71
	M & D - Limited	35	1,110	769	118	0.15
	Total	**39**	**2,461**	**1,188**	**415**	**0.35**
2001	M & D - "A" - Broad	4	616	351	232	0 66
	M & D - Limited	30	1,213	859	119	0.14
	Total	**34**	**1,829**	**1,210**	**351**	**0.29**

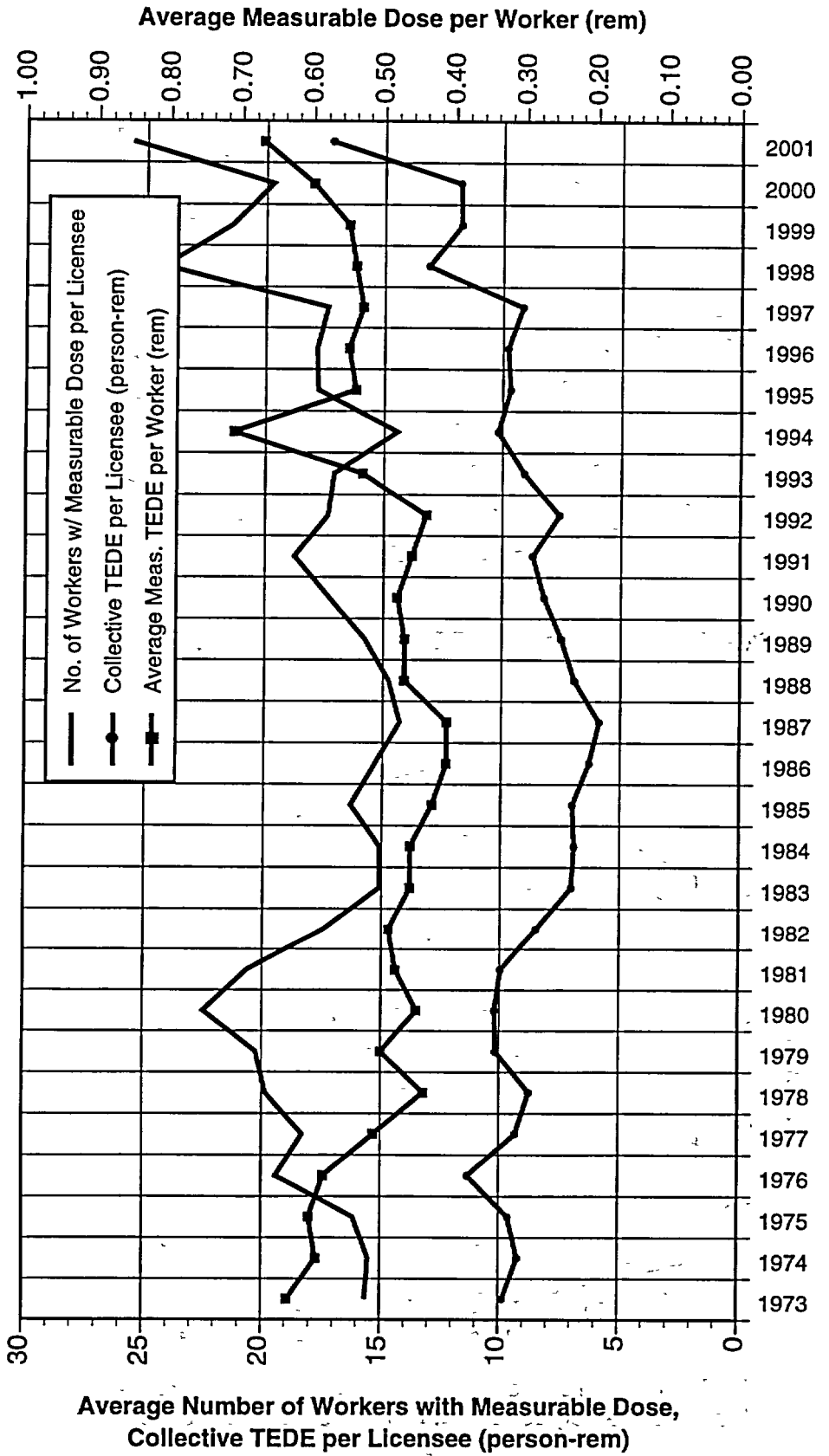


FIGURE 3.1. Average Annual Values at Industrial Radiography Facilities 1973 - 2001

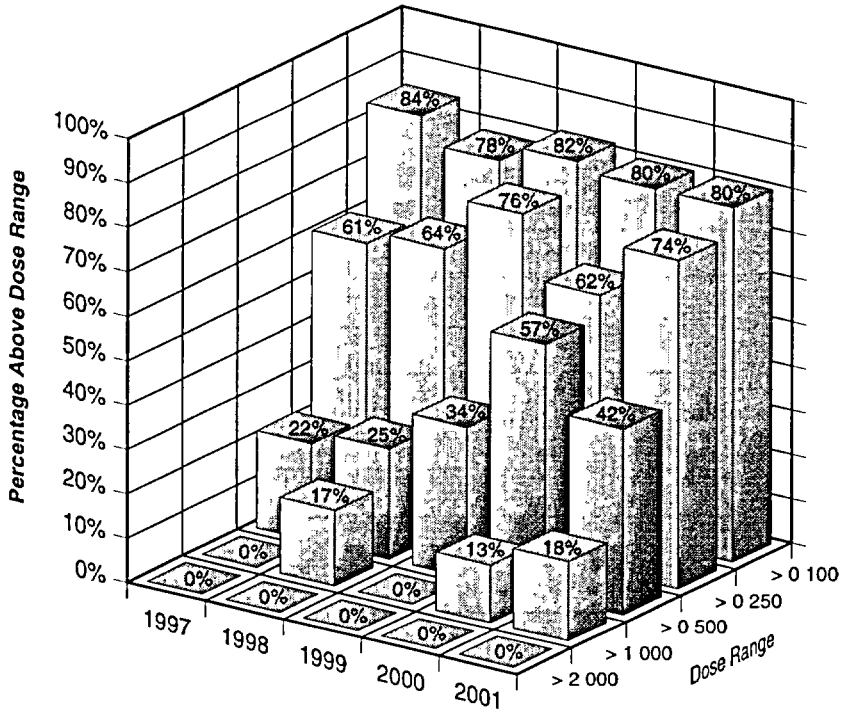


FIGURE 3.2. Collective TEDE Distribution by Dose Range
Industrial Radiographer – Single Location Licensees
1997 - 2001

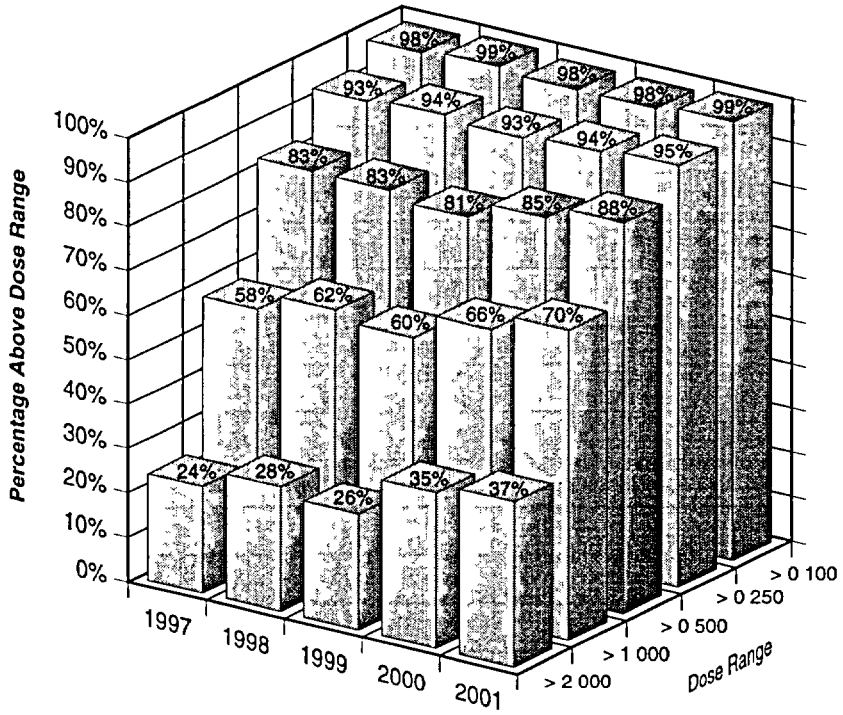


FIGURE 3.3. Collective TEDE Distribution by Dose Range
Industrial Radiographer – Multiple Location Licensees
1997 - 2001

nonmedical research. However, only those NRC licensees that possess or use at any one time specified quantities of the nuclides listed in paragraph 10 CFR 20.2206(a)(7) are required to submit reports to the NRC.

Table 3.5 presents the annual data that were reported by the two types of licensees for 2001 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 all of the parameters 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.

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 over 93% of the collective dose for this category of licensee in 2001. Several of the Type "A" Broad licensees that have reported significant dose in prior years have been transferred to Agreement State licensees. 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. For 1997 through 2000, over 55% of the collective dose was received by individuals above 2 rem. In 2001, this percentage decreased for the second consecutive year to 40%. Limited licensees exhibit a distribution of the collective dose where individuals below 0.500 rem receive most of the collective dose. However, the percentage of the collective dose above 1 rem has increased for the past 2 years.

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 2001.

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, no licensees have conducted these activities that are not 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. Figure 3.8 shows the collective dose distribution by dose range (see Section 3.1.8) for Low-Level Waste Disposal licensees for the past 5 years.

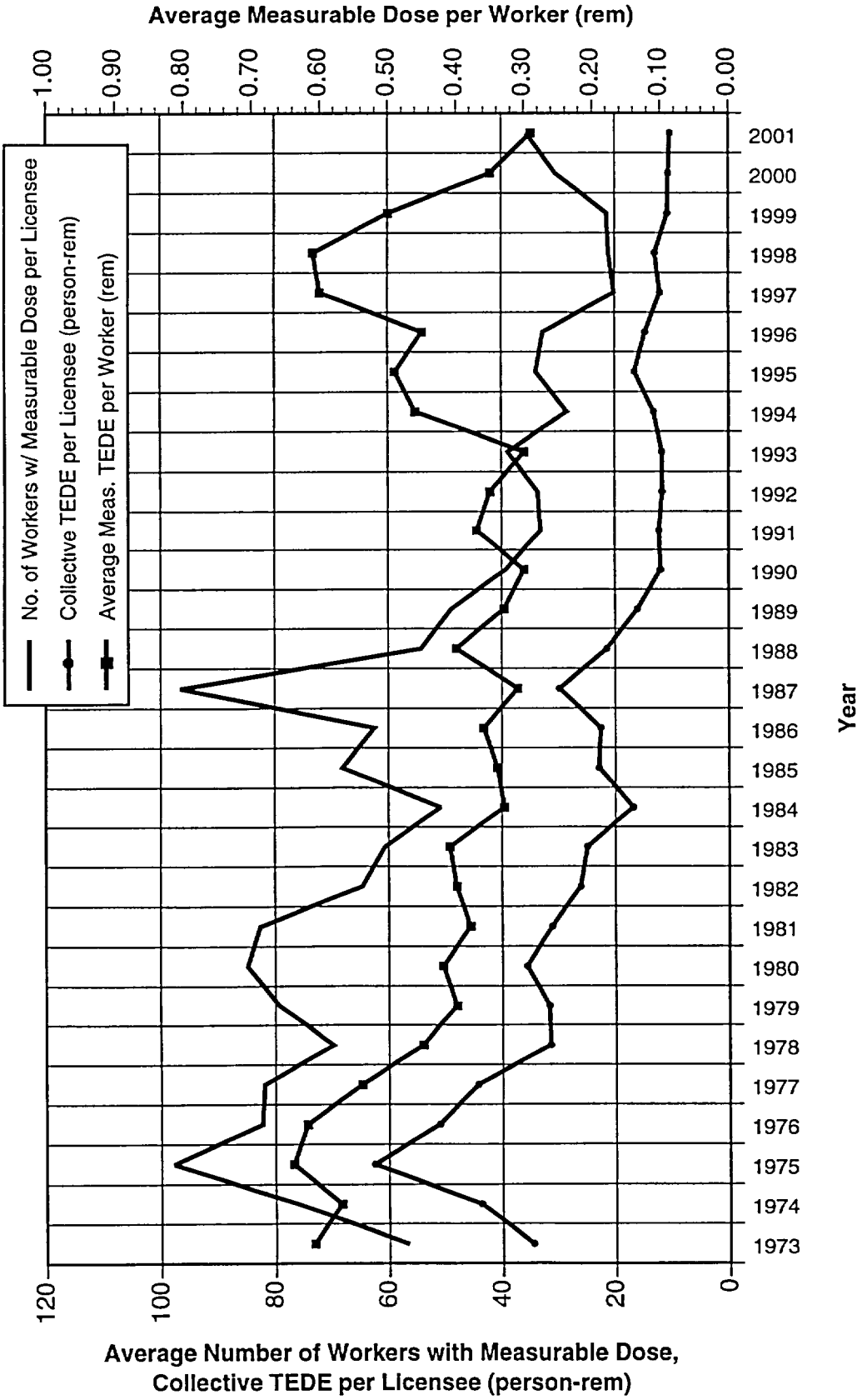


FIGURE 3.4. Average Annual Values at Manufacturing and Distribution Facilities 1973 - 2001

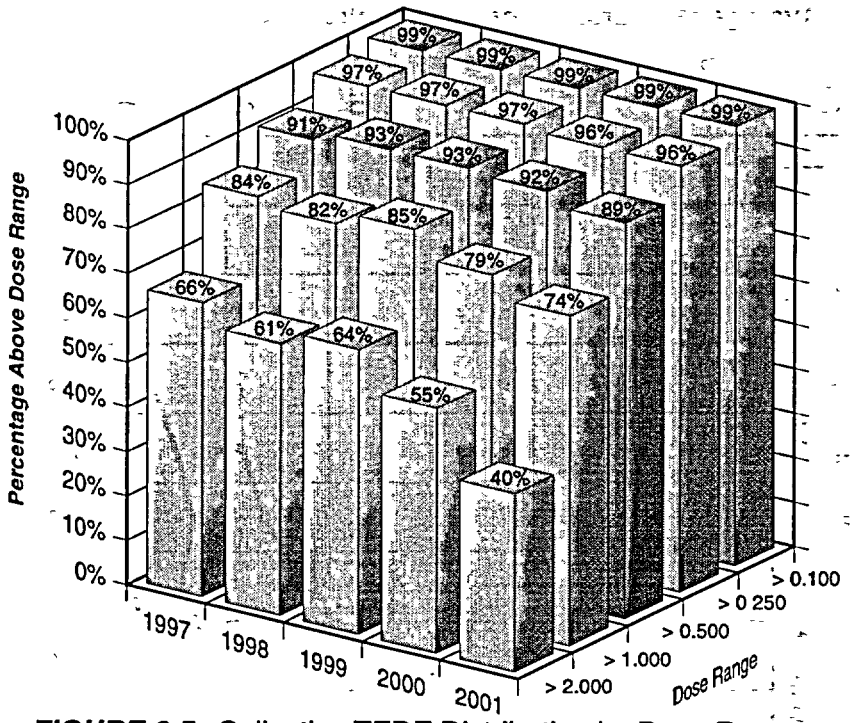


FIGURE 3.5. Collective TEDE Distribution by Dose Range
Type "A" Broad Manufacturing and Distribution Licensees
1997 - 2001

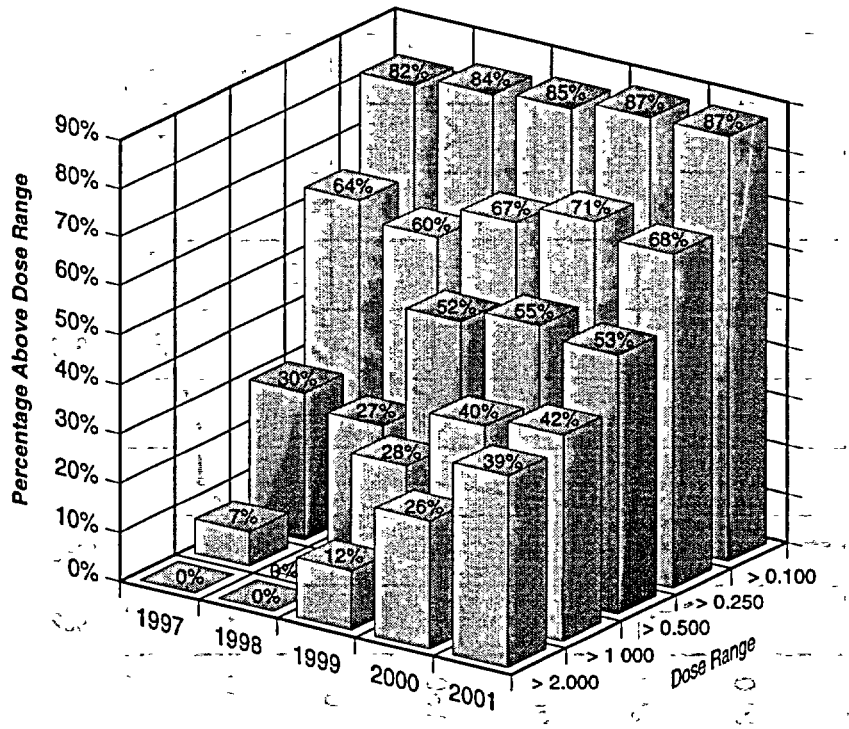


FIGURE 3.6. Collective TEDE Distribution by Dose Range
Limited Manufacturing and Distribution Licensees
1997 - 2001

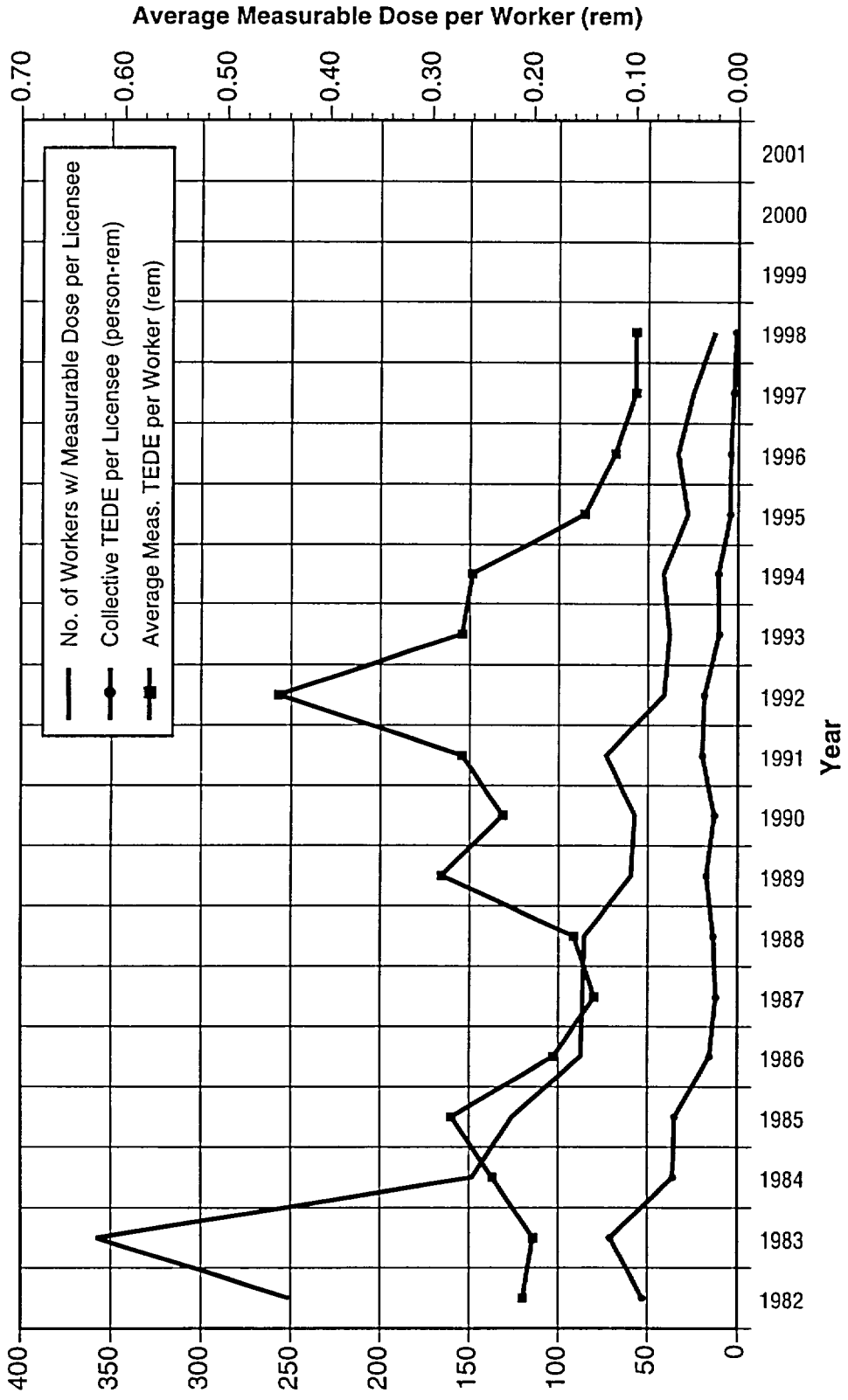


FIGURE 3.7. Average Annual Values at Low-Level Waste Disposal Facilities 1982 - 1998

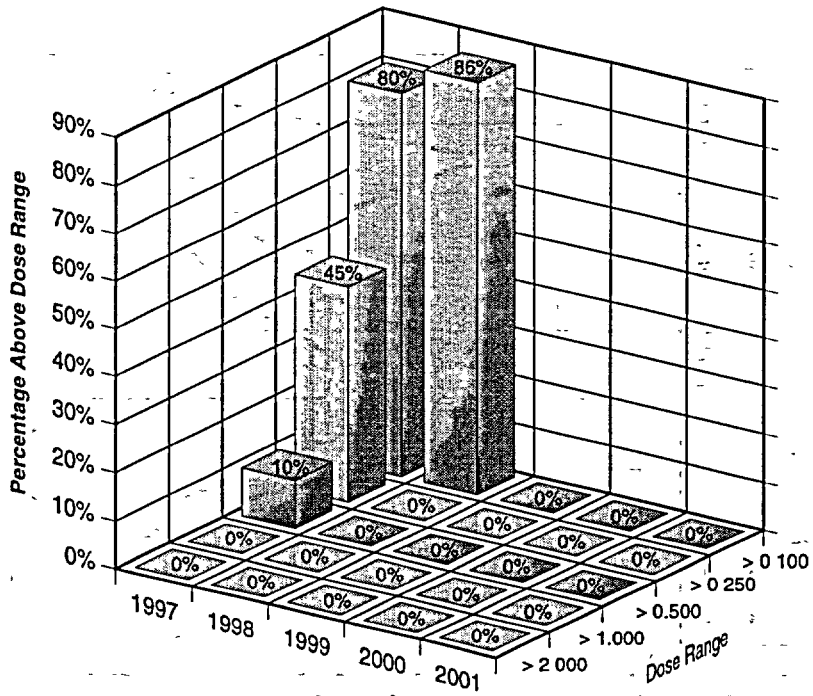
Note As of 1999, there are no longer any NRC licensees involved in this activity All low-level waste disposal facilities are now located in Agreement States and no longer report to the NRC

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.

Forty-one licenses were authorized to conduct these activities during 2001. Eighteen of these licenses are for activities involving cask design and storage systems. Twenty-one 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. 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. Appendix A summarizes the exposure information reported by these two installations.

Figure 3.9 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



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. Collective TEDE Distribution by Dose Range Low-Level Waste Disposal Licensees 1997 - 2001

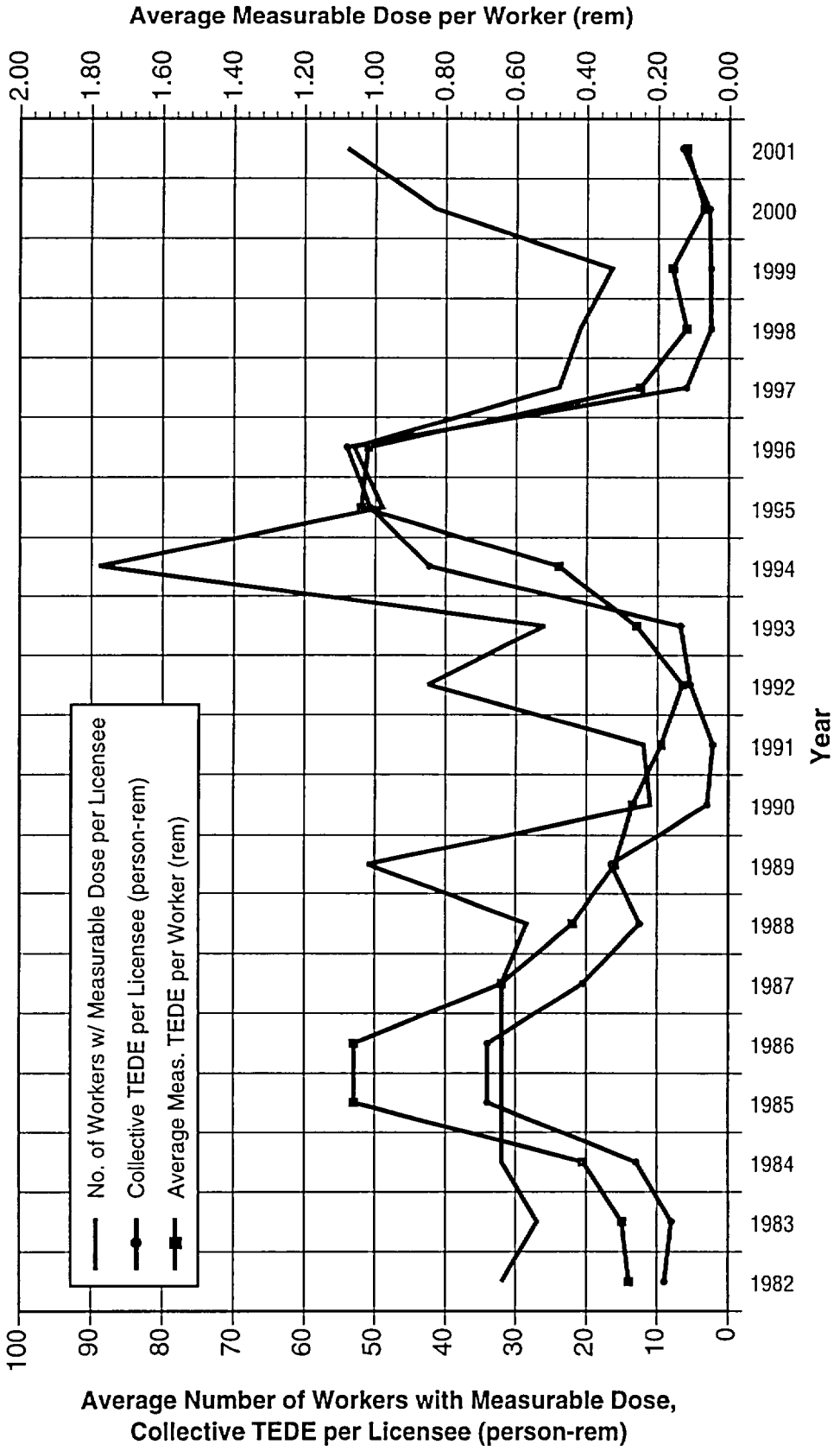


FIGURE 3.9. Average Annual Values at Independent Spent Fuel Storage Facilities 1982 - 2001

through 1998, rather than the two licensees that reported in prior years. All parameters decreased significantly from 1996 to 2000, but have increased from 2000 to 2001. This is due to increases in the number of workers with measurable dose and the collective dose reported by DOE from the storage of the TMI-2 fuel. Figure 3.10 shows the collective dose distribution by dose range (see Section 3.1.8) for ISFSI licensees from 1997 to 2001. The percentages for each dose range have decreased significantly since 1997.

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

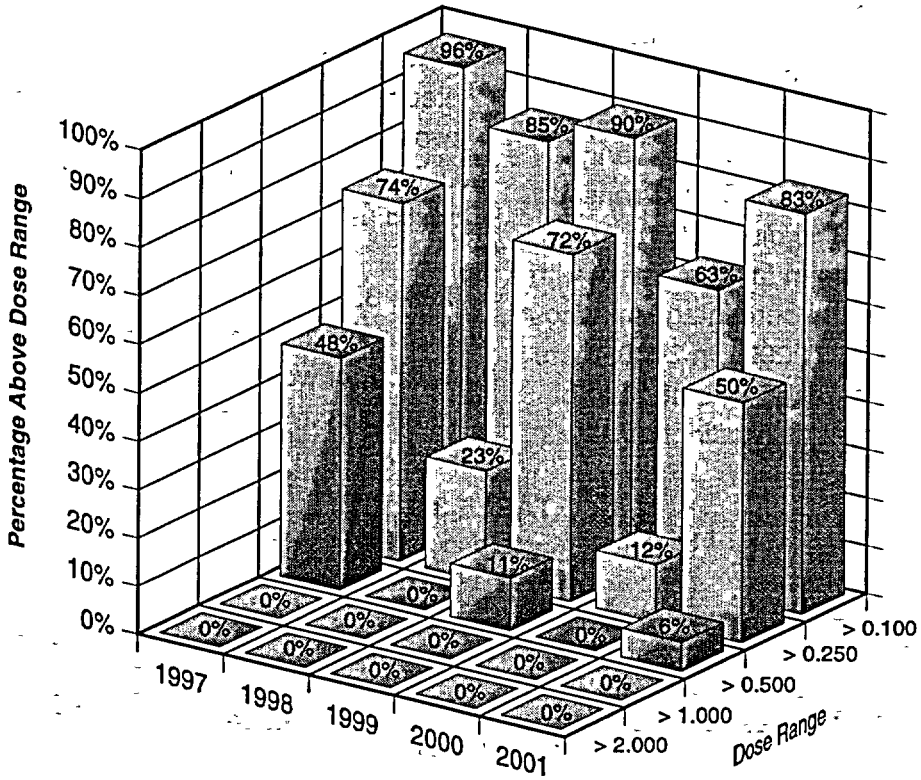


FIGURE 3.10. Collective TEDE Distribution by Dose Range
Independent Spent Fuel Storage Licensees
1997 - 2001

uranium from scrap and other off-specification materials prior to disposal of these materials. For 1997 to 2001, 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 3.11 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 3.12 shows the collective dose distribution by dose range (see Section 3.1.8) for Fuel Cycle licensees from 1997 to 2001. The distribution of collective dose has been fairly constant with a decreasing trend in the percentage in almost every dose range until 2000. In 2000, there was a three-fold increase in the number of individuals over 2 rem at Westinghouse Commercial Nuclear Fuel Division in South Carolina, which resulted in an increased percentage of the dose in each dose range for 2000 and 2001. Appendix A lists each of the licensees reporting in 2001, 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 9 licensed Fuel Cycle (Fabrication and Enrichment) facilities reporting in 2001.

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

TABLE 3.6
Annual Exposure Information for Fuel Cycle Licenses
1999 - 2001

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)
1999	Fuel Cycle	9	9,693	3,927	1,020	0.26	3,207	247	0 08	2,462	773	0 31
2000	Fuel Cycle	9	9,336	4,649	1,339	0 29	3,582	406	0.11	2,784	934	0 34
2001	Fuel Cycle	9	8,145	3,980	1,162	0 29	3,295	362	0 11	2,577	800	0 31

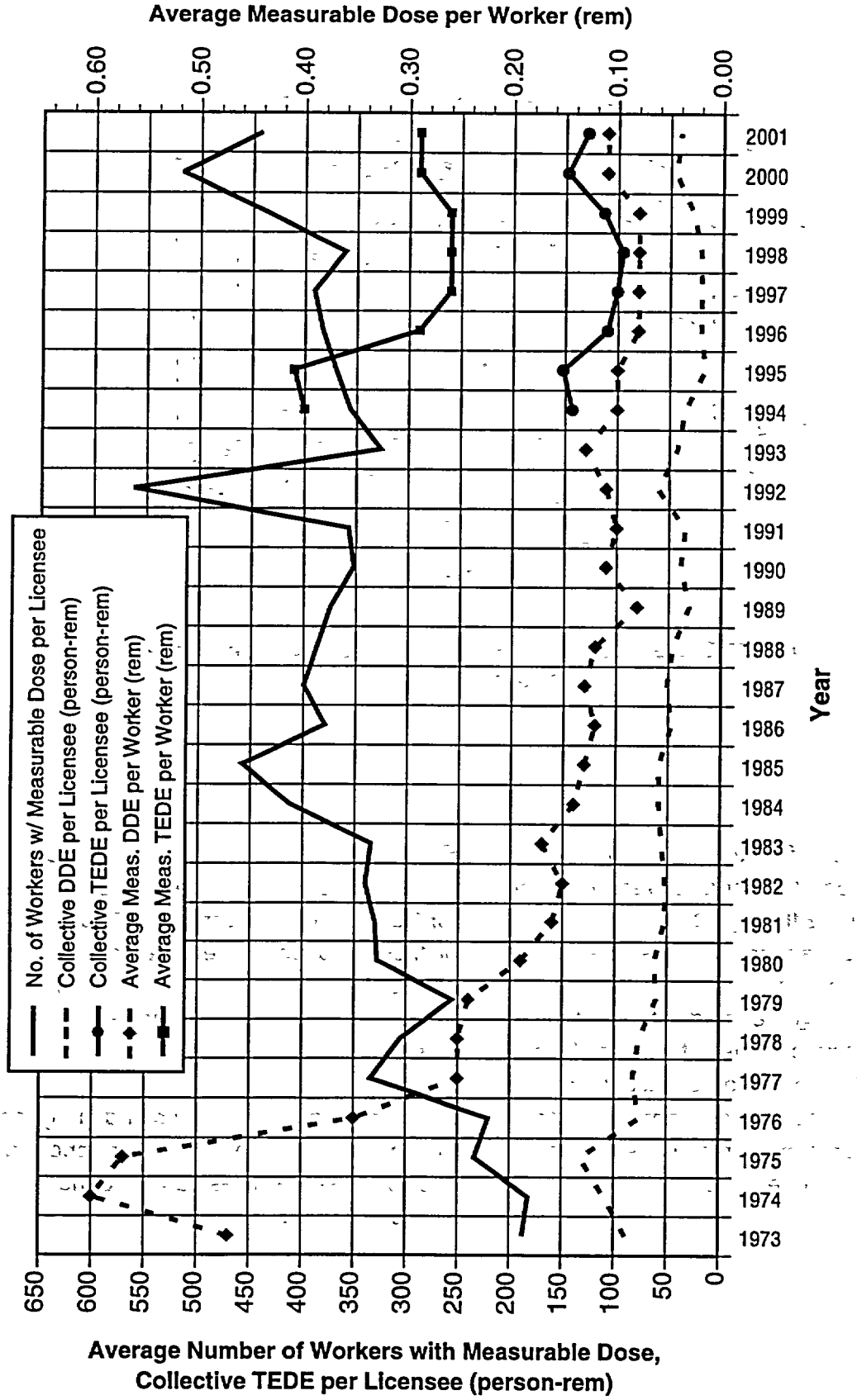


FIGURE 3.11. Average Annual Values at Fuel Cycle Licensees 1973 - 2001

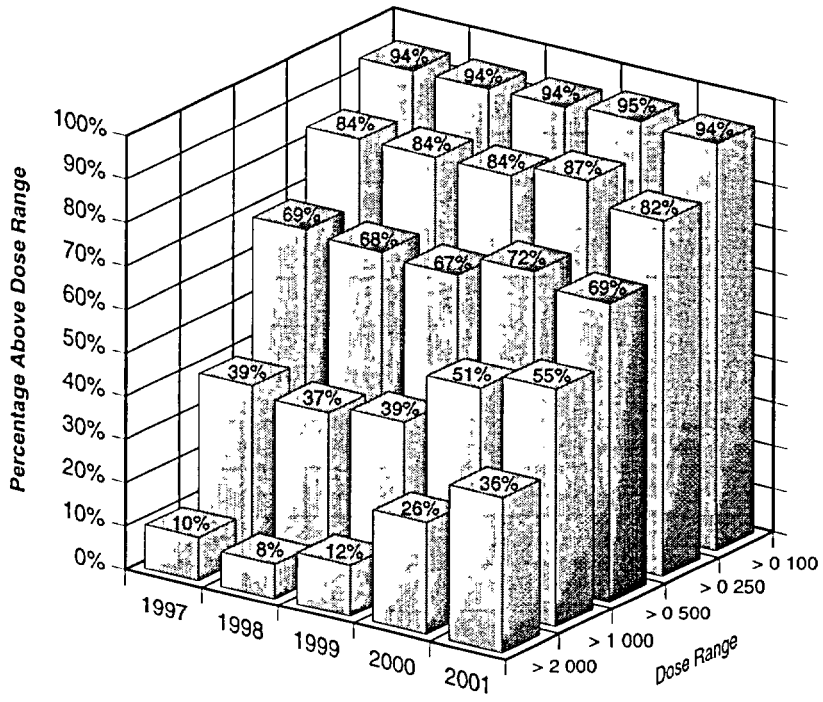


FIGURE 3.12. Collective TEDE Distribution by Dose Range
Fuel Cycle Licensees
1997 - 2001

worker for reactor facilities that were in commercial operation for a full year for each of the years 1992 through 2001. The values do not include reactors that have been 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 2001 is presented in alphabetical order by site name in Appendix B.

Figure 3.13 shows the collective dose distribution by dose range (see Section 3.1.8) for Reactor licensees from 1997 to 2001. The distribution of collective dose has been fairly constant with a decreasing trend in the percentage in every dose range over the past 5 years.

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

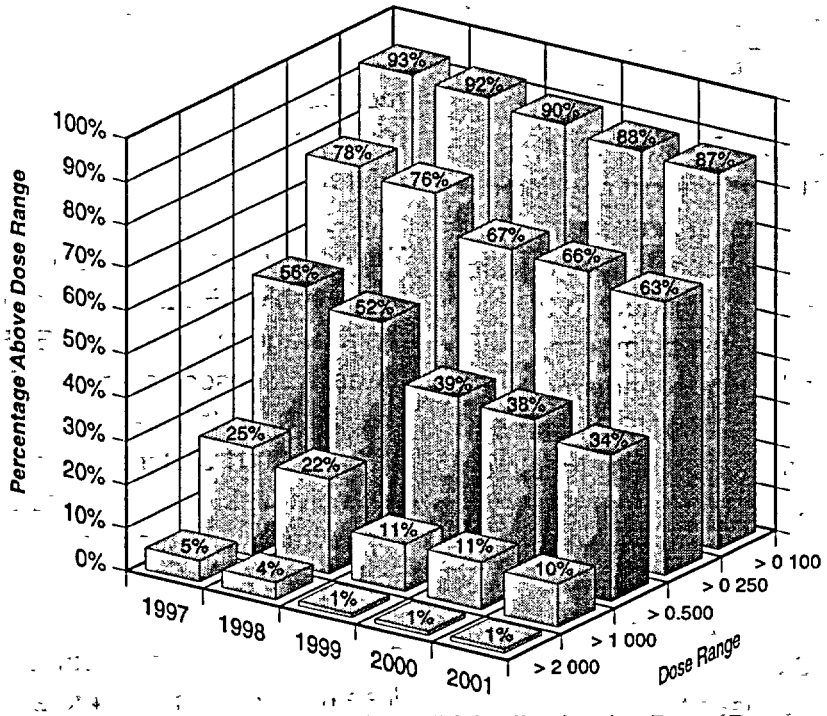


FIGURE 3.13. Collective TEDE Distribution by Dose Range
Reactor Licensees
1997 - 2001

3.4 SUMMARY OF INTAKE DATA BY LICENSE CATEGORY

With the revision of 10 CFR 20 in 1994, licensees were required to report additional data to the NRC concerning intakes of radioactive material. Licensees were 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 2001. 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. 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 (99%) in 2001 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 2001 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.

In 2001, the highest CEDE was 4.011 rem, received by an individual at Westinghouse Electric Company, a fuel fabrication facility. The individual received an intake of U-234, U-235, and U-238 from inhalation. The highest CDE was 34.887 rem to this same individual.

TABLE 3.7

Intake by Licensee Type and Radionuclide Mode of Intake – *Ingestion and Other*
2001

Mode	Licensee Type	Program Code	Radionuclide	Number of Intake Records*	Collective Intake in Microcuries**	Collective Intake in Microcuries (sci. notation)
Ingestion	Power Reactors	41111	AG-110M	1	0.055	5.50E-02
		41111	AM-241	27	0.003	2.84E-03
		41111	CE-144	2	0.001	1.43E-03
		41111	CM-242	25	0.000	2.14E-05
		41111	CM-243	26	0.001	9.85E-04
		41111	CM-244	1	0.000	1.56E-06
		41111	CO-58	13	0.102	1.02E-01
		41111	CO-60	**43**	**0.452**	**4.52E-01**
		41111	CS-134	1	0.259	2.59E-01
		41111	CS-137	2	0.315	3.15E-01
		41111	I-131	1	0.112	1.12E-01
		41111	MN-54	14	0.129	1.29E-01
		41111	NB-95	3	0.354	3.54E-01
		41111	PU-238	27	0.002	2.01E-03
		41111	PU-239	25	0.001	6.98E-04
		41111	PU-241	25	0.041	4.06E-02
		41111	RU-106	1	0.304	3.04E-01
		41111	SR-90	2	0.001	7.45E-04
		41111	ZR-95	2	0.266	2.66E-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

Intake by Licensee Type and Radionuclide Mode of Intake – *Inhalation*

2001

Licensee Type	Program Code	Radionuclide	Pulmonary Clearance Class	Number of Intake Records*	Collective Intake in Microcuries**	Collective Intake in Microcuries (sci. notation)
Nuclear Pharmacies	02500	I-123	D	4	2.800	2.80E+00
	02500	I-131	D	39	0.402	4.02E-01
	02500	I-131	W	38	0 520	5 20E-01
	02500	TC-99M	D	5	5,755.000	5.76E+03
Manufacturing and Distribution	03211	I-131	D	1	0.641	6.41E-01
Uranium Enrichment	21200	TC-99	D	10	8.331	8.33E+00
	21200	TC-99	W	1	0.759	7 59E-01
	21200	TH-230	W	2	0.000	2.27E-05
	21200	U-234	D	85	0.033	3.31E-02
Fuel Fabrication	21210	AM-241	W	172	0.001	1.34E-03
	21210	PU-239	W	255	0 006	6.32E-03
	21210	PU-239	Y	18	0 000	8.88E-05
	21210	TC-99	W	1	0 000	1.10E-05
	21210	TH-228	W	25	0 000	1 98E-04
	21210	TH-228	Y	17	0 000	1.14E-06
	21210	TH-230	W	23	0 000	7 68E-05
	21210	TH-230	Y	17	0.000	5 24E-07
	21210	TH-232	Y	258	0.002	2.23E-03
	21210	U-234	D	721	0.364	3.64E-01
	21210	U-234	F	1	0 004	3.60E-03
	21210	U-234	S	311	1 678	1 68E+00
	21210	U-234	W	484	0 042	4.18E-02
	21210	U-234	Y	2,379	6.571	6.57E+00
	21210	U-235	D	234	0.004	3 56E-03
	21210	U-235	S	311	0.045	4 45E-02
	21210	U-235	Y	1,063	0.165	1.65E-01
	21210	U-236	D	233	0.000	1.40E-04
	21210	U-236	S	204	0.003	2.92E-03
	21210	U-236	Y	389	0.001	8.07E-04
	21210	U-238	D	308	0 022	2.16E-02
	21210	U-238	S	204	0 038	3.81E-02
	21210	U-238	W	21	0 000	2.72E-04
	21210	U-238	Y	2,000	3 022	3 02E+00
Power Reactors	41111	AG-110M	Y	5	0 681	6 81E-01
	41111	AM-241	W	94	0 004	3 99E-03
	41111	AM-241	Y	1	0.001	1.00E-03
	41111	C-14	D	1	0.000	3.60E-06
	41111	C-14	Y	4	0.002	1.99E-03
	41111	CE-141	W	1	0.027	2.71E-02
	41111	CE-141	Y	1	0.109	1.09E-01
	41111	CE-144	W	3	0.017	1.70E-02
	41111	CE-144	Y	1	0 072	7 20E-02
	41111	CM-242	W	80	0 002	1.67E-03

* 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 microcune is one millionth of a Curie

TABLE 3.8 (continued)
Intake by Licensee Type and Radionuclide Mode of Intake – *Inhalation*
2001

Licensee Type	Program Code	Radionuclide	Pulmonary Clearance Class	Number of Intake Records*	Collective Intake in Microcuries**	Collective Intake in Microcuries (sci. notation)
Power Reactors (continued)	41111	CM-243	W	78	0.001	1.13E-03
	41111	CM-244	W	2	0.000	2.60E-05
	41111	CO-57	Y	6	0.039	3.90E-02
	41111	CO-58	D	1	0.216	2.16E-01
	41111	CO-58	Y	97	342.283	3.42E+02
	41111	CO-60	Y	232	295.453	2.95E+02
	41111	CR-51	Y	8	1.984	1.98E+00
	41111	CS-134	D	7	0.658	6.58E-01
	41111	CS-137	D	19	2.917	2.92E+00
	41111	CS-137	Y	13	0.157	1.57E-01
	41111	CU-64	Y	1	11.950	1.20E+01
	41111	FE-55	D	1	0.000	1.40E-04
	41111	FE-55	W	11	3.273	3.27E+00
	41111	FE-59	W	14	1.619	1.62E+00
	41111	FE-59	Y	1	0.100	1.00E-01
	41111	H-3	Y	9	189.600	1.90E+02
	41111	I-131	D	6	0.838	8.38E-01
	41111	I-131	Y	2	0.059	5.86E-02
	41111	MN-54	W	46	3.349	3.35E+00
	41111	MN-54	Y	2	0.260	2.60E-01
	41111	NB-95	W	6	1.121	1.12E+00
	41111	NB-95	Y	9	0.337	3.37E-01
	41111	NB-97	W	2	0.075	7.53E-02
	41111	NI-63	D	1	0.006	5.50E-03
	41111	NI-63	W	11	0.632	6.32E-01
	41111	NP-237	W	10	0.000	1.30E-07
	41111	PU-238	W	27	0.000	1.60E-04
	41111	PU-238	Y	53	0.001	1.24E-03
	41111	PU-239	W	27	0.000	6.09E-05
	41111	PU-239	Y	42	0.000	4.51E-04
	41111	PU-240	Y	10	0.000	2.74E-05
	41111	PU-241	W	27	0.005	5.15E-03
	41111	PU-241	Y	24	0.019	1.94E-02
	41111	SB-124	W	2	0.010	1.02E-02
	41111	SB-125	W	2	0.063	6.34E-02
	41111	SN-113	W	6	0.037	3.66E-02
	41111	SR-90	Y	1	0.000	3.40E-04
	41111	TC-99	W	1	0.000	5.60E-09
	41111	ZN-65	Y	13	1.676	1.68E+00
	41111	ZR-95	D	2	0.034	3.40E-02
	41111	ZR-95	W	6	1.761	1.76E+00
	41111	ZR-95	Y	2	0.248	2.48E-01
	41111	ZRNB-95	Y	1	0.146	1.46E-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 3.9
Collective and Average CEDE by Licensee
2001

Licensee Type	Licensee Name	License Number	Number with Meas. CEDE	Collective CEDE (person-rem)	Average Meas. CEDE (rem)
Nuclear Pharmacies 02500	EASTERN ISOTOPES, INC	45-25221-01MD	11	0 022	0 002
	SYNCOR INTERNATIONAL CORP	04-26507-01MD	8	0 153	0 019
		Total	19	0 175	0 009
Manufacturing and Distribution 03211	MALLINCKRODT INC	24-04206-01	1	0 021	0 021
		Total	1	0 021	0 021
Uranium Enrichment 21200	U S ENRICHMENT CORP - PADUCAH	GDP-1	51	0 088	0 002
	U S ENRICHMENT CORP - PORTSMOUTH	GDP-2	2	0 020	0.010
		Total	53	0 108	0.002
Fuel Fabrication 21210	BWX TECHNOLOGIES, INC.	SNM-0042	319	46 579	0.146
	WESTINGHOUSE ELECTRIC COMPANY, LLC	SNM-0033	164	43 801	0 267
	FRAMATOME ANP, INC	SNM-1168	31	2 438	0 079
	FRAMATOME ANP, INC	SNM-1227	329	62 123	0 189
	GLOBAL NUCLEAR FUEL - AMERICAS, LLC	SNM-1097	609	55 638	0 091
	NUCLEAR FUEL SERVICES, INC	SNM-124	620	78 697	0 127
	WESTINGHOUSE ELECTRIC COMPANY	SNM-1107	452	510 940	1.130
		Total	2,524	800 216	0 317
Power Reactors 41111	ARKANSAS	DPR-51	4	0 087	0 022
	BEAVER VALLEY	DPR-66	2	0 037	0 019
	BROWNS FERRY	DPR-33	61	0.781	0 013
	BRUNSWICK	DPR-62	8	0 174	0 022
	CALLAWAY	NPF-30	16	0 220	0 014
	CALVERT CLIFFS	DPR-53	11	0 240	0 022
	CATAWBA	NPF-35	1	0 012	0 012
	COLUMBIA GENERATING	NPF-21	4	0 090	0 023
	COOK	DPR-58	157	0 437	0 003
	COOPER STATION	DPR-46	9	0 060	0 007
	DAVIS-BESSE	NPF-03	10	0 053	0 005
	DRESDEN	DPR-19	1	0 015	0 015
	FARLEY	NPF-02	2	0 046	0 023
	FERMI	NPF-43	2	0 027	0 014
	GRAND GULF	NPF-29	3	0 070	0 023
	HADDAM NECK	DPR-61	25	0 234	0 009
	INDIAN POINT 3	DPR-64	1	0 018	0 018
	LIMERICK	NPF-39	12	0 083	0 007
	MAINE YANKEE	DPR-36	59	0 365	0 006
	MILLSTONE POINT 1	DPR-21	1	0 030	0 030
	MONTICELLO	DPR-22	13	0 088	0 007
	NINE MILE POINT	DPR-63	3	0 052	0 017
	NORTH ANNA	NPF-04	3	0 085	0 028
	OCONEE	DPR-38	32	0 940	0 029
	OYSTER CREEK	DPR-16	2	0 037	0 019
	PALISADES	DPR-20	41	1 231	0 030
	PEACH BOTTOM	DPR-44	15	0 191	0 013
	PILGRIM	DPR-35	22	0 175	0 008
	PRAIRIE ISLAND	DPR-42	1	0 012	0 012
	QUAD CITIES	DPR-29	2	0 080	0 040
	RANCHO SECO	DPR-54	1	0 008	0 008
	RIVER BEND	NPF-47	19	0 643	0 034
	SAN ONOFRE	DPR-13	10	0 237	0 024
	SEQUOYAH	DPR-77	360	1 495	0 004
	ST LUCIE	DPR-67	12	0 114	0 010
	SURRY	DPR-32	1	0 003	0 003
	SUSQUEHANNA	NPF-14	67	0 125	0 002
	THREE MILE ISLAND 1	DPR-50	15	0 089	0 006
	TURKEY POINT	DPR-31	24	0 053	0 002
	VERMONT YANKEE	DPR-28	47	0 505	0 011
	VOGTLE	NPF-68	3	0 037	0 012
	WATTS BAR	NPF-90	107	0 329	0 003
		Total	1,189	9 608	0 008
Grand Totals			3,786	810 128	0 214

TABLE 3.10
Internal Dose (CEDE) Distribution
1994 - 2001

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

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 had been included in the compilation of data for commercially operating reactors through 1988 even though the reactor was shut down following the 1979 accident and has been in the process of defueling and decommissioning since that time. 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 2001. The number of operating BWRs remains the same as in 2000 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 are 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 2001, the number

TABLE 4.1

Summary of Information Reported by Commercial Boiling Water Reactors
1973 - 2001

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 85	380	445	1.34	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%

* 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 - 2001

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	0.52	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	71	14,143	56,590	50,480.6	0.25	199	797	0.28	711	945	75%
1994	72	9,606	44,811	54,618.3	0.21	133	622	0.18	759	932	81%
1995	72	12,217	51,899	55,825.1	0.24	170	721	0.22	775	933	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	0.19	680	943	72%
1998	69	6,358	38,586	53,288.7	0.16	92	559	0.12	772	942	82%
1999	69	7,231	43,938	56,235.0	0.16	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%

* 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 - 2001

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	0.94	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	0.39	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	108	26,364	95,942	72,476.2	0 27	244	888	0 36	671	895	75%
1994	109	21,704	83,982	76,757.3	0.26	199	770	0 28	704	888	79%
1995	109	21,688	87,585	80,562.1	0 25	199	804	0 27	739	900	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	13,188	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%

* 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

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% increase in the net electricity generated at LWRs in 2001. Contributors to the increase include Cook and Indian Point 2, which resumed power near capacity, and Oyster Creek and Arkansas, which increased power generation by 34% and 27%, respectively. BWRs increased net electricity generated by less than 1%. PWRs increased 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 2001, 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 decreased from 0.15 in 2000 to a value of 0.13 in 2001.

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 achieved has increased by 2% from 2000 to 2001.

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 2001. 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 2001 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 12% to a value of 11,109 person-rem in 2001.

TABLE 4.4
Summary Distribution of Annual Whole Body Doses at Commercial Light Water Reactors*
1977 - 2001

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

* Summary of reports submitted in accordance with 10 CFR 20 407 or 20 2206 (since 1994) by only those plants 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 2001, the average collective dose per LWR dropped by 86%. Between 2000 and 2001, the collective dose per reactor for PWRs decreased by 4% to 91 person-rem. The collective dose per reactor for BWRs decreased by 21% to 138 person-rem from 2000 to 2001. The overall collective dose per reactor for LWRs decreased by 12% to 107 person-rem in 2001. The number of workers with measurable dose per reactor decreased to 823 for BWRs and decreased to 562 for PWRs in 2001. 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. The value for the total collective dose for all LWRs decreased by 12% from a value of 12,652 person-rem in 2000 to 11,109 person-rem in 2001. Together with the decrease in the number of workers with measurable dose, this resulted in the average measurable dose per worker decreasing from 0.17 rem in 2000 to 0.16 rem in 2001 (when not adjusted for transient workers). Figure 4.2 shows that in 2001 the net electricity generated increased to an all-time high of 87,552.8 MW-yr.

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.

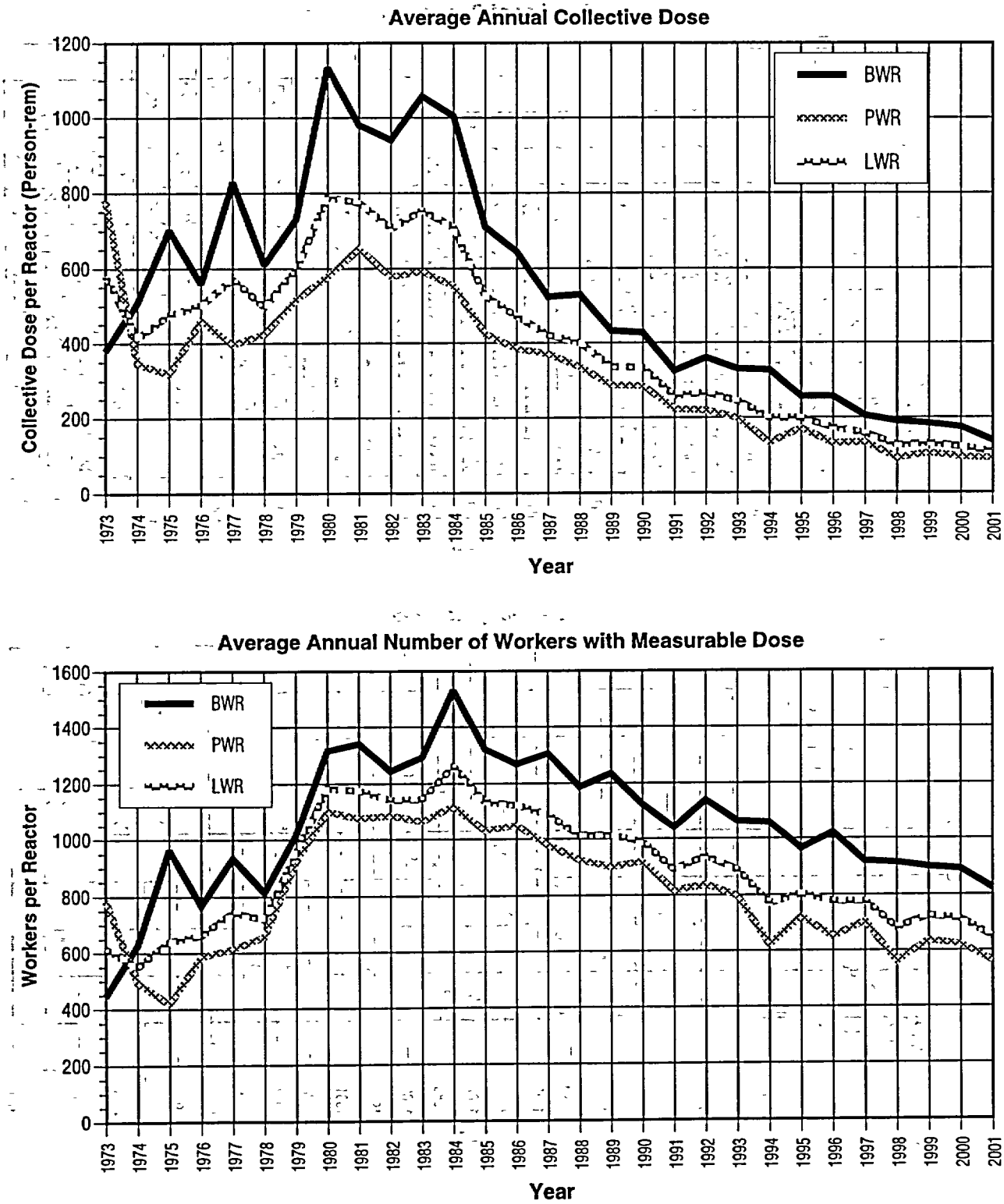


FIGURE 4.1. Average Collective Dose and Number of Workers with Measurable Dose per Reactor 1973 - 2001

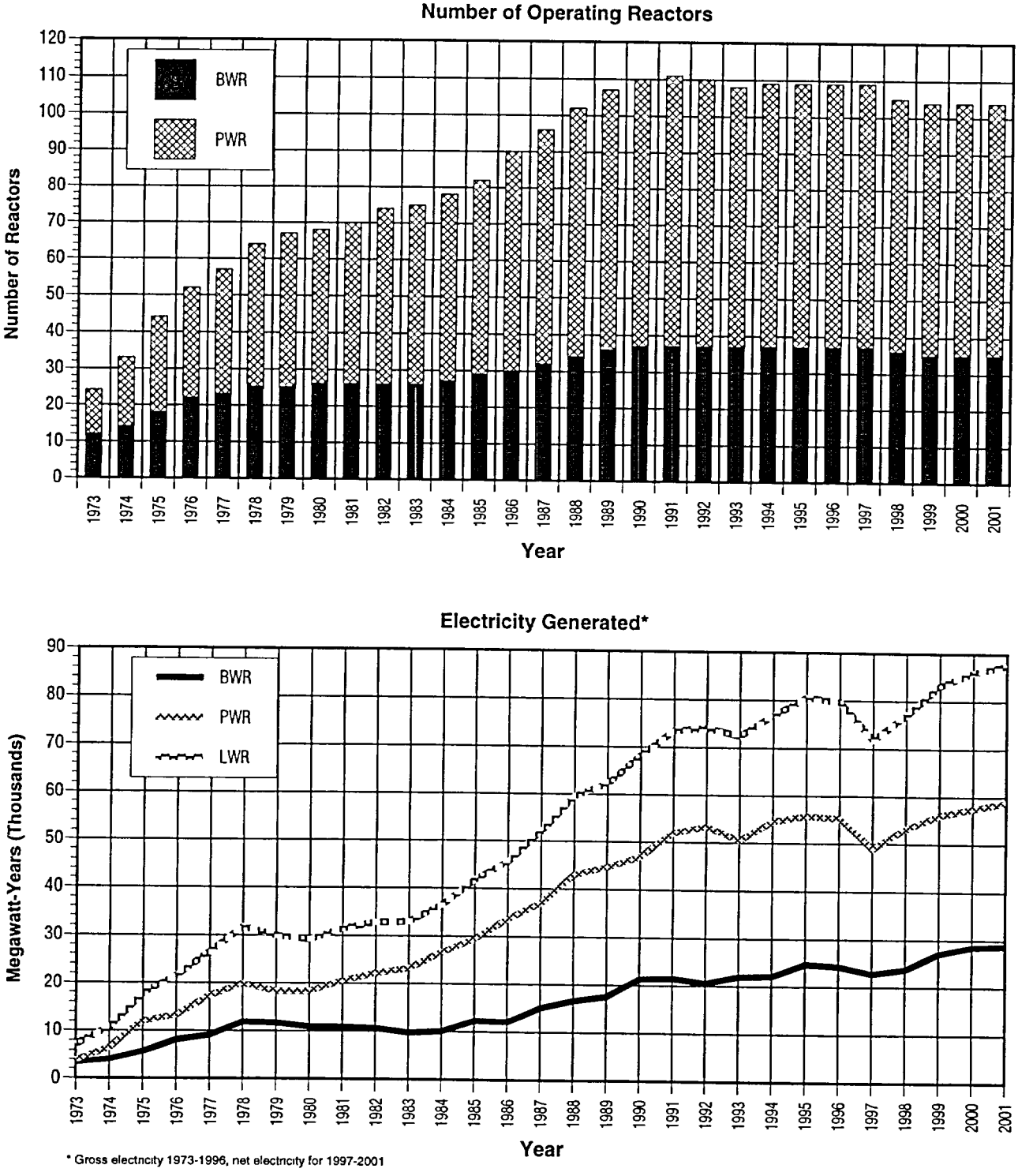


FIGURE 4.2. Number of Operating Reactors and Gross Electricity Generated 1973 - 2001

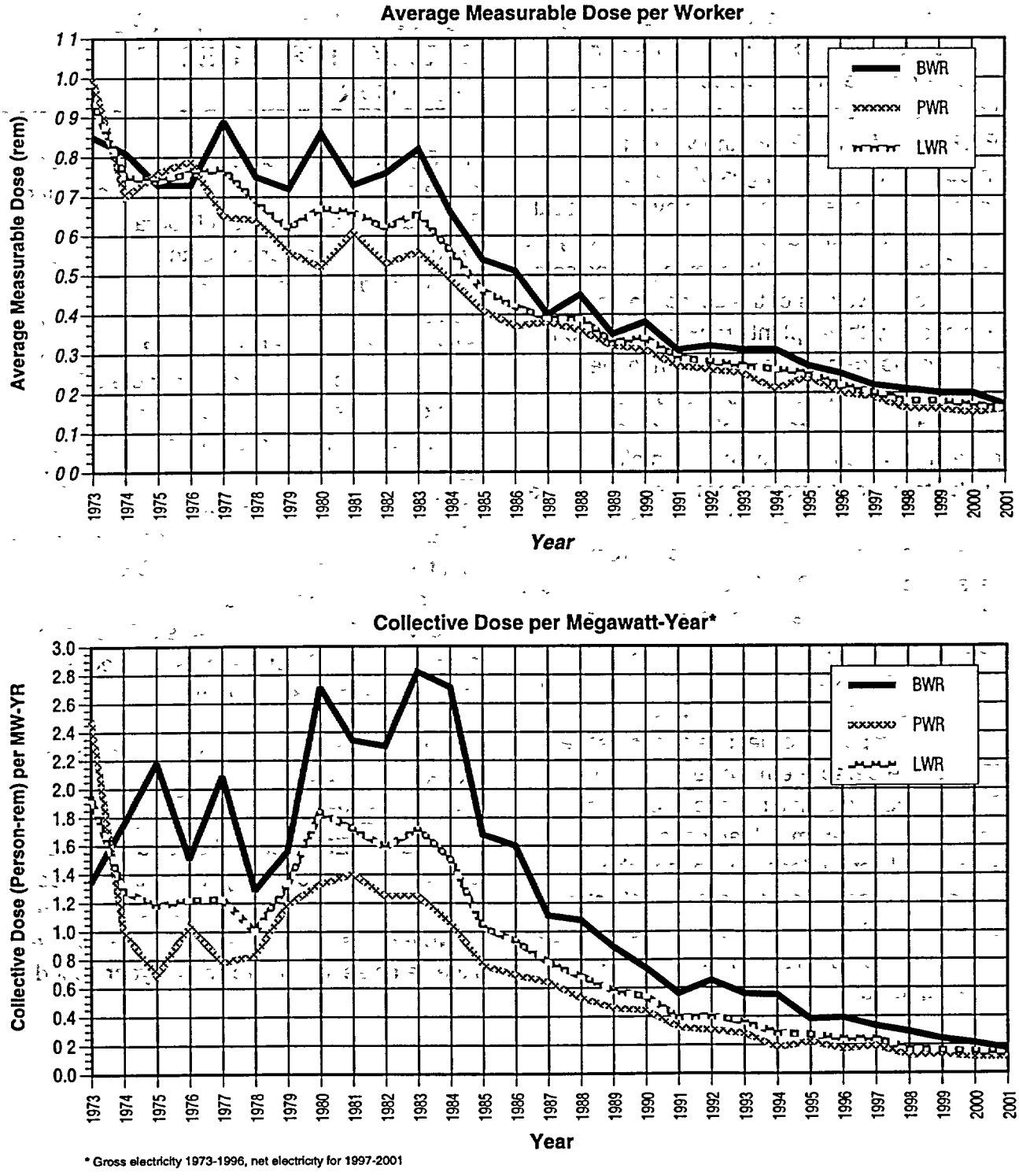


FIGURE 4.3. Average Measurable Dose per Worker and Collective Dose per Megawatt-Year 1973 - 2001

To further assist in the identification of any trends that might exist, Figures 4.4 and 4.5 together display the average and median[6] values of the collective dose per reactor for BWRs and for PWRs for the years 1973 through 2001. 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. Since 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 experienced a decrease from 91 person-rem in 2000 to 68 person-rem in 2001. At BWRs, the median fluctuates more from year to year, and in 2001 the median collective dose decreased to 144 person-rem. Figure 4.5 also shows that, in 2001, 50% of the PWRs reported collective doses between 57 and 119 person-rem, while 50% of the BWRs reported collective doses between 98 and 172 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 Revised 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, 2001, 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 165 person-rem, the average measurable TEDE per worker was 0.19 rem, and the average collective TEDE per MW-yr was 0.21 person-rem per MW-yr. All of these values decreased from the previous 3-year period.

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 97 person-rem, 0.16 rem, and 0.12 person-rem per MW-yr, respectively. Each of these values is the same as for the previous 3-year period.

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

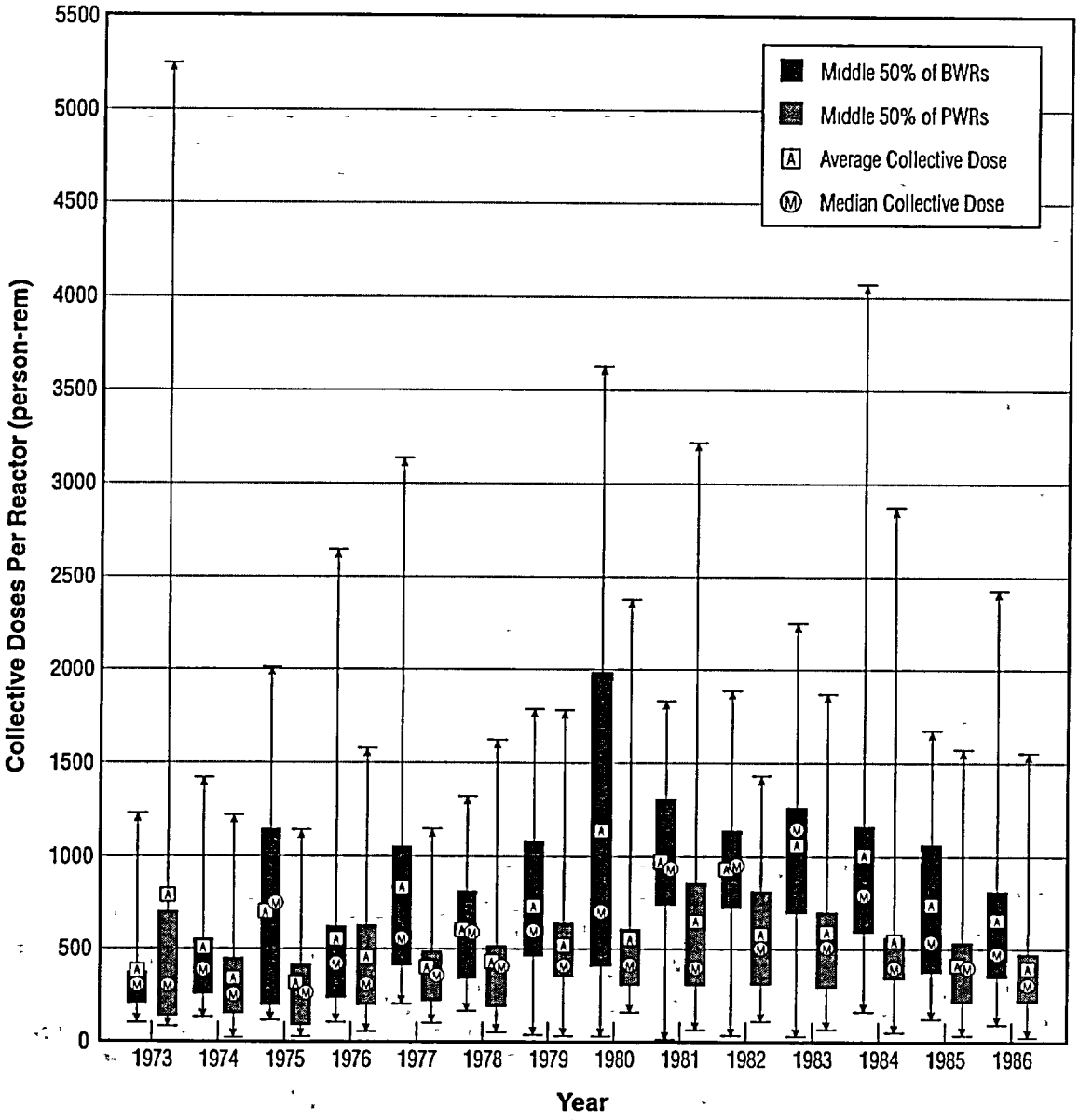


FIGURE 4.4. Average, Median, and Extreme Values of the Collective Dose per Reactor 1973 - 1986

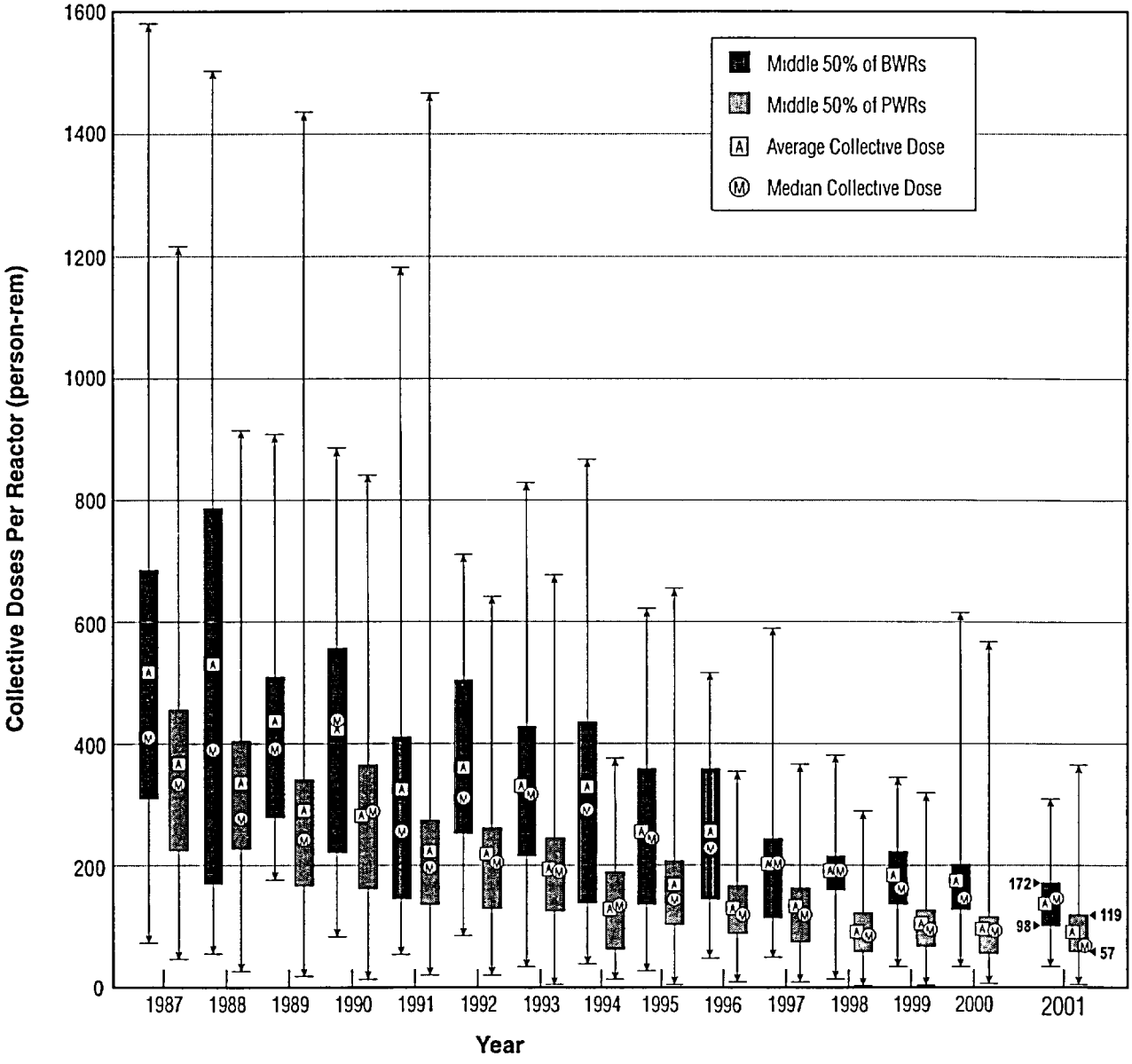


FIGURE 4.5. Average, Median, and Extreme Values of the Collective Dose per Reactor 1987 - 2001

TABLE 4.5
Three-Year Totals and Averages Listed in Ascending Order of Collective TEDE per BWR
1999-2001

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
FERMI 2	3	117	351	2,929	0.12	2,997.3	0.12
VERMONT YANKEE	3	119	357	1,915	0.19	1,456.1	0.24
BROWNS FERRY 1,2,3**	9	119	1,074	4,923	0.22	6,308.8	0.17
LIMERICK 1,2	6	124	742	4,206	0.18	6,450.4	0.12
CLINTON	3	125	375	2,214	0.17	2,218.0	0.17
DUANE ARNOLD	3	128	383	2,049	0.19	1,363.4	0.28
COOPER STATION	3	139	416	2,590	0.16	1,875.1	0.22
FITZPATRICK	3	144	433	2,490	0.17	2,242.8	0.19
COLUMBIA GENERATING	3	145	435	3,243	0 13	2,613.6	0.17
GRAND GULF	3	149	446	2,578	0.17	3,309.4	0.13
LASALLE 1,2	6	153	919	5,055	0.18	6,034.3	0.15
HATCH 1,2	6	160	961	5,186	0.19	4,605.4	0.21
PEACH BOTTOM 2,3	6	166	995	4,804	0.21	6,152.6	0.16
MONTICELLO	3	169	507	2,077	0.24	1,455.2	0.35
BRUNSWICK 1,2	6	174	1,043	5,089	0.20	4,641.9	0.22
SUSQUEHANNA 1,2	6	175	1,051	5,406	0.19	5,918.2	0.18
NINE MILE POINT 1,2	6	179	1,073	4,863	0.22	4,360.3	0.25
PILGRIM	3	192	575	2,757	0.21	1,723.8	0.33
QUAD CITIES 1,2	6	206	1,238	4,576	0.27	4,365.1	0.28
HOPE CREEK 1	3	208	624	3,879	0.16	2,625.1	0.24
DRESDEN 2,3	6	209	1,254	8,353	0.15	4,344.7	0.29
PERRY	3	213	640	3,651	0.18	3,075.8	0.21
OYSTER CREEK	3	234	702	2,952	0.24	1,655.0	0.42
RIVER BEND 1	3	256	768	3,680	0.21	2,377.6	0.32
Grand Totals and Averages	**105**		**17,360**	**91,465**	**0.19**	**84,169.9**	**0.21**
Averages Per Reactor-Year			**165**	**871**		**801.6**	

* Sites where not all reactors had completed 3 full years of commercial operation as of 12/31/01 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
1999 - 2001

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
PRAIRIE ISLAND 1,2	6	51	303	1,865	0 16	2,882.3	0.11
PALO VERDE 1,2,3	9	54	486	3,915	0.12	10,210.0	0 05
SEABROOK	3	61	184	2,920	0 06	2,882.9	0 06
DAVIS-BESSE	3	67	202	1,625	0.12	2,487.7	0 08
CATAWBA 1,2	6	70	421	3,169	0.13	6,196.9	0 07
BRAIDWOOD 1,2	6	73	441	3,596	0.12	6,490.8	0 07
COMANCHE PEAK 1,2	6	74	444	2,928	0.15	6,172.1	0 07
TURKEY POINT 3,4	6	75	449	3,038	0.15	3,960.3	0 11
WATTS BAR 1	3	76	227	2,225	0.10	3,072.3	0 07
NORTH ANNA 1,2	6	78	469	2,688	0.17	4,972.8	0 09
POINT BEACH 1,2	6	78	465	2,467	0.19	2,593.9	0 18
VOGTLE 1,2	6	80	480	3,128	0.15	6,561 4	0 07
INDIAN POINT 3	3	81	244	2,050	0 12	2,693 7	0.09
BYRON 1,2	6	82	492	3,156	0 16	6,562 6	0.08
CALVERT CLIFFS 1,2	6	82	493	2,941	0 17	4,651 8	0.11
ST. LUCIE 1,2	6	84	504	3,472	0 15	4,726 6	0.11
ROBINSON 2	3	86	257	1,772	0 15	1,986 8	0.13
WATERFORD 3	3	87	260	1,749	0 15	2,900 6	0.09
GINNA	3	87	262	1,210	0 22	1,325 6	0.20
MCGUIRE 1,2	6	88	526	3,177	0 17	6,175 1	0.09
ARKANSAS 1,2	6	89	532	4,522	0 12	4,490 5	0.12
COOK 1,2	6	89	536	4,591	0 12	2,354 4	0 23
MILLSTONE 2,3	6	95	569	4,400	0.13	5,071 4	0.11
WOLF CREEK 1	3	99	296	1,778	0 17	3,255 9	0 09
SAN ONOFRE 2,3	6	100	601	3,633	0 17	5,695 8	0.11
KEWAUNEE	3	102	305	1,607	0 19	1,331.8	0 23
BEAVER VALLEY 1,2	6	104	622	3,773	0.16	4,233 2	0 15
SURRY 1,2	6	110	660	3,435	0.19	4,414.5	0 15
SEQUOYAH 1,2	6	111	667	4,677	0.14	6,233 4	0 11
SALEM 1,2	6	111	669	3,665	0.18	5,756.4	0 12
OCONEE 1,2,3	9	117	1,054	5,256	0.20	6,753.1	0 16
SUMMER 1	3	119	356	2,246	0.16	2,335 2	0 15
THREE MILE ISLAND 1	3	120	360	2,550	0.14	2,152.5	0 17
SOUTH TEXAS 1,2	6	122	729	4,025	0.18	6,662.4	0.11
HARRIS	3	123	369	2,721	0.14	2,221.2	0 17
DIABLO CANYON 1,2	6	125	747	3,697	0.20	5,910.6	0 13
CRYSTAL RIVER 3	3	138	414	2,483	0.17	2,288.5	0 18
FORT CALHOUN	3	140	420	1,695	0.25	1,254.2	0 33
FARLEY 1,2	6	145	871	4,595	0.19	4,250.4	0 20
CALLAWAY 1	3	148	443	2,215	0.20	3,073.3	0 14
PALISADES	3	202	607	2,226	0 27	1,508.0	0.40
INDIAN POINT 2	3	210	630	2,752	0 23	1,834.4	0 34
Grand Totals and Averages	**207**		**20,066**	**125,633**	**0.16**	**172,587.3**	**0.12**
Averages Per Reactor-Year			**97**	**607**		**833.8**	

* Sites where not all reactors had completed 3 full years of commercial operation as of 12/31/01 are not included.

The average 3-year collective TEDE per BWR for 1999 - 2001 is 10% less than the average for 1998 - 2000. The average 3-year collective TEDE per PWR for 1999 - 2001 is the same as the average for 1999 - 2000. The average MW-yr per reactor for BWRs and PWRs was greater than the previous 3-year average.

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 2001. 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 2001. 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 Revised 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 a 2- to 3-year 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.

Section 5

TRANSIENT WORKERS AND CAREER DOSES AT NRC-LICENSED FACILITIES

5.1 TERMINATION REPORTS

Under the revised 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 "termination reports" submitted in accordance with the old § 20.408, listing the individual's complete dose history during employment at the facility, are no longer required.

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 2001, 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
2001

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	73,206	37,461	16,078	9,231	2,930	1,060	747	63					140,776	67,570	11,109	0 16
2) Transients - As Reported	26,731	15,746	8,061	4,728	1,582	622	473	45					57,988	31,257	5,832	0 19
3) Transients - Actual	6,161	5,531	3,474	3,156	1,559	885	1,118	203	53				22,140	15,979	5,832	0 36
Corrected Distribution (1-(2-3))	**52,636**	**27,246**	**11,491**	**7,659**	**2,907**	**1,323**	**1,392**	**221**	**53**				**104,928**	**52,292**	**11,109**	**0.21**
ALL LICENSEES																
1) Form 5 Summation	78,654	41,373	17,624	10,258	3,424	1,418	1,416	335	130	50			154,682	76,028	14,746	0.19
2) Transients - As Reported	27,082	16,017	8,149	4,793	1,612	644	519	50	1	1			58,868	31,786	5,996	0.19
3) Transients - Actual	6,146	5,554	3,487	3,185	1,585	899	1,174	214	56		1		22,301	16,155	5,996	0.37
Corrected Distribution (1-(2-3))	**57,718**	**30,910**	**12,962**	**8,650**	**3,397**	**1,673**	**2,071**	**499**	**185**	**49**	**1**		**118,115**	**60,397**	**14,746**	**0.24**

Table 5.1 illustrates the impact that the multiple reporting of these transient individuals had on the summation of the exposure reports for 2001. 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 2001, Table 5.1 shows that the summation of annual reports for reactor licensees indicated that 63 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 274 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 nearly twice as high as the value calculated by the summation of licensee records. The transient workers represent 27% of the workforce that receives measurable dose. The correction for the transient workers increases the average measurable dose by a factor of 2 from 0.19 rem to 0.37 rem for the transient workforce. 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 2001, one individual was discovered to have exceeded the 5 rem annual TEDE limit as a result of doses received at more than one radiography licensee during the year. This is the first instance since 1985 that a transient individual has been identified as having exceeded a regulatory dose limit that would not have been otherwise detected by the NRC.

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. The revised 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). The revised 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. The revised 10 CFR 20 no longer contains quarterly exposure limits but has reporting requirements for planned special exposures (PSEs)[7]. The annual TEDE limit for adult workers is 5 rem.

The revised 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.

[7] 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 2001. 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 revised 10 CFR 20 in 1994. The dose reporting thresholds have been revised – the skin of the whole body and the extremities now have the same dose limits, and a new set of dose limits has been added for the lens of the eye.

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 2001, there were three "Category A" occurrences, no "Category B" occurrences, and three "Category C" occurrences. All but one of the events resulted in extremity exposures in excess of the 50 rem annual extremity limit. One event was discovered during the transient analysis (see Section 5) in preparation for this report where an individual was found to have exceeded the 5 rem TEDE annual limit from doses received at

TABLE 6.1
Occupational Exposures in Excess of Regulatory Limits
1994 - 2001

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
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	
	POWER REACTORS	NO OF PERSONS SUM OF DOSES						
	MEDICAL FACILITIES	NO. OF PERSONS SUM OF DOSES						
	MARKETING & MANUFACT	NO OF PERSONS SUM OF DOSES					5[f] 675	3[f] 1,115
	OTHER	NO OF PERSONS SUM OF DOSES						
1997	INDUSTRIAL RADIOGRAPHY	NO OF PERSONS SUM OF DOSES						
	POWER REACTORS	NO OF PERSONS SUM OF DOSES					1[b] 51 1	
	MEDICAL FACILITIES	NO OF PERSONS SUM OF DOSES						
	MARKETING & MANUFACT	NO OFPERSONS SUM OF DOSES					5[f] 431	3[f] 1,199
	OTHER	NO OF PERSONS SUM OF DOSES						
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] These two 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

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

two different radiography licensees. A summary of the events follows.

One of the purposes of the NRC's REIRS database is to examine the dose records from all NRC licensees in order to identify transient individuals who may have exceeded regulatory limits from doses received at more than one facility during a year. In 2001, during the analysis of dose records for transient workers for Section 5 of this report, an individual was found to have exceeded the 5 rem annual TEDE limit. The individual worked at two radiography licensees during the year and received 1.348 rem at one facility during the first quarter of the year, and then received 4.258 rem at a second facility during the remainder of the year, resulting in annual TEDE of 5.606 rem. The doses were confirmed by the licensee and the NRC was notified. The NRC is currently in the process of reviewing and investigating this occurrence.

In September of 2001, a licensee reported a Category C extremity exposure to a nuclear pharmacist. On 10/19/2001, the dosimetry vendor notified the licensee that the pharmacist's extremity dosimeter results were 56.35 rem and 34.69 rem for the right and left finger rings, respectively. Through August 2001, the pharmacist had an annual extremity dose of 15.57 rem. The pharmacist routinely handled radiopharmaceuticals such as Tc-99m and I-131; however, during the month of September 2001, she prepared a significant number of F-18 doses using an automatic dose-drawing robot. The pharmacist was assigned non-radiological duties during an investigation into the event. The investigation determined that the pharmacist did not use the robotic dose-handling machine as designed. Instead of using the remote handling tools provided, the pharmacist handled the sample container and the syringe by hand during the F-18 dose splitting process. The licensee determined that the pharmacist's total occupational extremity dose for 2001 was 127.38 rem and 86.31 rem for the right and left index fingers, respectively. The root cause of this event was the licensee's failure to have adequate procedures in place for handling F-18 doses. A contributing factor was the licensee's failure to adequately train the pharmacist in the F-18 dose handling process. To prevent recurrence, the licensee updated and posted the procedure for the safe handling of materials for the F-18 dose splitting process.

In April of 2002, a licensee reported possible Category A extremity exposures in excess of the annual limit to two radiopharmacists involved in dispensing doses of Tc-99m. Ring dosimeter readings of 30 to 40 rem were recorded for the individuals in the year of 2001. During follow-up investigation, a certified health physicist determined that the individuals were receiving fingertip doses 3 to 7 times higher than those recorded on the ring dosimeters. Therefore, the two radiopharmacists could have received doses up to 280 rem to the fingertips. The two individuals are shown in Table 6.1 as having received these maximum doses.

In December of 2001, an individual was observed by an NRC inspector dispensing 3.7 GBq (100 mCi) bulk doses of Tc-99m using a vial shield without a shielded top. The individual's dispensing technique resulted in exceeding 10 CFR 20 extremity exposure limits. The individual's left-hand index fingertip exposure was estimated at

700 R/year. The assumptions for the exposure estimate were based on a calculation from an article "Fingertip and Whole Body Exposure to Nuclear Medicine Personnel." The individual was estimated at 40 draws/day x 6 seconds/draw x 6 days/week x 50 weeks/year = 20 hours/year. This equates to 1.6 hours/year of exposure to the finger = 56 R. Therefore, 56 R/1.6 hours x 20 hours = 700 R. During the inspection, the licensee took action to ensure that the vial shields would be appropriately used. Although the individual wore an extremity monitor on his right ring finger, it appeared that the dosimetry results may not reflect the highest exposure received by the individual. Following a discussion with the inspector, the licensee committed to perform a calculation to determine the dose to the individual's index finger. A consultant also concluded that the radiopharmacist received an extremity exposure to his left index finger of 700 rem, which is a Category A event.

In January of 2001, during an inspection, the NRC inspector learned of an event that resulted in an assistant radiographer receiving a Category C exposure to his hand. The individual's hand was within 6 inches of a 1.48 TBq (40 Ci) Ir-192 radiography source. The assistant radiographer received the overexposure while disconnecting the guide tube from the radiography camera. After completing a radiography exposure, the radiographer retracted the source, but the source was not in the fully shielded position when the assistant radiographer began to disconnect the guide tube from the camera. The assistant radiographer immediately released the guide tube when he saw that the drive cable and source pigtail cable were extended outside of the camera. The radiographer and assistant radiographer failed to survey the guide tube and camera before the assistant radiographer removed the guide tube. Because the radiographers were in a high noise work environment, they were unable to hear their alarming ratemeters or the "Posi-Lock" locking mechanism on the camera engage the source. Their pocket dosimeters were off scale. The radiographer's film badge indicated a whole body exposure of approximately 445 mrem and the assistant radiographer's film badge indicated a whole body exposure of 1.002 rem. Based on a re-enactment of the event, the inspector estimated that the extremity exposure received by the assistant radiographer was 60 rem. A consultant provided revised dose estimates for the assistant radiographer of 1.2 rem to the whole body and 1.33 rem to the hand. After reviewing the information from the consultant and considering the unresolved uncertainties in the calculations, the licensee stated that a reasonable estimate of the assistant radiographer's dose was 1.2 rem whole body and 80 rem to the hand. Corrective actions include briefing all radiography personnel of the incident, implementing a weekly audit program of the radiation protection program, and instituting measures to respond to the inability of staff to hear alarming ratemeters in high noise environments.

Of the six occurences summarized above, two of the occurences took place at licensees that were required to report exposure records to the NRC REIRS database in 2001 and are included in the tables and figures in other sections of this report. All six occurences are included in Table 6.1.

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 approach the NRC limits.

As shown in Table 6.3, few exposures exceed half of the NRC occupational annual limits. In 2001, four individuals exceeded 95% of the TEDE limit. One individual exceeded the 5 rem TEDE limit and one individual exceeded the 50 rem extremity limit. No individuals were reported to have exceeded the skin, eye, or organ dose limits.

TABLE 6.3
Maximum Occupational Exposures for Each Exposure Category *
2001

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
SDE-ME	50 rem	127 380	> limit	50,145	77	31	4	2 (1 > limit)
SDE-WB	50 rem	34.040	68%	61,733	1	1	0	0
LDE	15 rem	5.606	37%	59,315	60	0	0	0
CEDE		4.011		3,786				
CDE		34 887		2,981				
DDE		5 606		61,191				
TEDE	5 rem	5 606	> limit	62,003	1920	448	73	4 (1> limit)
TODE	50 rem	35 394	71%	54,119	184	24	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

Section 7
REFERENCES

1. U.S. Atomic Energy Commission, *Nuclear Power Plant Operating Experience During 1973*, USAEC Report 00E-ES-004, December 1974.*

2. U.S. Nuclear Regulatory Commission, *Nuclear Power Plant Operating Experience 1974-1975*, USNRC Report NUREG-0227, April 1977.*

3. U.S. Nuclear Regulatory Commission, *Nuclear Power Plant Operating Experience 1976*, USNRC Report NUREG-0366, December 1977.*

4. M.R. Beebe, *Nuclear Power Plant Operating Experience - 1977*, USNRC Report NUREG-0483, February 1979.*

5. *Nuclear Power Plant Operating Experience - 1978*, USNRC Report NUREG-0618, December 1979.*

6. *Nuclear Power Plant Operating Experience - 1979*, USNRC Report NUREG/CR-1496, May 1981.*

7. *Nuclear Power Plant Operating Experience - 1980*, USNRC Report NUREG/CR-2378, ORNL/NSIC-191, October 1982.*

8. *Nuclear Power Plant Operating Experience - 1981*, USNRC Report NUREG/CR-3430, ORNL/NSIC-215, Vol. 1, December 1983.*

9. *Nuclear Power Plant Operating Experience - 1982*, USNRC Report NUREG/CR-3430, ORNL/NSIC-215, Vol. 2, January 1985.*

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

11. United Nations, *Report of the Scientific Committee on the Effects of Atomic Radiation*, General Assembly of Official Records, United Nations, New York, 1993.

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.

Appendix A

ANNUAL TEDE FOR NON-REACTOR NRC LICENSEES

2001

APPENDIX A
Annual TEDE for Non-Reactor NRC Licensees
CY 2001

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				
NUCLEAR PHARMACIES - 02500																		
CAPITAL PHARMACY INC.	21-26597-01MD	9	11	4								-	-	-	24	15	0 858	0 057
EASTERN ISOTOPES, INC.	45-25221-01MD	16	53	7	4	2	2	1	5	4	3	-	-	-	97	81	**48.182**	**0 595**
MALLINCKRODT, INC	24-04206-00MD	9	11	4	2										26	17	1.710	0 101
MALLINCKRODT, INC.	24-04206-08MD	1	14	5	1								-	-	21	20	1.753	0 088
MALLINCKRODT, INC.	24-04206-22MD	3	5	1											9	6	0.284	0 047
MALLINCKRODT MEDICAL, INC.	24-04206-01MD	47	9	6	1	1							-	-	64	17	2 464	0 145
MALLINCKRODT MEDICAL, INC.	24-04206-14MD	2	8	13		1							-	-	24	22	2 906	0 132
MALLINCKRODT MEDICAL, INC	24-04206-19MD	9	10	6	7	1	1						-	-	33	24	4 177	0 174
MID-AMERICA ISOTOPES, INC.	24-26241-01MD	5	21	3		2							-	-	31	26	2.113	0 081
NUCLEAR DIAGNOSTIC PRODUCTS	29-30500-01MD	4	15	5									-	-	24	20	1 218	0 061
OKLAHOMA, UNIVERSITY OF	35-03176-04MD	5	16	4	1								-	-	26	21	1 433	0 068
PHARMALOGIC OF PENN LTD	37-30219-01MD	1	7	6											14	13	1 126	0 087
PSI, INC	11-27705-01MD	-	-	4	2	1									7	7	1 845	0 264
RADIOPHARMACY, INC.	13-26246-01MD	-	18	3	3								-	-	24	24	2 262	0 094
SPECTRUM PHARMACY INC.	13-26367-01MD	2	25	9	5	2		2					-	-	45	43	7 709	0 179
SPECTRUM PHARMACY, INC.	13-32053-01MD	14	12	1									-	-	27	13	0 569	0 044
SYNCOR CARIBE	52-16345-02MD	1	9	3	2	1							-	-	16	15	2 057	0 137
SYNCOR INTERNATIONAL CORP	04-26507-01MD	**87**	206	**37**	9	**3**							-	-	**342**	**255**	15 595	0 061
Total	**18**	**215**	**450**	**121**	**37**	**13**	**3**	**3**	**5**	**4**	**3**	-	-	-	**854**	**639**	**98 261**	**0 154**

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 2001 (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																		
CANBERRA DOVER, INC.	29-04236-01	19	11	-	-	-	-	-	-	-	-	-	-	30	11	0 062	0 006
E. R. SQUIBB & SONS	29-00139-02	130	7	12	4	2	2	-	-	-	-	-	-	157	27	6 327	0 234
INTERNATIONAL ISOTOPES IDAHO, INC.	11-27680-01	2	1	2	1	2	2	3	1	-	-	-	-	14	12	9 897	**0.825**
MALLINCKRODT, INC.	24-04206-01	114	96	35	46	17	22	50	35	-	-	-	-	415	301	216.081	0 718
Total	**4**	265	115	49	51	21	26	53	36	-	-	-	-	616	351	232.367	0 662
MANUFACTURING AND DISTRIBUTION - TYPE B BROAD - 03212																	
BEST INDUSTRIES	45-19757-01	57	78	7	5	5	6	-	-	-	-	-	-	158	101	12.962	0.128
OHMART/VEGA CORP	34-00639-04	27	26	3	4	2	-	-	-	-	-	-	-	62	35	3 656	0 104
Total	**2**	84	104	10	9	7	6	-	-	-	-	-	-	220	136	16 618	0.122
MANUFACTURING AND DISTRIBUTION - OTHER - 03214																	
ADVANZ MEASUREMENT & CONTROL	34-26683-03	-	10	-	-	-	-	-	-	-	-	-	-	10	10	0 538	0 054
BERTHOLD SYSTEMS, INC.	37-21226-01	-	3	-	-	1	-	-	-	-	-	-	-	4	4	0 652	0 163
BRISTOL-MYERS SQUIBB MEDICAL	20-00320-19	-	-	-	1	-	-	-	-	-	-	-	-	1	1	0 310	0 310
CANBERRA INDUSTRIES, INC.	37-02401-01	10	26	2	-	-	-	-	-	-	-	-	-	38	28	0 652	0 023
CIS-US, INC.	20-20973-04	-	-	-	3	-	-	-	-	-	-	-	-	3	3	1 019	**0.340**
FAIRCHILD SEMICONDUCTOR	37-24841-02	10	-	-	-	-	-	-	-	-	-	-	-	10	-	-	-
FISCHER TECHNOLOGY	06-19165-01	9	-	-	-	-	-	-	-	-	-	-	-	9	-	-	-
NORDION INTERNATIONAL, INC.	54-28275-01	1	10	1	-	-	-	-	-	-	-	-	-	12	11	0 374	0 034
PHARMASAN LABS, INC.	48-26355-01	-	3	-	-	-	-	-	-	-	-	-	-	3	3	0 016	0 005
PRINCETON GAMMA-TECH, INC.	29-12783-01	25	24	-	-	-	-	-	-	-	-	-	-	49	24	0.258	0 011
Total	**10**	55	76	3	4	1	-	-	-	-	-	-	-	139	84	3 819	0 045

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 2001 (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 - SINGLE LOCATION - 03310																	
ARMY, DEPARTMENT OF THE	13-18235-01	37	-	-	-	-	-	-	-	-	-	-	-	-	37	-	-	-
ARMY, DEPARTMENT OF THE	29-00047-06	2	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-
ARROW TANK & ENGINEERING CO	22-13253-01	1	1	-	2	1	-	-	-	-	-	-	-	-	5	4	1 301	0 325
BUCKEYE STEEL CASTINGS	34-06627-01	-	2	-	-	-	-	-	-	-	-	-	-	-	2	2	0 020	0 010
CARONDELET FOUNDRY COMPANY	24-26136-01	3	5	-	-	-	-	-	-	-	-	-	-	-	8	5	0 341	0.068
CHART INDUSTRIES, INC.	22-24393-01	-	5	-	-	-	-	-	-	-	-	-	-	-	5	5	0 137	0 027
CITY METAL COMPANY	24-15152-01	4	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-
DURALOY TECHNOLOGIES	37-02279-02	-	2	2	-	-	-	-	-	-	-	-	-	-	4	4	0.438	0 110
GREDE -PRYOR, INC	35-18099-01	1	2	-	-	-	-	-	-	-	-	-	-	-	3	2	0 003	0 002
HARRISON STEEL CASTINGS CO	13-02141-01	3	2	-	-	-	-	-	-	-	-	-	-	-	5	2	0 062	0 031
HUTCHINSON TECHNICAL COLLEGE	22-15554-01	29	19	-	-	-	-	-	-	-	-	-	-	-	48	**19**	0 168	0 009
INTERMET - ARCHER CREEK	45-17464-01	5	2	-	-	-	-	-	-	-	-	-	-	-	7	2	0 046	0 023
LAFAYETTE TESTING SERVICES, INC.	48-32158-01	-	3	-	-	-	-	-	-	-	-	-	-	-	3	3	0 111	0 037
NILES STEEL TANK CO.	21-04741-01	2	1	-	-	-	-	-	-	-	-	-	-	-	3	1	0 005	0 005
THE FLOWSERVE CORPORATION	34-06398-01	-	3	-	-	-	-	-	-	-	-	-	-	-	3	3	0 078	0 026
THE SHAW GROUP, INC	45-25521-01	2	1	-	-	-	-	-	-	-	-	-	-	-	3	1	0 014	0 014
TRANS WORLD AIRLINES, INC	24-05151-05	**81**	18	-	-	-	-	-	-	-	-	-	-	-	**99**	18	0 075	0 004
WAUKESHA FOUNDRY DIVISION	48-13776-01	4	1	-	-	-	-	-	-	-	-	-	-	-	5	1	0 025	0 025
WISCONSIN CENTRIFUGAL, INC.	48-11641-01	3	1	-	4	-	1	1	-	-	-	-	-	-	10	7	**3 089**	**0.441**
Total	**19**	**177**	**68**	**2**	**6**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**256**	**79**	**5 913**	**0.075**

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 2001 (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																	
ALASKA INDUSTRIAL X-RAY	50-16084-01	-	2	5	1	1	2	2	1	1	-	-	-	-	15	15	13.205	0 880
ALLEGHENY LABORATORIES	37-20734-01	1	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
ALLIED INSPECTION SERVICES, INC.	21-18428-01	-	1	1	-	-	1	3	-	-	-	-	-	-	6	6	4 568	0 761
ALONSO & CARUS IRON WORKS, INC.	52-21350-01	-	1	2	2	-	-	-	-	-	-	-	-	-	5	5	0 960	0.192
AMERICAN AIRLINES, INC.	35-13964-01	12	20	-	-	-	-	-	-	-	-	-	-	-	32	20	0.257	0 013
AMERICAN ENGINEERING TESTING	22-20271-02	1	8	3	3	-	-	2	2	-	-	-	-	-	19	18	9 731	0 541
ANVIL CORPORATION	46-23236-03	7	21	16	9	11	4	11	2	-	-	-	-	-	81	74	35 850	0 484
APPLIED TECHNICAL SERVICES, INC.	45-25477-01	-	5	1	1	-	-	-	-	-	-	-	-	-	7	7	0 674	0 096
ARCTIC SLOPE INSPECTION SVCS, INC.	50-29015-01	28	61	36	18	13	2	6	1	-	-	-	-	-	165	137	35 230	0 257
ASTROTECH, INC.	37-09928-01	11	10	4	1	2	-	-	-	-	-	-	-	-	28	17	2.580	0.152
BARNETT INDUSTRIAL X-RAY	35-26953-01	3	-	3	2	2	4	4	2	-	-	-	-	-	20	17	16.400	0 965
BIG STATE X-RAY, INC.	35-21144-01	-	1	7	3	1	3	13	1	-	-	-	-	-	29	29	25 200	0 869
BILL MILLER, INC.	35-19048-01	2	2	6	11	6	5	3	-	-	-	-	-	-	35	33	16.241	0 492
BRANCH RADIOGRAPHIC LABS , INC.	29-03405-02	9	6	5	6	1	2	2	-	-	-	-	-	-	31	22	8 864	0 403
BRAUN INTERTEC CORPORATION	22-16537-02	9	3	4	3	5	1	2	-	-	-	-	-	-	27	18	8 890	0 494
CALIBER INSPECTION	46-03414-03	6	11	3	2	1	-	3	-	-	-	-	-	-	26	20	7 529	0.376
CALUMET TESTING SERVICES, INC.	13-16347-01	1	3	1	2	2	3	1	1	5	-	-	-	-	19	18	34 506	**1.917**
CAPITAL X-RAY SERVICES, INC.	35-11114-01	-	7	5	3	2	2	5	3	3	1	-	-	-	31	31	34.812	1.123
CBI SERVICES, INC.	12-32299-01	9	20	1	1	2	-	-	-	-	-	-	-	-	33	24	2.126	0 089
CENTURY INSPECTION, INC.	42-08456-02	9	19	18	8	12	9	10	3	-	-	-	-	-	88	79	41.189	0 521
CERTIFIED TESTING LABS, INC.	29-14150-01	3	2	9	1	-	-	2	-	1	-	-	-	-	18	15	8 360	0.557
COLBY & THIELMEIER TESTING CO.	24-13737-01	-	-	1	4	4	1	3	-	-	-	-	-	-	13	13	8 705	0 670
COMO TECH INSPECTION	15-26978-01	-	-	1	-	3	-	2	-	-	-	-	-	-	6	6	5.255	0 876
CONAM INSPECTION	12-16559-02	13	9	9	7	4	4	7	-	-	-	-	-	-	53	40	19 809	0 495
CONNELL LIMITED PARTNERSHIP	35-13735-01	-	2	1	-	-	-	-	-	-	-	-	-	-	3	3	0.183	0 061
CONSUMERS ENERGY - NON-DEST.	21-08606-03	6	12	1	4	1	-	-	-	-	-	-	-	-	24	18	2.781	0 155
COOPERHEAT - MQS	42-32219-01	47	152	77	64	50	32	72	6	3	1	-	-	-	504	457	230 337	0 504

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 2001 (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																		
CTI CORE DRILLING SERVICES, INC.	45-25383-01	-	1	2	-	1	3	-	-	-	-	-	-	-	7	7	3 614	0 516
DAYTON X-RAY CO DBA/U S INSPEC.	34-06943-02	2	19	6	15	7	5	10	1	1	-	-	-	-	66	64	34 779	0 543
DIAMOND H TESTING COMPANY	11-27316-01	2	5	1	3	1	3	3	-	2	-	-	-	-	20	18	16 428	0 913
EASTERN TESTING & INSPECTION, INC	29-09814-01	2	2	3	1	-	2	-	-	-	-	-	-	-	10	8	2 649	0 331
EDWARDS PIPELINE SERVICES, INC	35-23193-01	9	13	24	31	9	11	14	1	-	-	-	-	-	112	103	51 206	0 497
ELECTRIC BOAT CORPORATION	06-01781-08	1	11	3	-	-	-	-	-	-	-	-	-	-	15	14	0 805	0 058
ELITE INSPECTION, INC	13-26712-01	2	4	4	2	3	4	3	2	1	-	-	-	-	25	23	18 853	0 820
FROEHLING & ROBERTSON, INC	45-08890-01	7	1	5	-	-	-	-	-	-	-	-	-	-	13	6	0 865	0 144
GENERAL TESTING & INSPECTION CO	47-32191-01	-	1	-	3	1	1	-	-	-	-	-	-	-	6	6	2 465	0 411
GLITSCH FIELD SERVICES/NDE,INC	34-14071-01	4	19	7	2	5	-	1	-	-	-	-	-	-	38	34	6 603	0 194
GLOBE X-RAY SERVICES, INC	35-15194-01	2	7	6	3	2	2	7	7	2	-	-	-	-	38	36	40 141	1 115
GREAT LAKES TESTING, INC	48-26484-01	1	2	-	5	1	-	5	1	2	-	-	-	-	17	16	18 210	1 138
H & G INSPECTION CO , INC	42-26838-01	-	-	1	-	-	-	5	2	-	-	-	-	-	8	8	13 895	1 737
H & H X-RAY SERVICES, INC	17-19236-01	3	12	13	20	22	24	58	23	10	12	-	-	-	197	194	**272 428**	1 404
HIGH MOUNTAIN INSPECTION SVCS	49-26808-02	-	5	6	9	4	9	20	12	9	9	-	-	-	83	83	141 609	1 706
HUNTINGTON TESTING & TECHNOLOGY	47-23076-01	5	4	12	10	3	3	4	1	1	-	-	-	-	43	38	22 727	0 598
IESCO GROUP 2	04-32290-01	3	-	1	1	-	2	-	-	-	-	-	-	-	7	4	2.105	0 526
INDUSTRIAL NDT CO , INC.	39-24888-01	1	2	5	-	1	3	1	-	-	-	-	-	-	13	12	5.099	0 425
INTEGRATED TECHNOLOGIES, INC.	06-30317-01	1	4	2	1	1	1	2	-	-	-	-	-	-	12	11	4 141	0 376
INTERNATIONAL RADIOGRAPHY & INSP	35-30246-02	-	5	5	6	4	3	15	11	11	3	-	-	-	63	63	107 201	1 702
INTERNATIONAL SCIENTIFIC RESEARCH	11-27661-01	2	7	1	-	-	-	-	-	-	-	-	-	-	10	8	0 508	0 064
JACOBS PAN-AMERICAN CORP	55-25502-01	1	6	1	1	2	1	7	3	-	3	-	-	-	25	24	32 743	1 364
JAN X-RAY SERVICES, INC.	21-16560-01	7	26	29	43	29	16	22	2	-	-	-	-	-	174	167	85 447	0 512
KAKIVIK ASSET MANAGEMENT	50-27667-01	15	19	11	9	3	3	2	-	-	-	-	-	-	62	47	12 895	0 274
LAWGIBB GROUP	34-25898-02	1	3	-	3	-	4	1	1	-	-	-	-	-	13	12	8 894	0 741
LEHIGH TESTING LABS, INC.	07-01173-03	-	1	-	-	3	-	-	-	-	-	-	-	-	4	4	1 976	0 494

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 2001 (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																		
LONGVIEW INSPECTION, INC.	42-27593-01	**11**	9	**8**	15	**11**	9	**22**	10	**1**	-	-	-	-	96	85	80 689	0 949
LONGVIEW INSPECTION, INC. (WIT)	48-17480-01	-	1	2	-	-	1	1	-	-	-	-	-	-	5	5	2.861	0 572
LUCIUS PITKIN	29-27816-01	1	1	1	3	-	-	-	-	-	-	-	-	-	6	5	1 326	0.265
MAGNA CHEK, INC.	21-19111-02	2	2	-	-	-	-	-	-	-	-	-	-	-	4	2	0 012	0 006
MARTIN INDUSTRIAL TESTING, INC.	45-25452-01	-	1	-	1	-	1	-	-	-	-	-	-	-	3	3	1.183	0 394
MARYLAND Q C. LABORATORIES, INC.	19-28683-01	3	12	3	2	1	1	-	-	-	1	-	-	-	23	20	7 522	0.376
MATTINGLY TESTING SERVICES, INC.	25-21479-01	2	2	-	2	1	3	2	-	-	-	-	-	-	12	10	6 699	0 670
MET-CHEM TESTING LABS OF UTAH, INC.	43-27362-01	-	9	2	1	1	1	4	-	-	-	-	-	-	18	18	7 522	0 418
MID AMERICAN INSPECTION SERV, INC.	21-26060-01	5	-	-	2	4	1	4	4	-	-	-	-	-	20	15	20 272	1.351
MIDWEST INDUSTRIAL X-RAY, INC.	33-27427-01	1	1	1	2	2	1	1	4	4	-	-	-	-	17	16	29 871	1 867
NAVY, DEPARTMENT OF THE*	45-23645-01NA	**99**	107	**10**	4	-	-	-	-	-	-	-	-	-	220	121	4.733	0 039
NDT SPECIALISTS, INC.	48-25917-01	1	-	2	2	-	1	2	-	1	-	-	-	-	9	8	7 670	0 959
NEWPORT NEWS SHIPBLDG. & DRY DOCK	45-09428-02	-	17	**15**	1	-	-	-	-	-	-	-	-	-	33	33	3 542	0 107
NON-DESTRUCTIVE TESTING GROUP	21-32340-01	-	2	5	6	1	-	6	3	-	-	-	-	-	23	23	18 423	0.801
NOVA DATA TESTING LABS, INC.	45-24872-01	-	4	1	-	-	1	-	-	-	-	-	-	-	6	6	1 073	0.179
PACIFIC TESTING, INC.	53-29118-01	-	1	-	2	-	-	-	-	-	-	-	-	-	3	3	0 748	0 249
PRECISION CALIBRATION & TESTING CO	37-30546-01	3	6	3	-	-	-	-	-	-	-	-	-	-	12	9	0 650	0 072
PRECISION COMPONENTS CORP.	37-16280-01	7	11	-	-	-	-	-	-	-	-	-	-	-	18	11	0 048	0 004
PRIME NDT SERVICES, INC.	37-23370-01	-	2	4	1	2	3	7	4	1	1	-	-	-	25	25	32 824	1 313
PROFESSIONAL NDE & WELDING SVCS.	52-25538-01	-	3	3	-	-	-	-	-	-	-	-	-	-	6	6	0 661	0.110
PROFESSIONAL SERVICE INDUSTRIES	12-16941-03	1	5	3	5	2	6	2	1	-	-	-	-	-	25	24	13.409	0 559
PROFESSIONAL WELDING ASSOC. INC.	48-25806-01	1	1	-	1	1	-	-	-	-	-	-	-	-	4	3	0 883	0.294
PROGRESS SERVICES, INC.	34-19592-02	3	2	1	-	-	-	-	-	-	-	-	-	-	6	3	0 188	0 063
Q. C. LABORATORIES, INC.	09-11579-03	1	4	5	3	3	-	-	-	-	-	-	-	-	16	15	3 947	0.263
QSL INSPECTION, INC.	37-28085-01	2	8	4	4	2	4	5	4	9	2	-	-	-	44	42	63 964	1.523
QUALITY INSPECTION SERVICES, INC.	31-30187-01	1	2	-	-	1	-	1	1	-	-	-	-	-	6	5	4 302	0 860

* Reported under program code 03613 as a multi-site, multi-regional R&D broad scope licensee.

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 2001 (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																		
QUALITY TESTING SERVICE, INC	24-32292-01	2	3	2	-	-	-	-	-	-	-	-	-	-	7	5	0 338	0 068
RIVEST TESTING USA, INC	35-27438-01	-	-	2	2	4	1	1	-	-	-	-	-	-	10	10	5 560	0.556
SCIENTIFIC TECHNICAL, INC	45-24882-01	-	3	1	5	-	-	-	-	-	-	-	-	-	9	9	2 138	0 238
S K MCBRYDE, INC.	32-25137-01	-	3	3	1	-	-	1	-	-	-	-	-	-	8	8	2 364	0 296
SOUTHWEST X-RAY CORPORATION	49-27434-01	-	1	1	-	2	-	2	-	-	-	-	-	-	6	6	4 656	0 776
ST. LOUIS TESTING LABS , INC	24-00188-02	2	4	8	2	1	-	-	2	-	-	-	-	-	19	17	7 979	0 469
T & K INSPECTION, INC	33-27678-01	-	-	1	1	-	1	3	2	2	-	-	-	-	10	10	17.478	1 748
TEI ANALYTICAL SERVICES, INC	37-28004-01	3	10	6	3	3	3	8	-	-	-	-	-	-	36	33	18 037	0 547
TESTING INSTITUTE OF ALASKA, INC	50-17446-01	-	3	2	2	1	1	1	-	-	-	-	-	-	10	10	3 795	0 380
TESTING TECHNOLOGIES, INC	45-25007-01	1	7	8	6	5	2	-	-	-	-	-	-	-	29	28	8 973	0 320
TESTMASTER INSPECTION CO , INC	34-24872-01	-	-	-	1	-	1	4	1	-	1	-	-	-	8	8	14 149	1 769
THERMAL ENGINEERING INT'L	24-19500-01	3	3	-	-	-	-	-	-	-	-	-	-	-	6	3	0 030	0 010
THREE RIVERS GAMMA SERVICES	37-28367-01	-	-	-	-	-	-	2	-	-	-	-	-	-	2	2	2 395	1 198
TMP WORLDWIDE	37-27891-01	2	9	1	4	1	1	5	2	-	-	-	-	-	25	23	14 674	0 638
TULSA GAMMA RAY, INC	35-17178-01	11	10	10	16	11	4	21	10	4	1	-	-	-	98	87	92 288	1 061
TVA INSPECTION SERVICES ORG	41-06832-06	11	5	2	2	1	-	-	-	-	-	-	-	-	21	10	1 934	0 193
TWIN CITY TESTING CORPORATION	22-01376-02	-	3	1	2	2	5	4	-	-	-	-	-	-	17	17	12 476	0 734
TWIN PORTS TESTING, INC	48-23476-01	5	3	1	1	2	1	1	-	-	-	-	-	-	14	9	3 940	0 438
UNITED EVALUATION SERVICES, INC	29-28358-02	1	3	1	1	1	1	4	3	1	-	-	-	-	16	15	17 377	1 158
VALLEY INDUSTRIAL X-RAY	04-29076-01	7	9	9	8	5	7	12	2	-	-	-	-	-	59	52	36 934	0.710
VALLEY INSPECTION SERVICE, INC	37-28385-01	-	-	1	2	-	-	2	2	-	-	-	-	-	7	7	8 819	1 260
VERMONT RADIOLOGISTS	44-28802-01	-	1	-	1	-	-	-	-	-	-	-	-	-	2	2	0 352	0.176
WESTERN X-RAY COMPANY	35-19993-01	-	3	5	7	5	3	8	4	-	-	-	-	-	35	35	29.035	0 830
WESTINGHOUSE GVT SVC CO, LLC	37-05809-02	-	3	-	-	-	-	-	-	-	-	-	-	-	3	3	0 020	0 007
WOS TESTING COMPANY, INC	48-26385-01	-	2	-	2	-	-	1	-	-	-	-	-	-	5	5	1 742	0 348
Total	**104**	**440**	**858**	**506**	**450**	**299**	**238**	**472**	**148**	**71**	**40**	**-**	**-**	**-**	**3,522**	**3,082**	**2,105 033**	**0 683**

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 2001 (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				
URANIUM ENRICHMENT PLANTS - 21200																		
USEC - PADUCAH	GDP-1	1864	200	11	-	-	-	-	-	-	-	-	-	-	2,075	211	6.125	0 029
USEC - PORTSMOUTH	GDP-2	1806	123	11	-	-	-	-	-	-	-	-	-	-	1,940	134	4 200	0.031
Total	**2**	**3,670**	**323**	**22**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**4,015**	**345**	**10.325**	**0 030**
FUEL FABRICATION FACILITIES - 21210																		
BWX TECHNOLOGIES, INC. (NNFD)	SNM-0042	4	134	174	47	11	2	6	-	-	-	-	-	-	378	374	67.695	0.181
FRAMATOME ANP, INC.	SNM-1227	88	278	116	75	34	16	9	1	-	-	-	-	-	617	529	105 224	0.199
FRAMATOME ANP, INC.	SNM-1168	127	215	29	6	1	2	-	-	-	-	-	-	-	380	253	13.125	0 052
GLOBAL NUCLEAR FUEL-AMERICAS, LLC	SNM-1097	179	455	181	117	4	1	-	-	-	-	-	-	-	937	758	86 000	0 113
NUCLEAR FUEL SERVICES, INC.	SNM-0124	70	498	104	64	21	10	12	2	-	-	-	-	-	781	711	95 599	0 134
WESTINGHOUSE ELECTRIC CO.	SNM-1107	13	180	161	102	59	39	105	80	55	7	-	-	-	801	788	725.177	0.920
WESTINGHOUSE ELECTRIC CO. LLC	SNM-0033	14	94	45	40	21	14	8	-	-	-	-	-	-	236	222	59.117	0.266
Total	**7**	**495**	**1,854**	**810**	**451**	**151**	**84**	**140**	**83**	**55**	**7**	**-**	**-**	**-**	**4,130**	**3,635**	**1,151.937**	**0.317**
INDEPENDENT SPENT FUEL STORAGE INSTALLATION - 23200																		
DEPARTMENT OF ENERGY (TMI)	SNM-2508	31	37	21	13	1	-	-	-	-	-	-	-	-	103	72	10 040	0.139
GENERAL ELECTRIC COMPANY	SNM-2500	16	27	2	6	-	-	-	-	-	-	-	-	-	51	35	3 048	0 087
Total	**2**	**47**	**64**	**23**	**19**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**154**	**107**	**13 088**	**0.122**

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

2001

APPENDIX B
Annual Whole Body Doses at Licensed Nuclear Power Facilities
CY 2001

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	1,221	740	244	86	8	3	1	-	-	-	-	-	-	-	2,303	1,082	106 040
BEAVER VALLEY 1, 2	PWR	1,383	620	344	185	29	16	8	-	-	-	-	-	-	-	2,585	1,202	184 361
BRAIDWOOD 1, 2	PWR	1,303	571	200	90	15	4	1	-	-	-	-	-	-	-	2,184	881	100.570
BROWNS FERRY 1, 2, 3	BWR	1,244	695	386	315	93	25	11	-	-	-	-	-	-	-	2,769	1,525	293 879
BRUNSWICK 1, 2	BWR	1,368	868	352	242	89	47	25	-	-	-	-	-	-	-	2,991	1,623	302 812
BYRON 1, 2	PWR	1,382	499	187	32	1	-	-	-	-	-	-	-	-	-	2,101	719	59 451
CALLAWAY 1	PWR	1,039	579	171	87	24	4	8	-	-	-	-	-	-	-	1,912	873	106 782
CALVERT CLIFFS 1, 2	PWR	1,363	448	223	140	50	16	18	-	-	-	-	-	-	-	2,258	895	166 864
CATAWBA 1, 2	PWR	1,688	572	291	59	28	8	2	-	-	-	-	-	-	-	2,648	960	116 241
CLINTON	BWR	1,185	199	104	25	1	-	-	-	-	-	-	-	-	-	1,514	329	33 770
COLUMBIA GENERATING 2	BWR	820	876	302	248	68	19	2	-	-	-	-	-	-	-	2,335	1,515	226 675
COMANCHE PEAK 1, 2	PWR	1,311	470	247	106	24	5	1	-	-	-	-	-	-	-	2,164	853	114 968
COOK 1, 2	PWR	1,861	339	69	10	4	1	-	-	-	-	-	-	-	-	2,284	423	27 290
COOPER STATION	BWR	540	836	261	144	49	17	2	-	-	-	-	-	-	-	1,849	1,309	168 665
CRYSTAL RIVER 3	PWR	857	474	232	131	45	15	5	-	-	-	-	-	-	-	1,759	902	147 946
DAVIS-BESSE	PWR	837	108	11	-	-	-	-	-	-	-	-	-	-	-	956	119	5 505
DIABLO CANYON 1, 2	PWR	1,111	690	266	89	25	4	-	-	-	-	-	-	-	-	2,185	1,074	117 804
DRESDEN 2, 3	BWR	1,307	1,674	616	313	112	25	29	-	-	-	-	-	-	-	4,076	2,769	400.702
DUANE ARNOLD	BWR	843	502	212	127	44	9	4	-	-	-	-	-	-	-	1,741	898	137 564
FARLEY 1, 2	PWR	1,195	825	552	307	89	30	7	-	-	-	-	-	-	-	3,005	1,810	320 509
FERMI 2	BWR	1,089	685	294	162	50	11	-	-	-	-	-	-	-	-	2,291	1,202	168 689
FITZPATRICK	BWR	632	497	82	66	18	1	1	-	-	-	-	-	-	-	1,297	665	63 229
FORT CALHOUN	PWR	456	271	161	164	108	48	18	-	-	-	-	-	-	-	1,226	770	225 891
GINNA	PWR	588	115	19	5	1	-	-	-	-	-	-	-	-	-	728	140	10 156
GRAND GULF	BWR	994	601	273	156	43	26	10	-	-	-	-	-	-	-	2,103	1,109	185 214
HARRIS	PWR	974	818	423	258	74	12	1	-	-	-	-	-	-	-	2,560	1,586	252 241
HATCH 1, 2	BWR	1,157	653	418	273	56	6	1	-	-	-	-	-	-	-	2,564	1,407	230 242
HOPE CREEK 1	BWR	625	1,064	241	154	49	20	4	-	-	-	-	-	-	-	2,157	1,532	156.180
INDIAN POINT 2	PWR	1,253	336	57	4	2	-	-	-	-	-	-	-	-	-	1,652	399	22 067
INDIAN POINT 3	PWR	877	612	262	128	12	-	-	-	-	-	-	-	-	-	1,891	1,014	118 115
KEWAUNEE	PWR	665	470	359	227	41	11	2	-	-	-	-	-	-	-	1,775	1,110	200 245
LASALLE 1, 2	BWR	1,804	222	206	96	6	3	2	-	-	-	-	-	-	-	2,339	535	82 721
LIMERICK 1, 2	BWR	1,622	581	295	135	65	31	20	-	-	-	-	-	-	-	2,749	1,127	210 336
MCGUIRE 1, 2	PWR	1,499	486	313	133	22	9	-	-	-	-	-	-	-	-	2,462	963	136 581
MILLSTONE 2, 3	PWR	1,079	929	232	116	35	12	3	-	-	-	-	-	-	-	2,406	1,327	174 238
MONTICELLO	BWR	514	357	176	147	85	40	29	-	-	-	-	-	-	-	1,348	834	220 683
NINE MILE POINT 1, 2	BWR	1,532	593	308	249	123	50	46	2	-	-	-	-	-	-	2,903	1,371	343 197
NORTH ANNA 1, 2	PWR	2,076	607	286	178	64	30	48	18	-	-	-	-	-	-	3,307	1,231	308 907

APPENDIX B
Annual Whole Body Doses at Licensed Nuclear Power Facilities
CY 2001

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	1,859	836	524	296	111	95	126	14	-	-	-	-	-	-	3,861	2,002	579 209
OYSTER CREEK	BWR	1,101	282	110	45	5	-	-	-	-	-	-	-	-	-	1,543	442	45 817
PALISADES	PWR	677	356	247	202	88	53	67	19	-	-	-	-	-	-	1,709	1,032	362.723
PALO VERDE 1, 2, 3	PWR	1,307	869	247	164	56	21	4	-	-	-	-	-	-	-	2,668	1,361	182.043
PEACH BOTTOM 2, 3	BWR	1,415	684	292	257	121	44	45	2	-	-	-	-	-	-	2,860	1,445	344 283
PERRY	BWR	1,052	638	375	274	87	17	1	-	-	-	-	-	-	-	2,444	1,392	258 268
PILGRIM	BWR	555	609	258	177	49	11	9	-	-	-	-	-	-	-	1,668	1,113	179.585
POINT BEACH 1, 2	PWR	738	365	172	146	50	7	-	-	-	-	-	-	-	-	1,478	740	131 667
PRAIRIE ISLAND 1, 2	PWR	623	316	197	122	46	9	1	-	-	-	-	-	-	-	1,314	691	124.708
QUAD CITIES 1, 2	BWR	1,057	388	119	145	61	17	6	-	-	-	-	-	-	-	1,793	736	143 849
RIVER BEND 1	BWR	809	594	368	213	59	11	4	-	-	-	-	-	-	-	2,058	1,249	207 614
ROBINSON 2	PWR	791	401	250	145	31	-	-	-	-	-	-	-	-	-	1,618	827	124.750
SALEM 1, 2	PWR	520	885	200	128	41	16	4	-	-	-	-	-	-	-	1,794	1,274	153 088
SAN ONOFRE 2, 3	PWR	1,590	669	270	111	27	5	1	-	-	-	-	-	-	-	2,673	1,083	131.384
SEABROOK	PWR	844	404	19	-	-	-	-	-	-	-	-	-	-	-	1,267	423	8 672
SEQUOYAH 1, 2	PWR	1,220	827	292	155	16	1	1	-	-	-	-	-	-	-	2,512	1,292	145 066
SOUTH TEXAS 1, 2	PWR	1,105	692	326	185	68	41	13	-	-	-	-	-	-	-	2,430	1,325	237.645
ST. LUCIE 1, 2	PWR	972	723	385	172	61	16	18	-	-	-	-	-	-	-	2,347	1,375	228 071
SUMMER 1	PWR	753	324	87	34	25	9	7	-	-	-	-	-	-	-	1,239	486	69 398
SURRY 1, 2	PWR	2,101	616	287	159	52	37	84	8	-	-	-	-	-	-	3,344	1,243	328.650
SUSQUEHANNA 1, 2	BWR	1,422	993	427	261	81	38	7	-	-	-	-	-	-	-	3,229	1,807	288 413
THREE MILE ISLAND 1	PWR	1,544	730	257	101	47	30	31	-	-	-	-	-	-	-	2,740	1,196	196 699
TURKEY POINT 3, 4	PWR	989	517	201	79	23	4	3	-	-	-	-	-	-	-	1,816	827	101.575
VERMONT YANKEE	BWR	775	453	211	138	48	9	4	-	-	-	-	-	-	-	1,638	863	143 010
VOGTLE 1, 2	PWR	1,047	449	253	130	25	11	2	-	-	-	-	-	-	-	1,917	870	129.270
WATERFORD 3	PWR	1,009	79	12	-	-	-	-	-	-	-	-	-	-	-	1,100	91	4 677
WATTS BAR 1	PWR	1,129	185	12	-	-	-	-	-	-	-	-	-	-	-	1,326	197	5 912
WOLF CREEK 1	PWR	908	95	5	5	-	-	-	-	-	-	-	-	-	-	1,013	105	5.176
TOTALS: 35 BWRs		**25,462**	**15,544**	**6,686**	**4,362**	**1,462**	**477**	**262**	**4**	-	-	-	-	-	-	**54,259**	**28,797**	**4,835.397**
TOTALS: 69 PWRs		**47,744**	**21,917**	**9,392**	**4,869**	**1,468**	**583**	**485**	**59**	-	-	-	-	-	-	**86,517**	**38,773**	**6,273.155**
TOTALS: 104 LWRs		**73,206**	**37,461**	**16,078**	**9,231**	**2,930**	**1,060**	**747**	**63**	-	-	-	-	-	-	**140,776**	**67,570**	**11,108.552**

APPENDIX B
Annual Whole Body Doses at Licensed Nuclear Power Facilities
CY 2001

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	185	76	31	13	32	8	7	-	-	-	-	-	-	-	352	167	47 556
HADDAM NECK	PWR	612	158	78	63	25	16	21	-	-	-	-	-	-	-	973	361	95 348
HUMBOLDT BAY	BWR	157	9	1	-	-	-	-	-	-	-	-	-	-	-	167	10	0 360
LACROSSE	BWR	19	35	6	4	-	-	-	-	-	-	-	-	-	-	64	45	2 782
MAINE YANKEE	PWR	376	234	82	61	24	7	4	-	-	-	-	-	-	-	788	412	68.121
MILLSTONE 1	BWR	337	290	72	36	11	4	1	-	-	-	-	-	-	-	751	414	14 946
RANCHO SECO	PWR	119	156	26	23	5	-	-	-	-	-	-	-	-	-	329	210	18 432
SAN ONOFRE 1	PWR	1,153	174	84	51	21	8	-	-	-	-	-	-	-	-	1,491	338	57 785
TROJAN	PWR	289	11	2	1	-	-	-	-	-	-	-	-	-	-	303	14	1 091
YANKEE-ROWE	PWR	438	36	9	2	1	-	-	-	-	-	-	-	-	-	486	48	3.969
ZION 1, 2	PWR	93	5	1	-	-	-	-	-	-	-	-	-	-	-	99	6	0 274
REACTORS NO LONGER IN COMMERCIAL OPERATION, REPORTED WITH OTHER UNITS																		
BROWNS FERRY 1	BWR	Reported with Browns Ferry 2, 3 and still included in the count of operating reactors, although Unit 1 has been on Administrative Hold since June, 1985																
DRESDEN 1	BWR	Reported with Dresden 2, 3. An estimated 12 person-rem was attributed to Unit 1																
INDIAN POINT 1	PWR	Reported with Indian Point 2																
THREE MILE ISLAND 2	PWR	Reported with Three Mile Island 1																
TOTAL REPORTING:	**12**	**3,778**	**1,184**	**392**	**254**	**119**	**43**	**33**	-	-	-	-	-	-	-	**5,803**	**2,025**	**310 664**

Appendix C*

PERSONNEL, DOSE, AND POWER GENERATION SUMMARY

1969 - 2001

* 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
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

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	---
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 - 1168, 1122 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
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

[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.

[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
BROWNS FERRY 1[2], 2, 3	1985	368.2	11.9	2,854	1,164	0.41	3.16
(continued)	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
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 - 820, 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
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

[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 (continued)	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
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
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, 835MWe	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
	1999	1,521.4	90.1	1,134	192	0.17	0.13
	2000	1,575.7	92.7	912	135	0.15	0 09
	2001	1,554.7	91.7	895	167	0.19	0.11
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

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
CATAWBA 1, 2	1997	2,028.2	89.3	1,561	266	0.17	0.13
(continued)	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
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 - 930 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
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
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

[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
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
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
	1992	731.0	96.4	463	84	0.18	0.11
	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

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
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
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
	1998	699 8	83 2	980	155	0.16	0.22
	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
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

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
DIABLO CANYON 1, 2 (continued)	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
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), 772, 773 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
	2000	1,506.4	97.3	2,341	262	0.11	0.17
	2001	1,427.4	94.5	2,769	401	0.14	0.28
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

[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
DUANE ARNOLD	1993	393.4	79.5	1,043	407	0.39	1.03
(continued)	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
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 - 833, 842 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
	2000	1,430.1	88 6	1,683	360	0.21	0.25
	2001	1,384.3	84.4	1,810	321	0.18	0 23
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
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

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
FITZPATRICK	1989	727.5	92.3	1,027	377	0.37	0.52
(continued)	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
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	74	0.10	0.17
	1987	366.0	75.4	1,247	388	0 31	1.06
	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
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

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
GINNA	1990	414.3	84.4	991	347	0.35	0.84
(continued)	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
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 - 1210 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
	1996	1,096.2	88.7	1,564	357	0 23	0.33
	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
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

[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
HADDAM NECK[5]	1997	-1.3	0.0	219	11	0.05	---
(continued)	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	---
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 - 860 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
	2000	783.0	92.5	888	101	0.11	0.13
	2001	611.2	72.4	1,586	252	0.16	0.41
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 - 863, 878 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
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

[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
HOPE CREEK 1	1997	731.8	77.8	1,747	350	0.20	0.48
(continued)	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
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
	1975	45 3	83.9	265	339	1.28	7.48
	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	---
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 - 951 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

[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 and now 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 (continued)	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
	1998	282.8	31.5	1,154	290	0.25	1.03
	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
INDIAN POINT 3[8] Docket 50-286; DPR-64 1st commercial operation 8/76 Type - PWR Capacity - 965 MWe	1979	574.0	66.5	808	636	0.79	1.11
	1980	367.3	53.2	977	308	0 32	0.84
	1981	367.5	59.8	677	364	0 54	0 99
	1982	171.5	22.5	1,477	1,226	0.83	7.15
	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
KEWAUNEE Docket 50-305; DPR-43 1st commercial operation 6/74 Type - PWR Capacity - 511 MWe	1975	401.9	88.2	104	28	0.27	0 07
	1976	405 9	78.9	381	270	0.71	0.67
	1977	425.0	79.9	312	140	0.45	0.33
	1978	466 6	89.5	335	154	0.46	0.33
	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

[8] Indian Point 3 was purchased by a different utility and now 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	1997	269 8	56.0	278	56	0.20	0.21
(continued)	1998	423.0	87.2	284	88	0 23	0.21
	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
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	---
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

[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 - 1143, 1143 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
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	---
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

[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	1993	1,470.4	66.2	1,685	463	0 27	0.31
(continued)	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
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	---
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 - 869, 1136 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

[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 (continued)	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
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
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

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	1990	656.2	46.6	2,405	699	0 29	1.07
(continued)	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
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
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

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	1998	1,989.1	81.3	1,695	366	0.22	0.18
(continued)	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
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
	1999	615.1	100.0	466	42	0 09	0.07
	2000	444.9	83.3	2,044	614	0.30	1.38
	2001	595.0	97.6	442	46	0.10	0.08
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

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
PALISADES	1995	583.5	75.8	1,230	462	0.38	0.79
(continued)	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
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
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 - 1093, 1093 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
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 - 1241 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

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
PERRY	1998	1,163.1	99.3	385	42	0.11	0.04
(continued)	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
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 - 653 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	---
	1988	0.0	0.0	2,073	392	0.19	---
	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
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 - 510, 512 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

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
POINT BEACH 1, 2 (continued)	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
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
	1985	882.6	84.0	1,082	416	0.38	0.47
	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
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 - 769, 769 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

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]	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
	1982	409.5	53.3	766	337	0.44	0 82
	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	---
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 - 936 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
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 - 683 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

[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	1985	629.5	87.9	1,378	311	0.23	0.49
(continued)	1986	577.1	80.3	1,571	539	0.34	0.93
	1987	510.1	72.5	1,379	499	0.36	0.98
	1988	385.0	65.9	1,351	564	0.42	1.46
	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
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, 1092 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
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
	1982	61.6	15.7	3,055	832	0.27	13.51
	1983	0 0	0 0	1,701	155	0 09	---

[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	1984	670.4	68.3	7,514	986	0.27	1.47
(continued)	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							
Type - PWR							
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 8/83, 4/84							
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
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 - 1122, 1117 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
	1992	1,849.0	85.4	1,714	465	0.27	0.25
	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

[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	1998	2,135.3	95.3	1,530	266	0.17	0.12
(continued)	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
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
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
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

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
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
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 - 1090, 1111 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
	1992	1,604.2	79.7	1,885	724	0.38	0 45
	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

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 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 - 786 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
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	---
	1996	0.0	0.0	122	2	0.02	---
	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

[14] Three Mile Island 1 resumed commercial power generation 10/85 after being under regulatory restraint since 1979. Parentheses indicate plant capacity when plant was operational.

[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.

[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
TROJAN	1983	494.2	62.4	969	307	0.32	0.62
(continued)	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	---
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
	1991	258.2	21.0	2,087	939	0.45	3.64
	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
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

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
VERMONT YANKEE	1984	398.1	79.0	954	626	0.66	1.57
(continued)	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
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 - 1148, 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
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
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 - 1125 MWe	2001	1,095.9	96.5	197	6	0.03	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
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 - 1170 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
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
	1980	35.6	22.0	502	213	0.42	5.98
	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	---

[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
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	—

[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

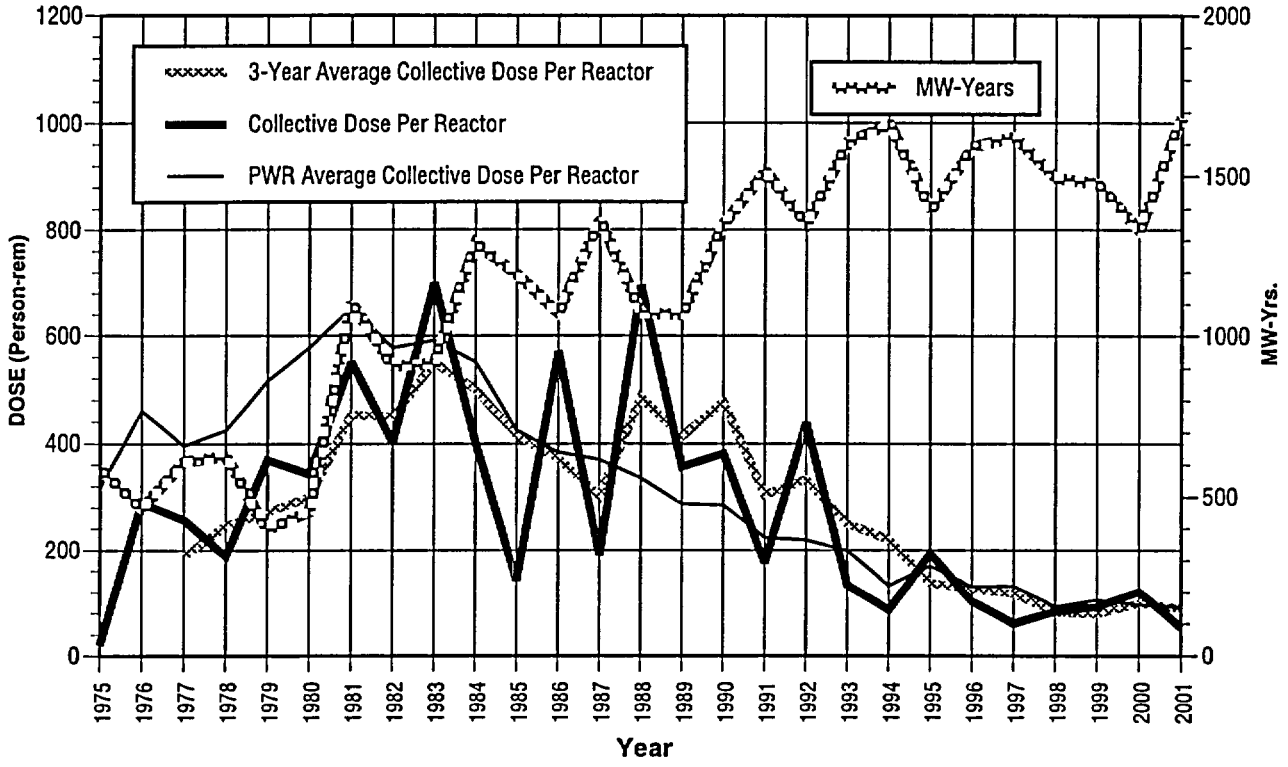
1973 - 2001

NOTE: Appendix D contains data on operating plants as well as plants which are no longer in commercial operation.

ARKANSAS 1, 2

Dose-Performance Indicators

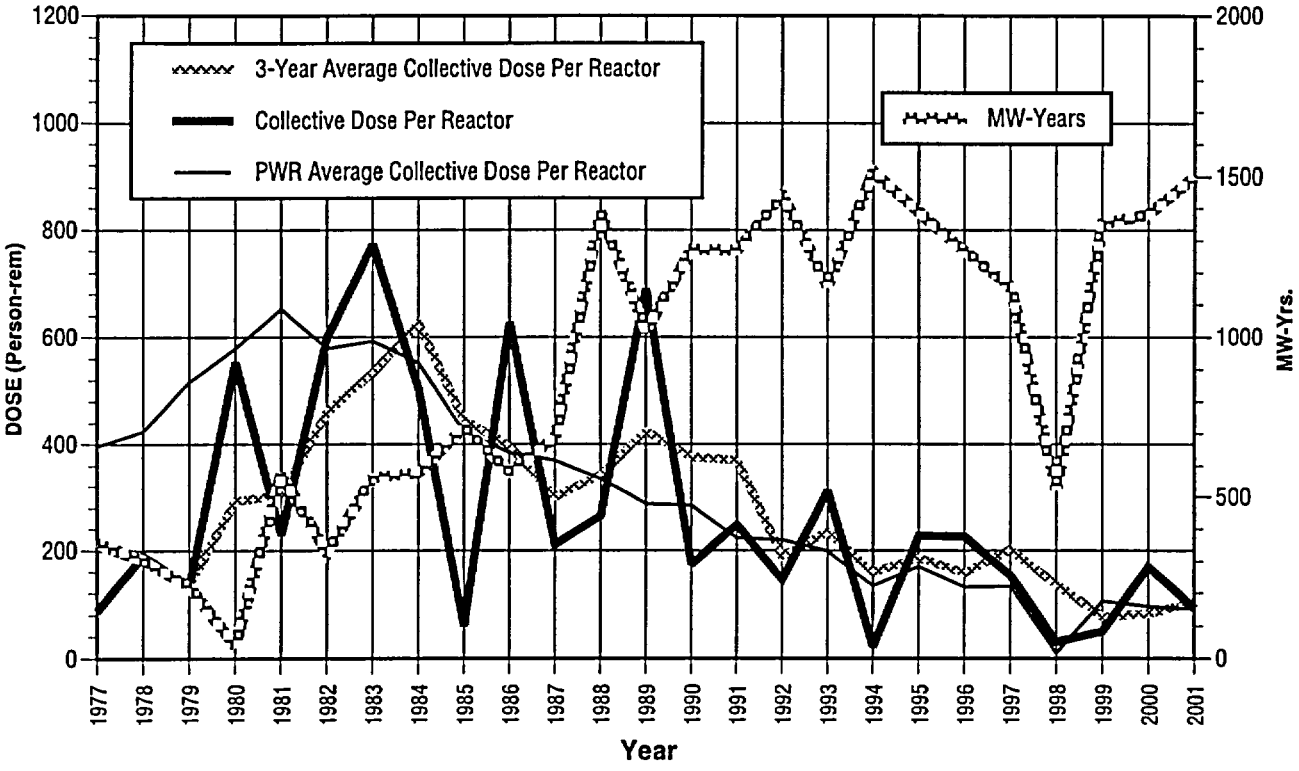
PWR



BEAVER VALLEY 1, 2

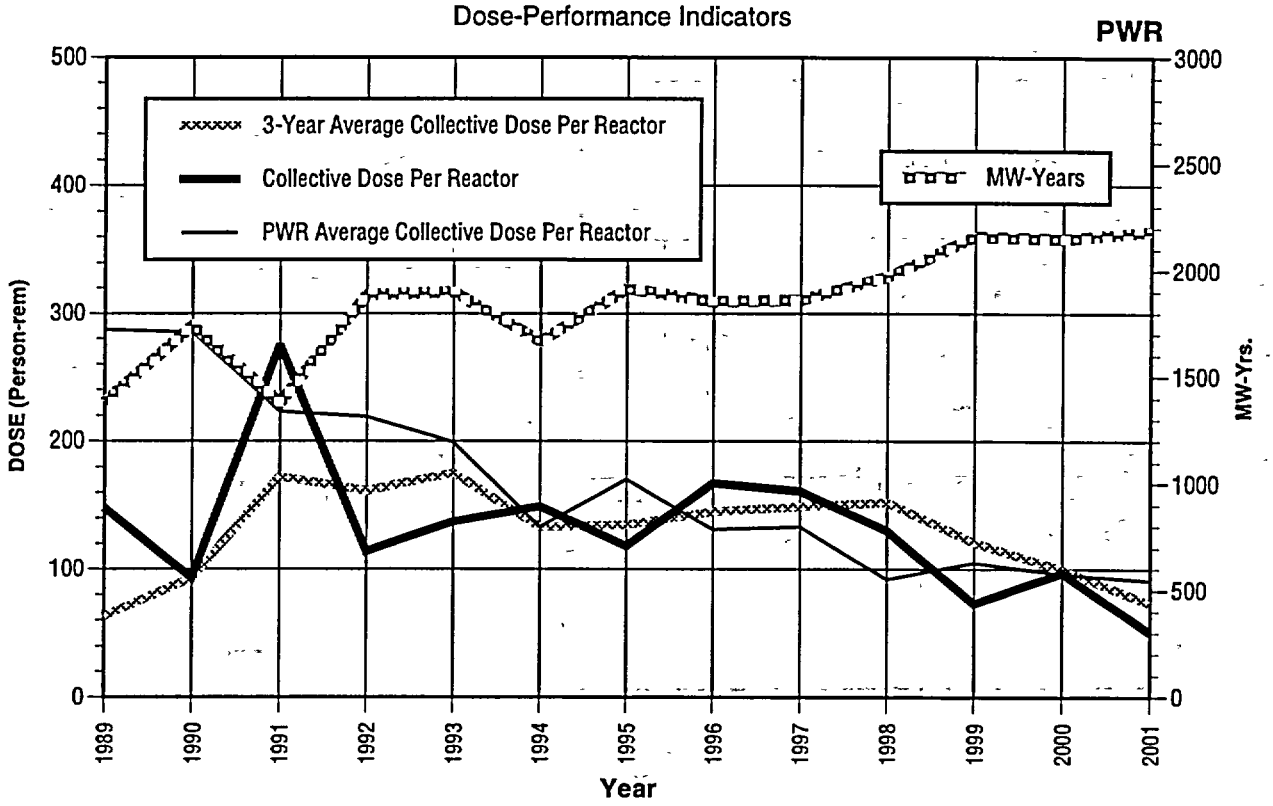
Dose-Performance Indicators

PWR



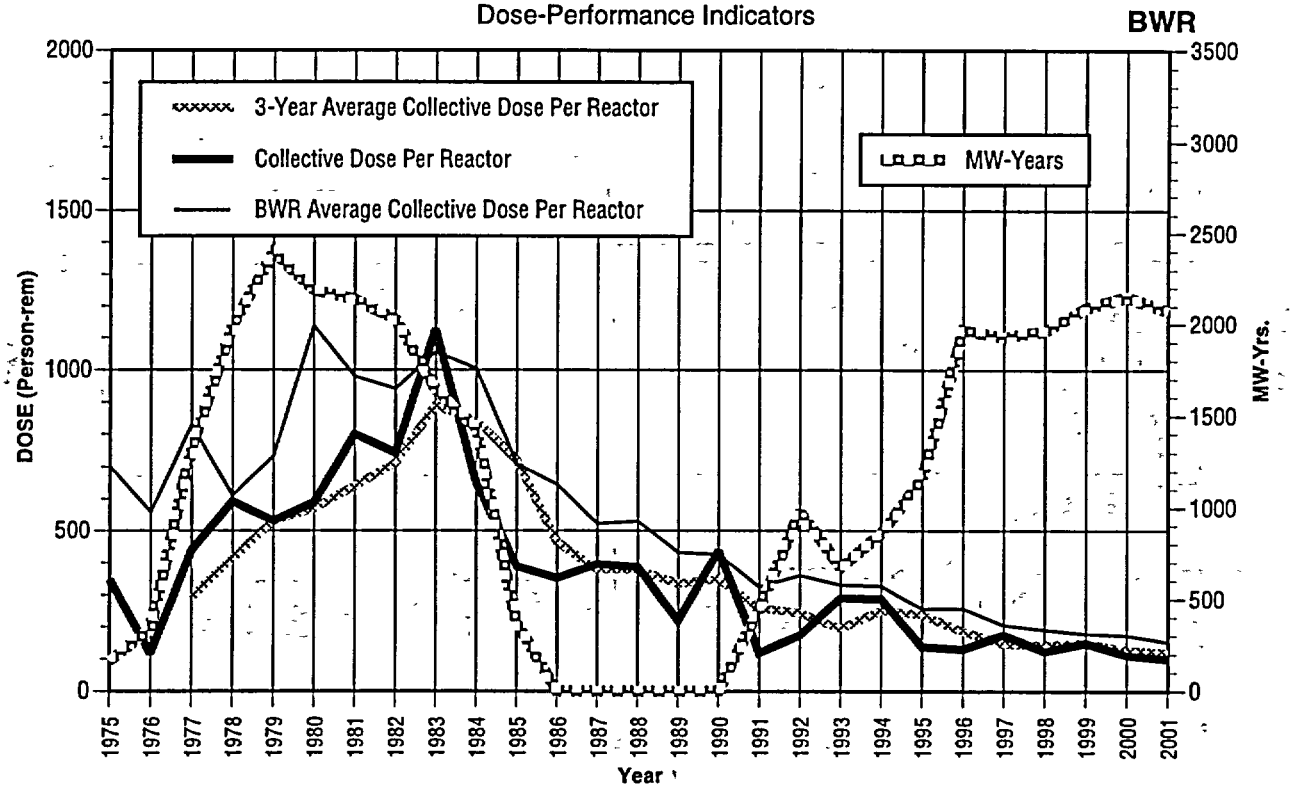
BRAIDWOOD 1, 2

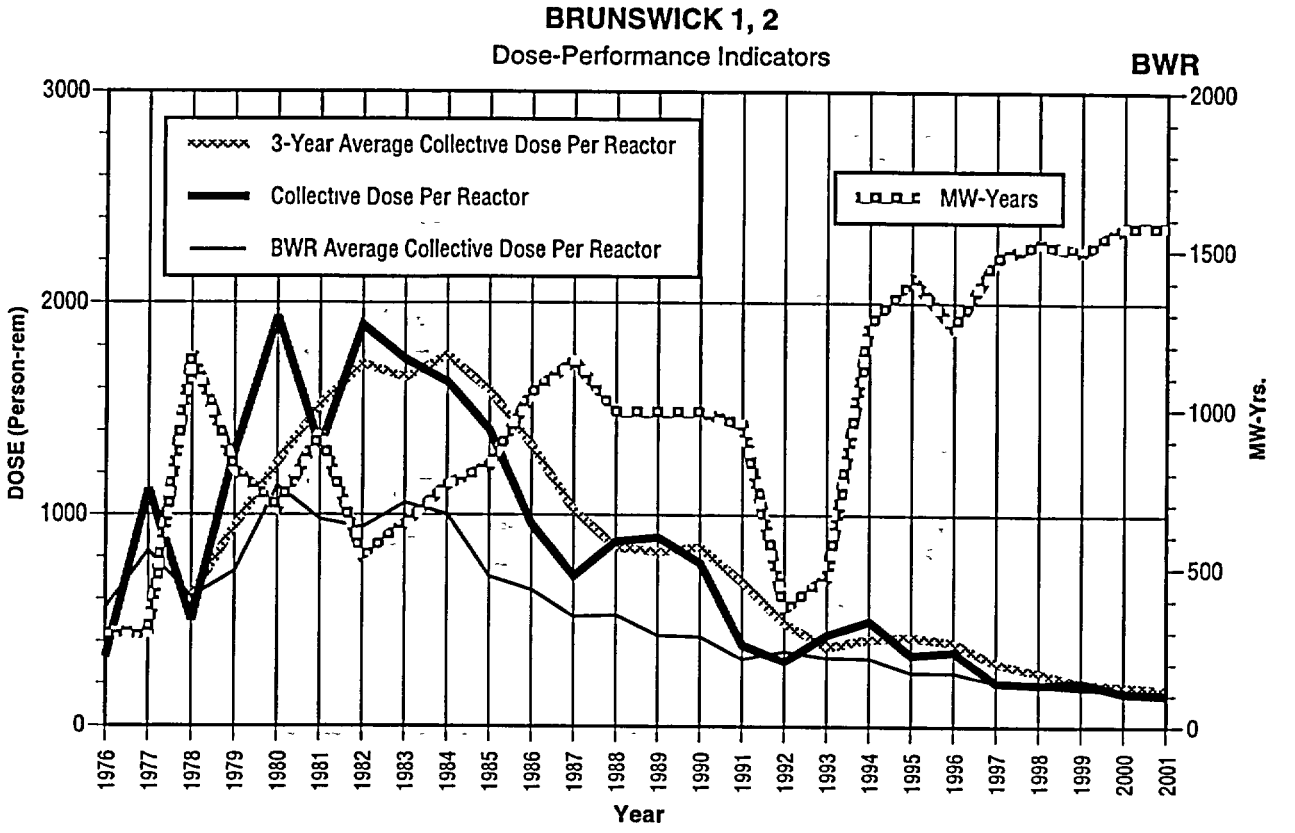
Dose-Performance Indicators

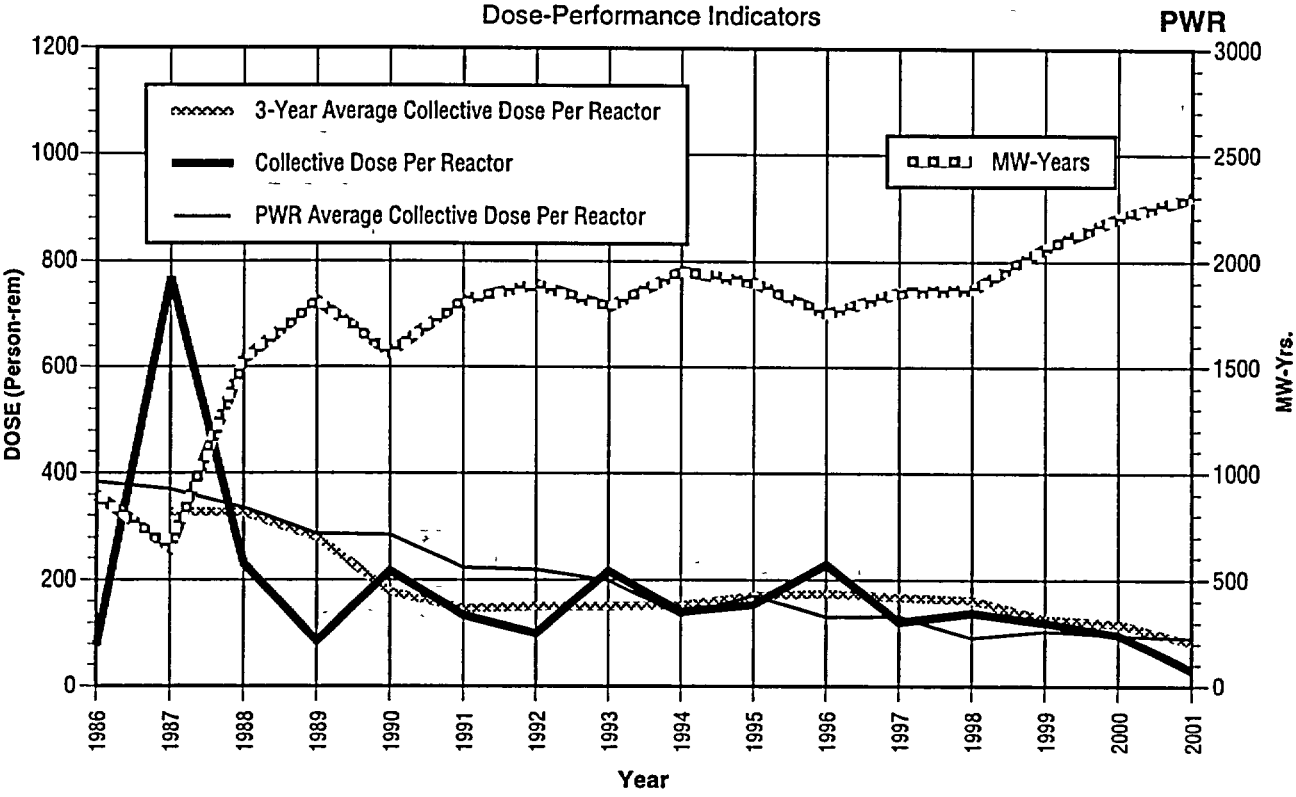


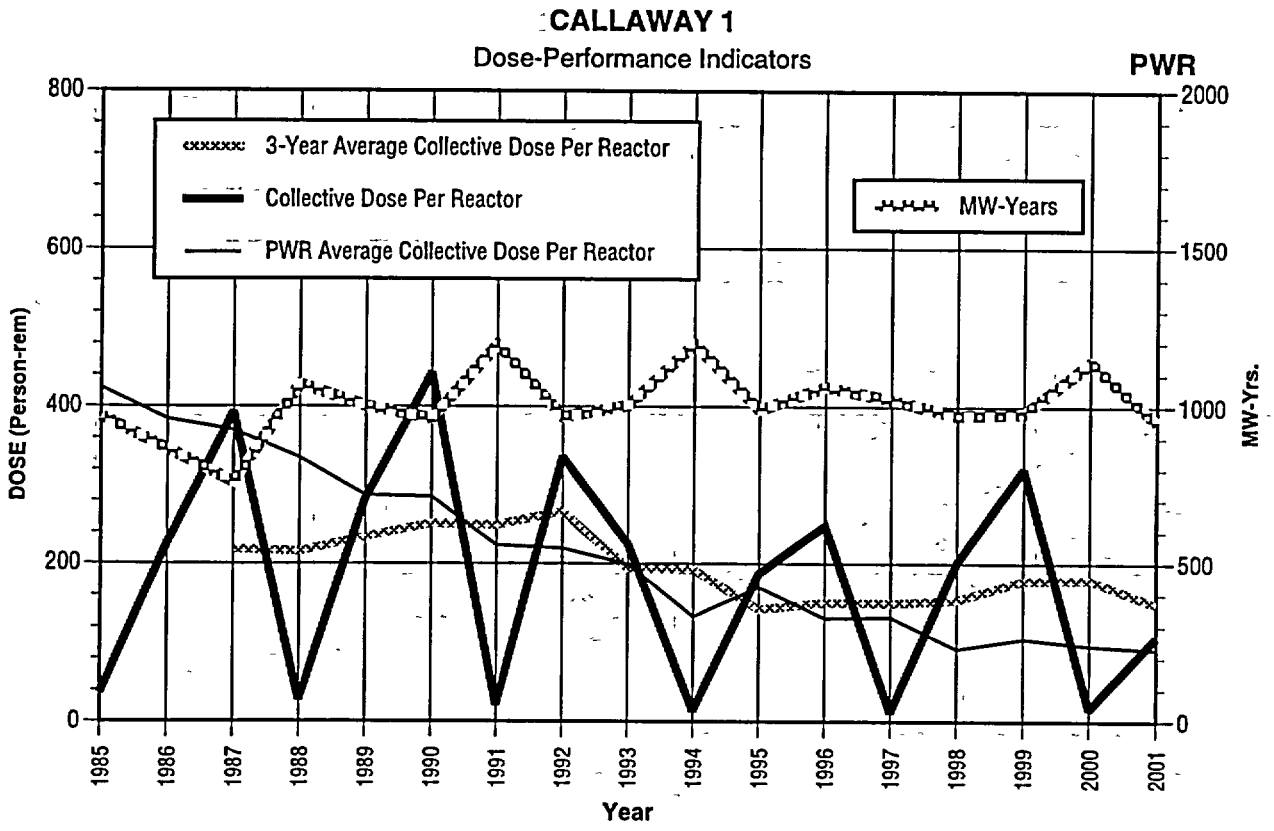
BROWNS FERRY 1, 2, 3

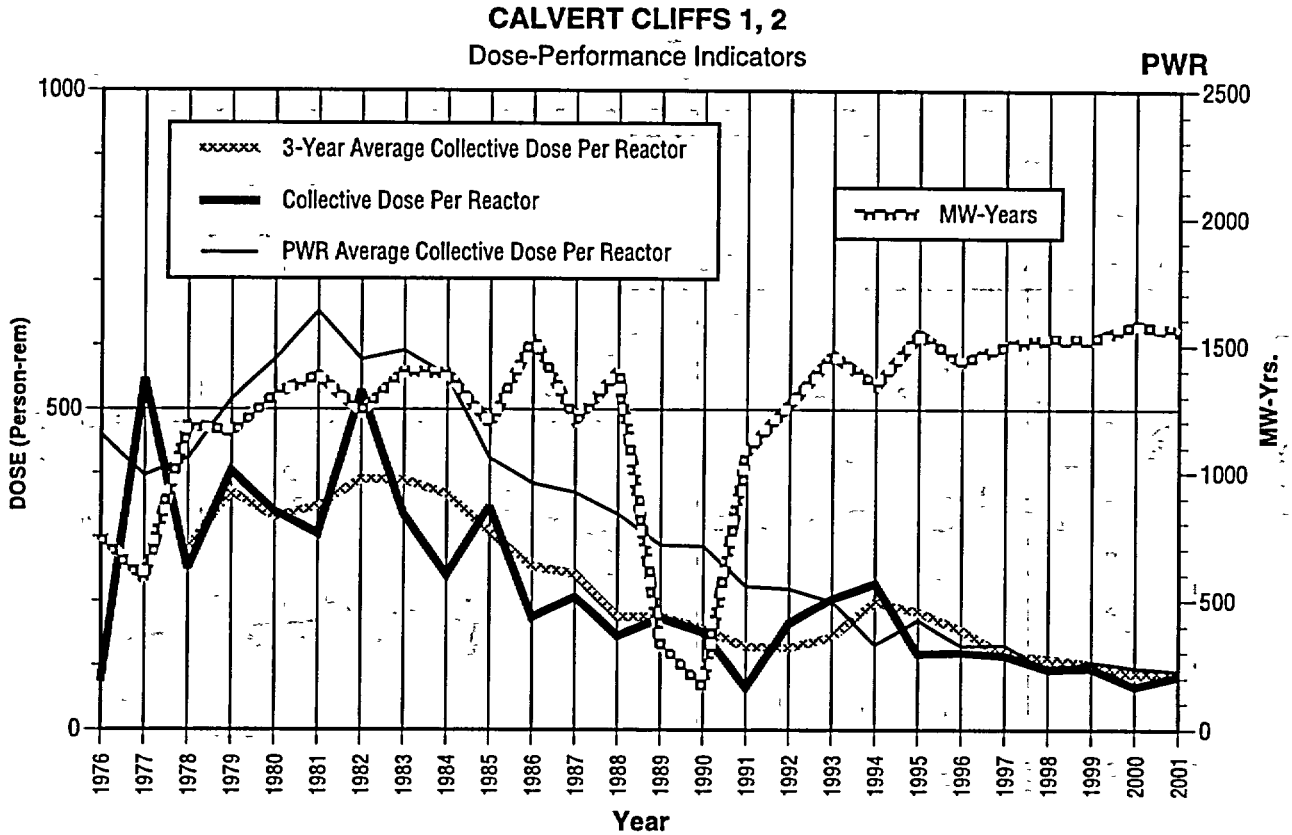
Dose-Performance Indicators

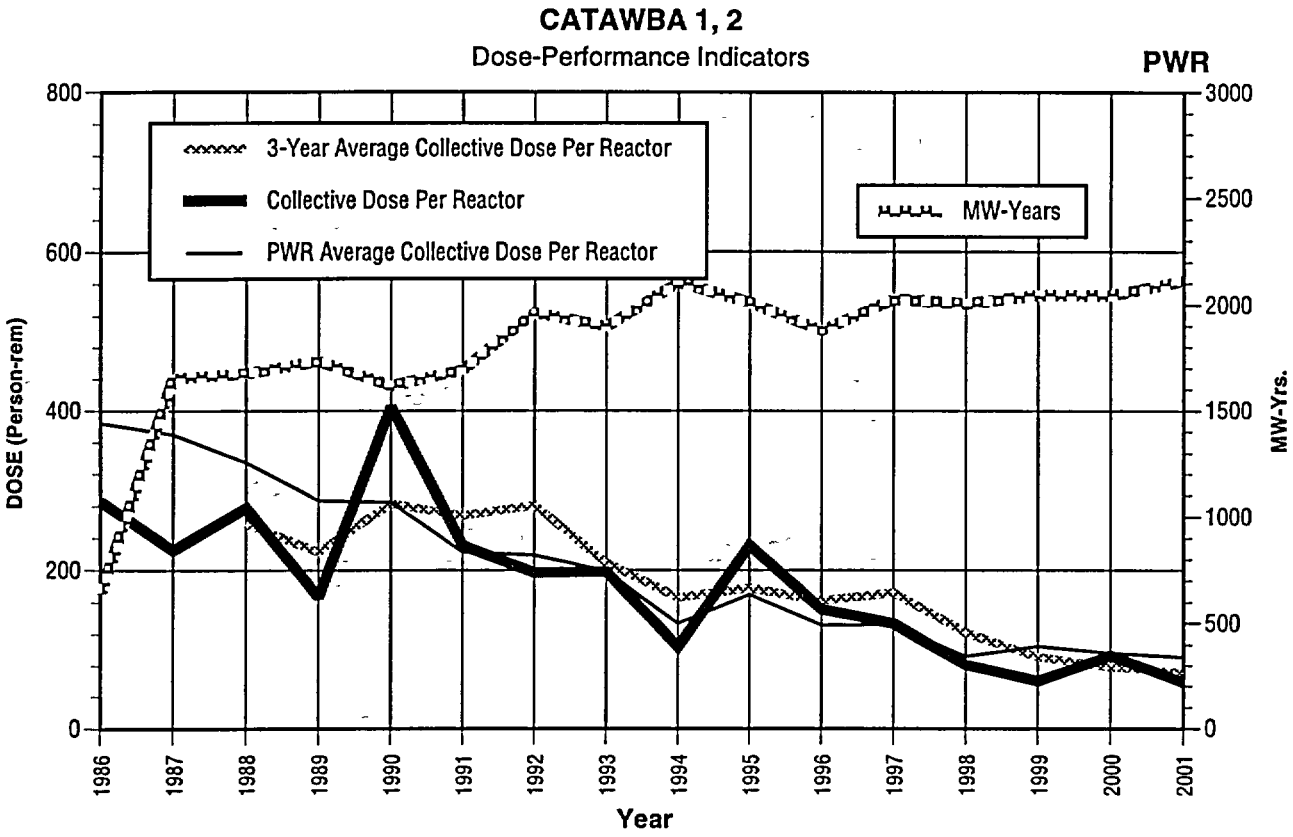



BRUNSWICK 1, 2
Dose-Performance Indicators
BWR
3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
BWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year
0
1000
2000
3000
500
1500
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001


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


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


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


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
500
1000
1500
2000
2500
3000
1986
1987
1988
1989
1990
1991
1992
1993
1994
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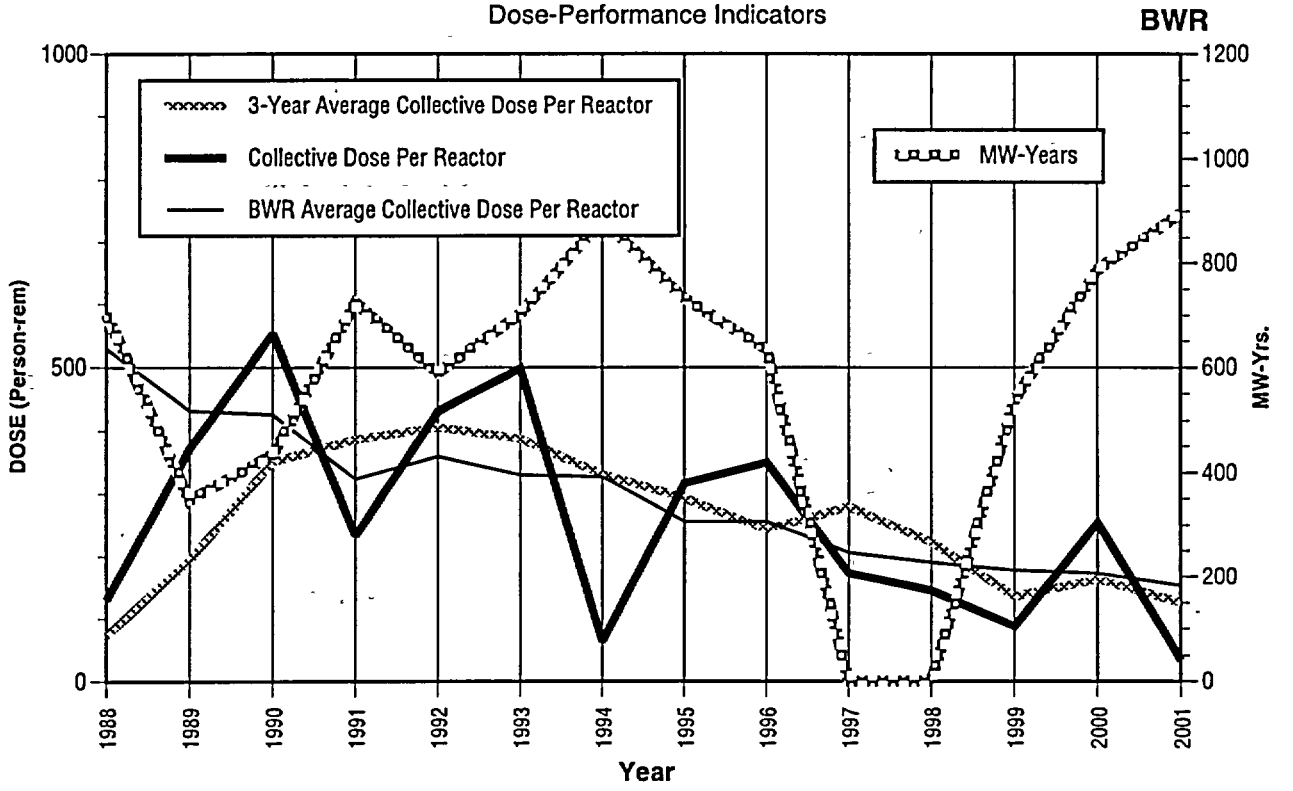
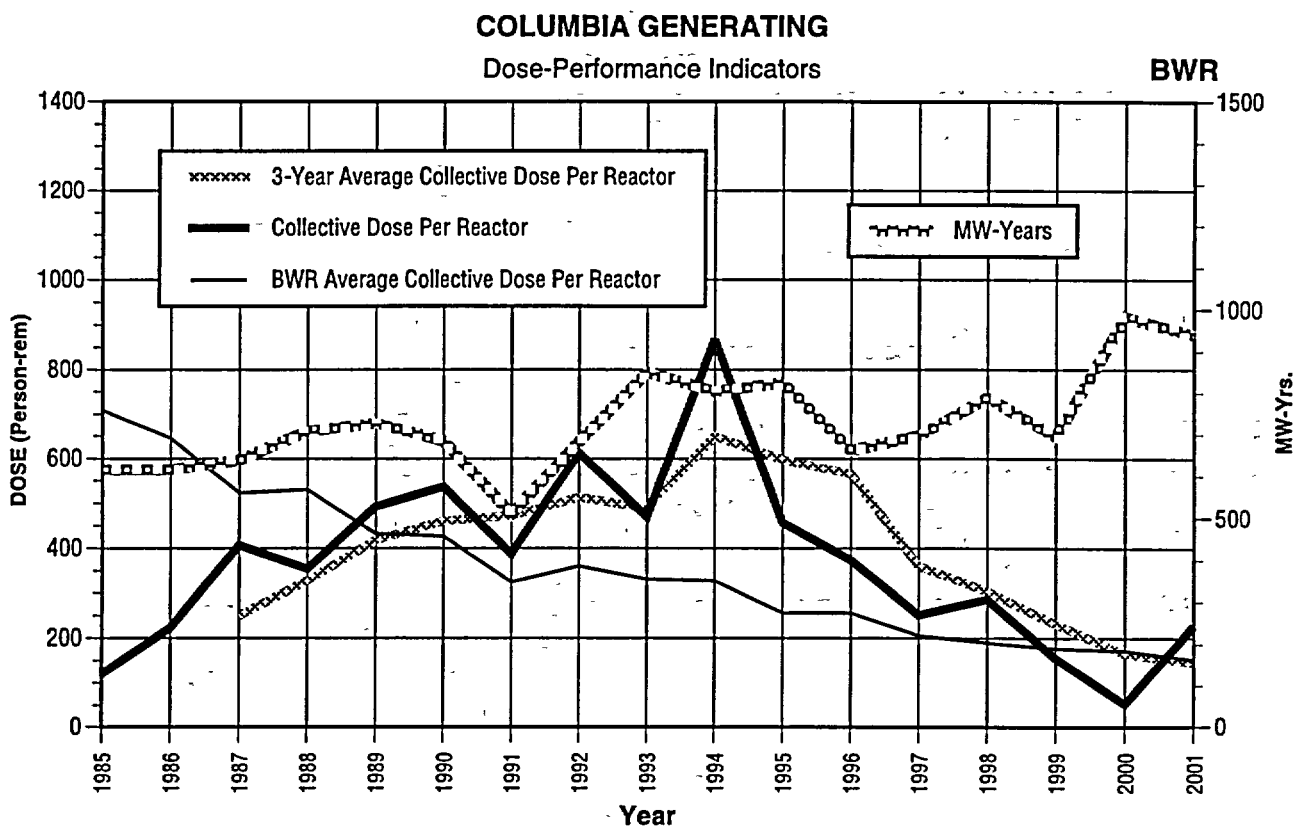
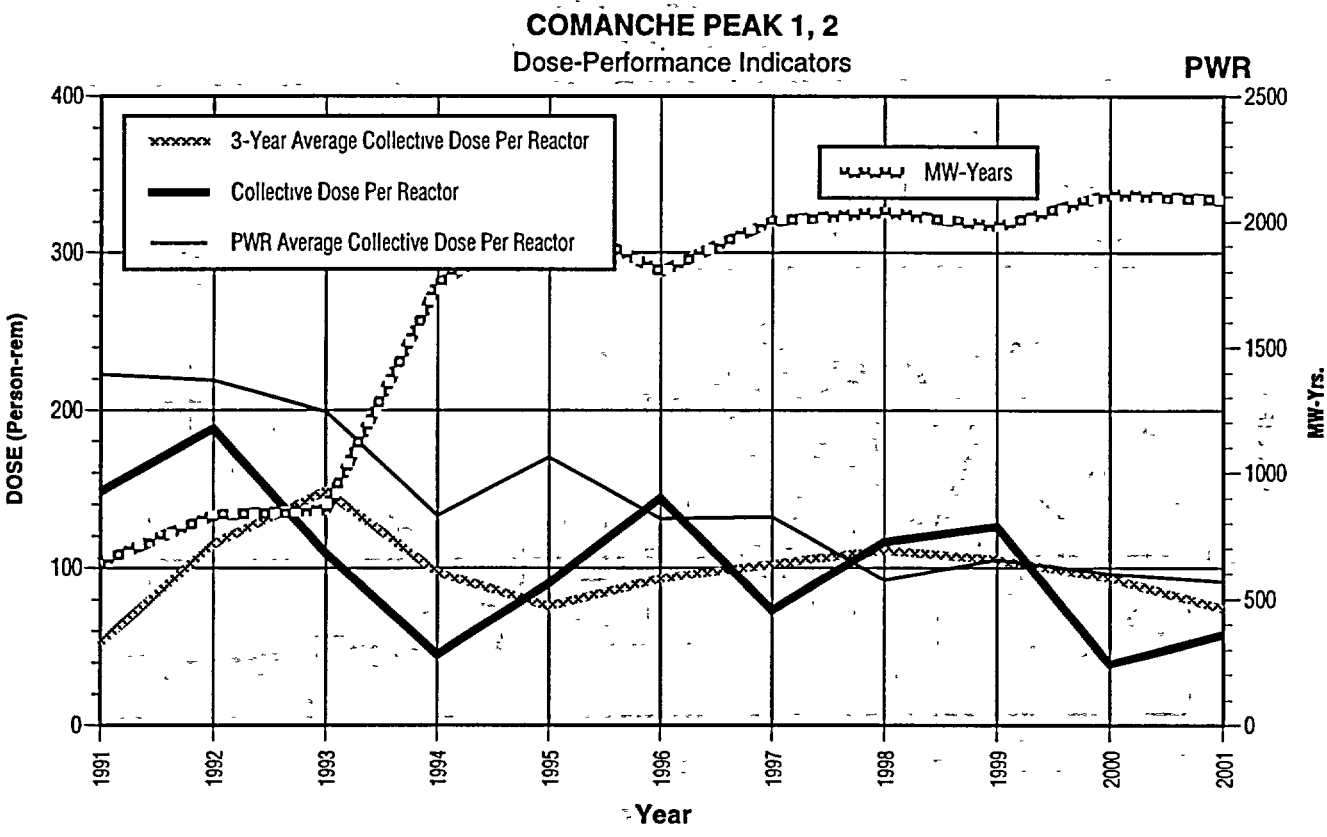
1996
1997
1998
1999
2000
2001

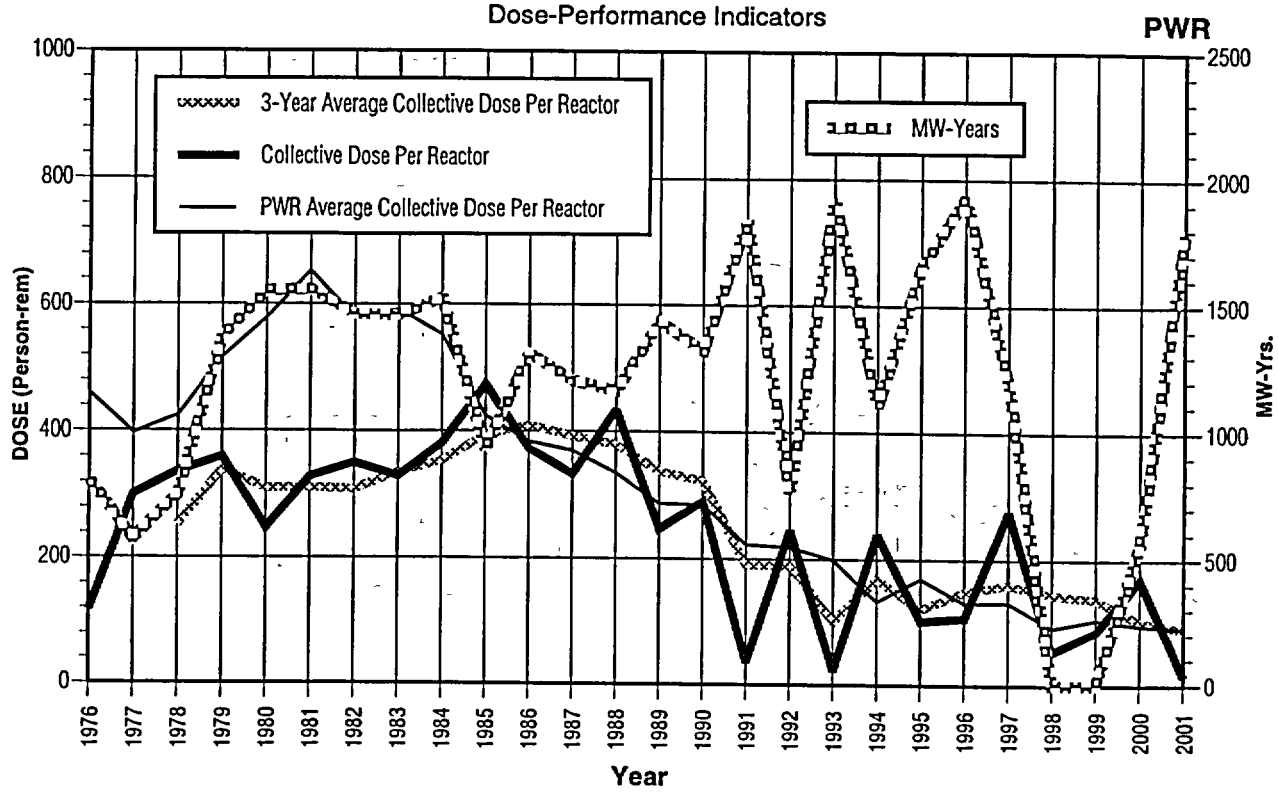

CLINTON
Dose-Performance Indicators
BWR
3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
BWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year
0
500
1000
200
400
600
800
1200
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001


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


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

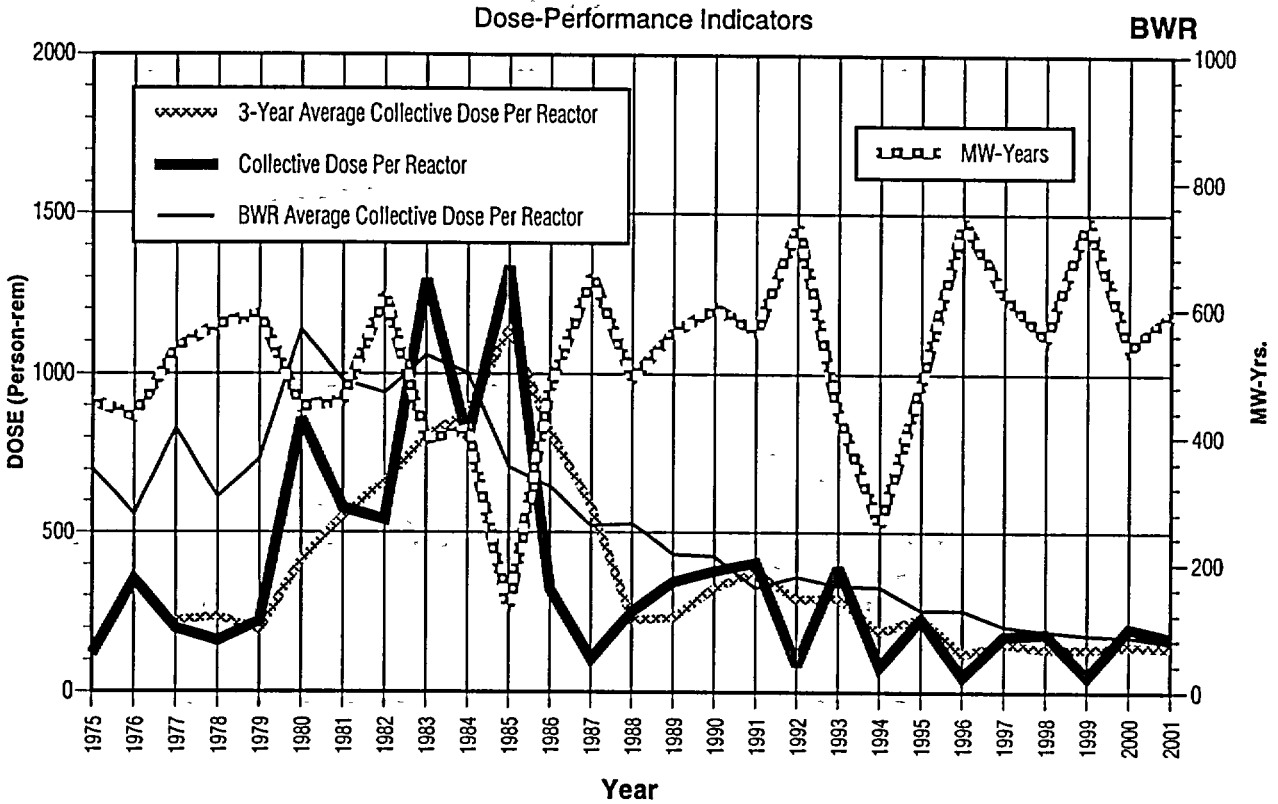
COOK 1, 2

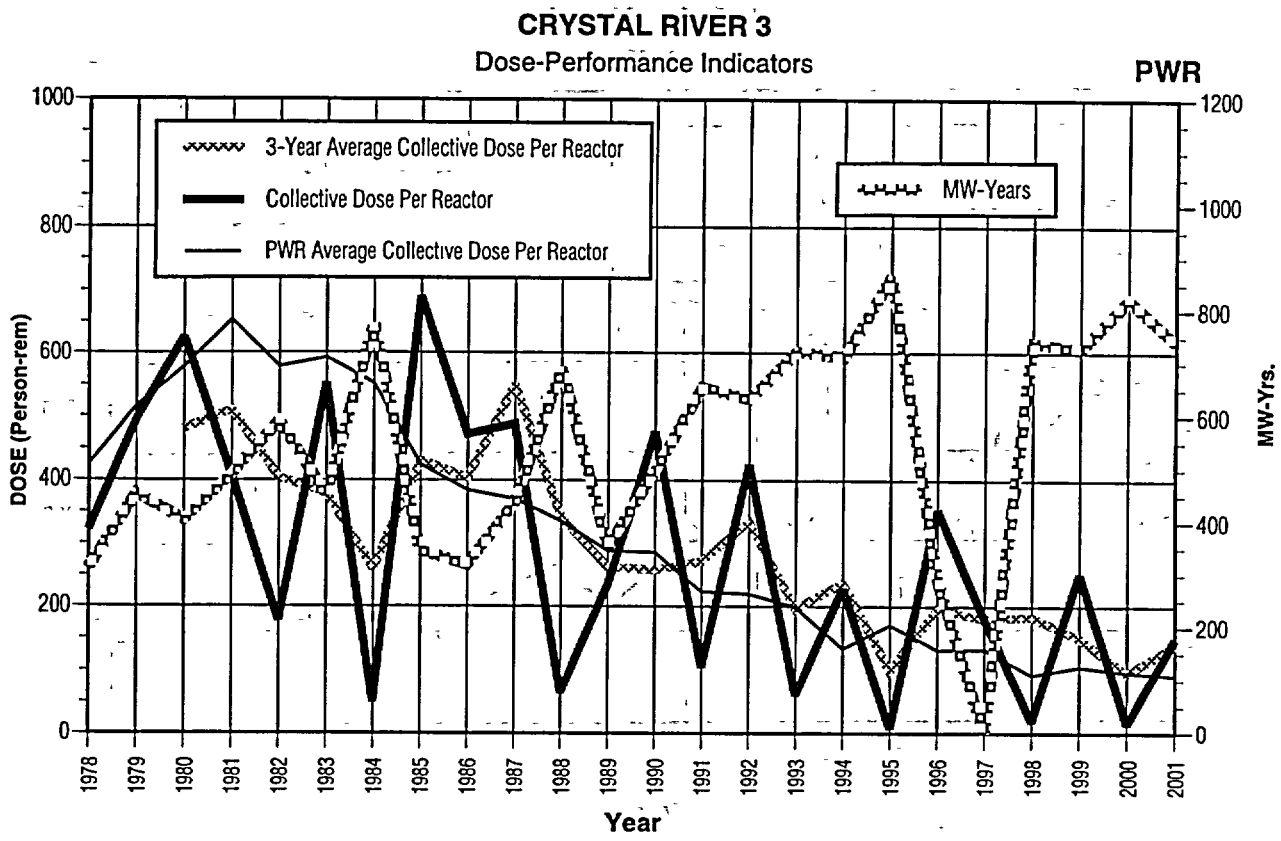
Dose-Performance Indicators

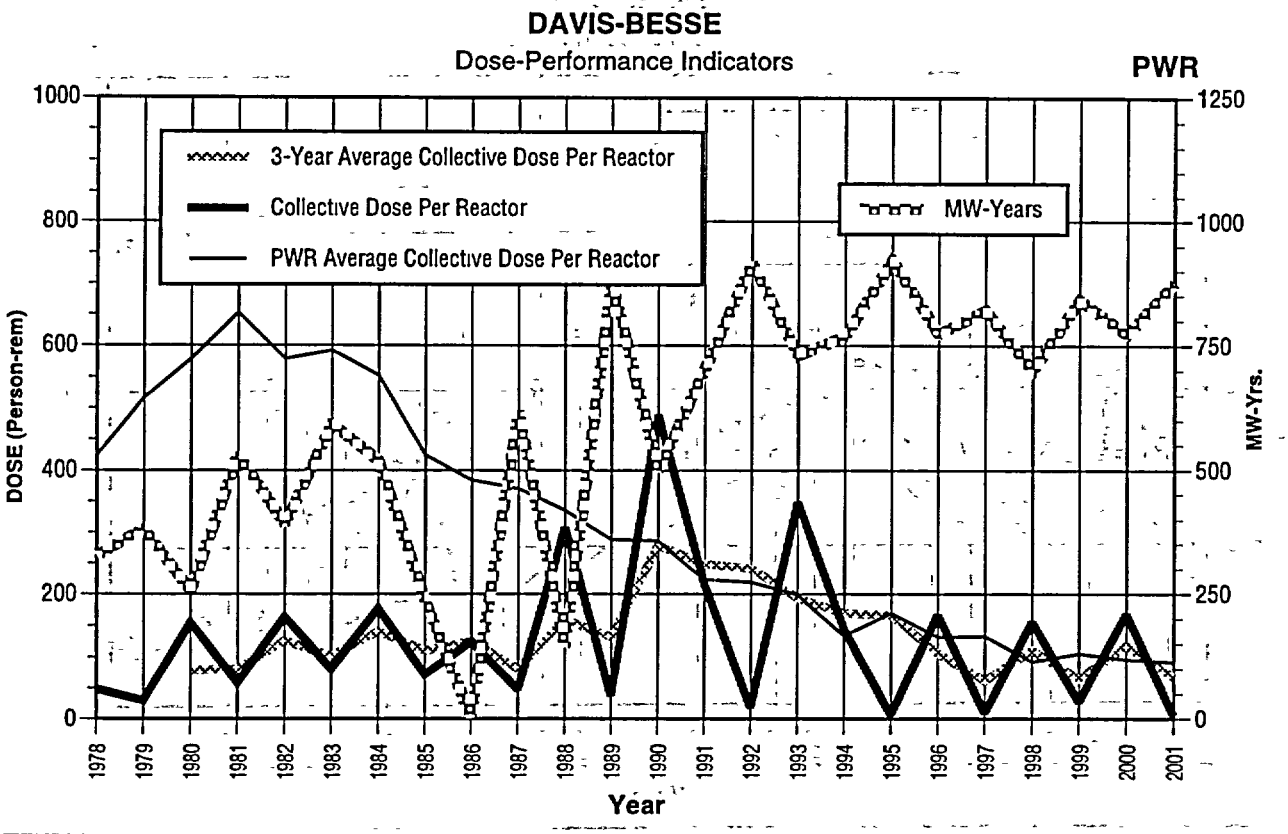


COOPER STATION

Dose-Performance Indicators

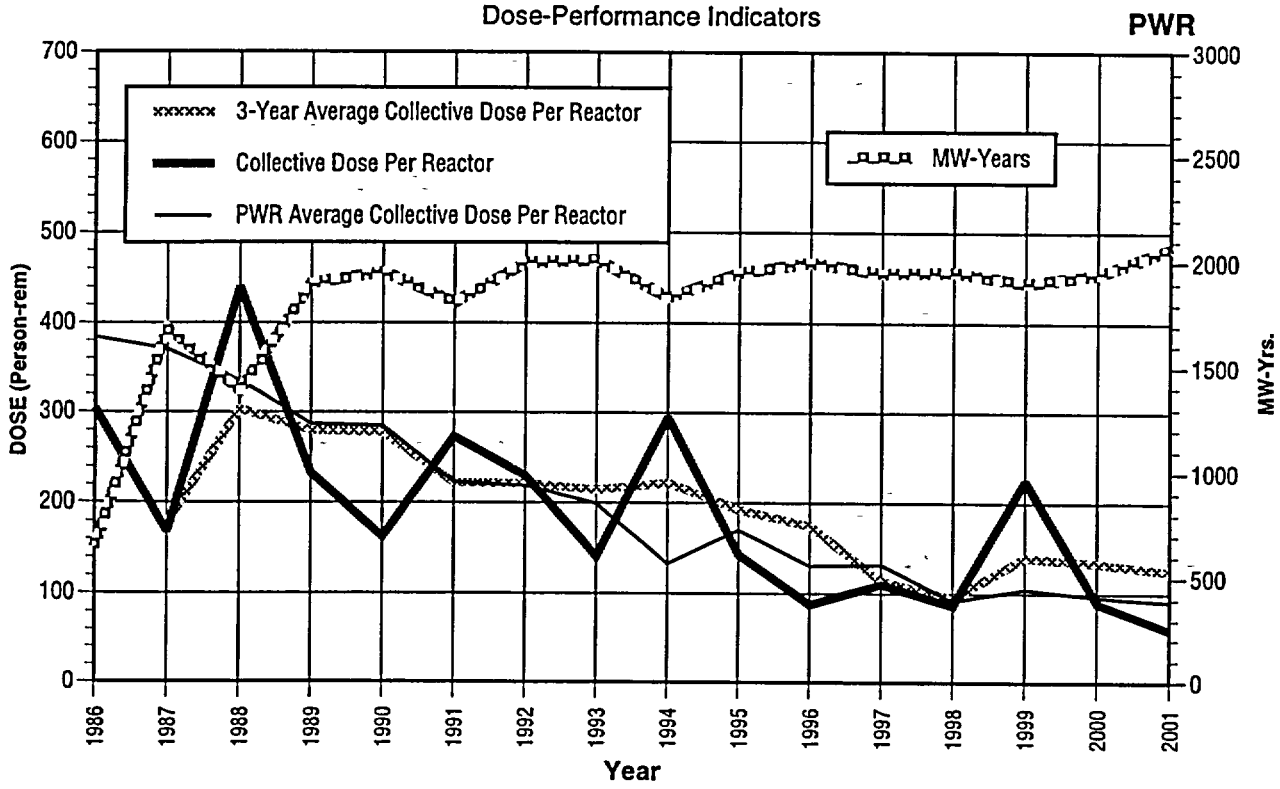



CRYSTAL RIVER 3
Dose-Performance Indicators
PWR
3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
PWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year


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

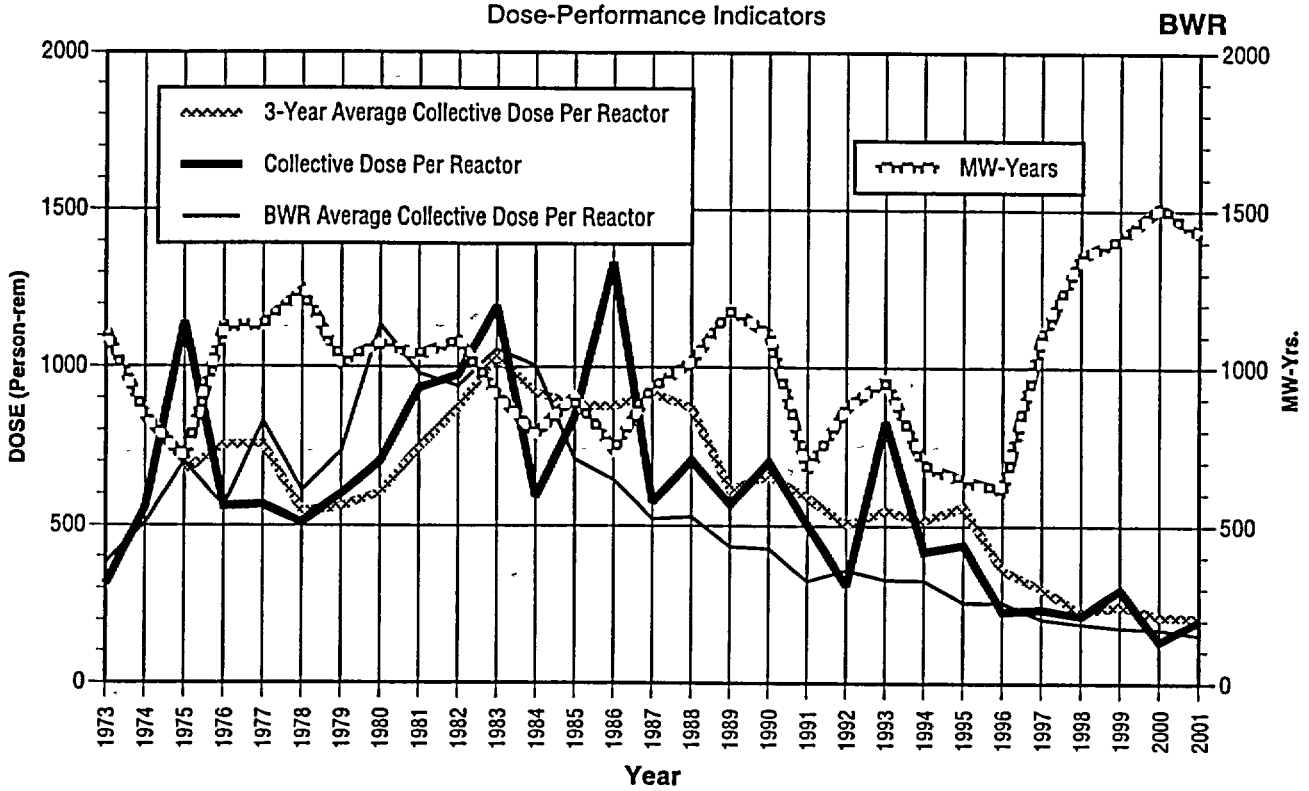
DIABLO CANYON 1, 2

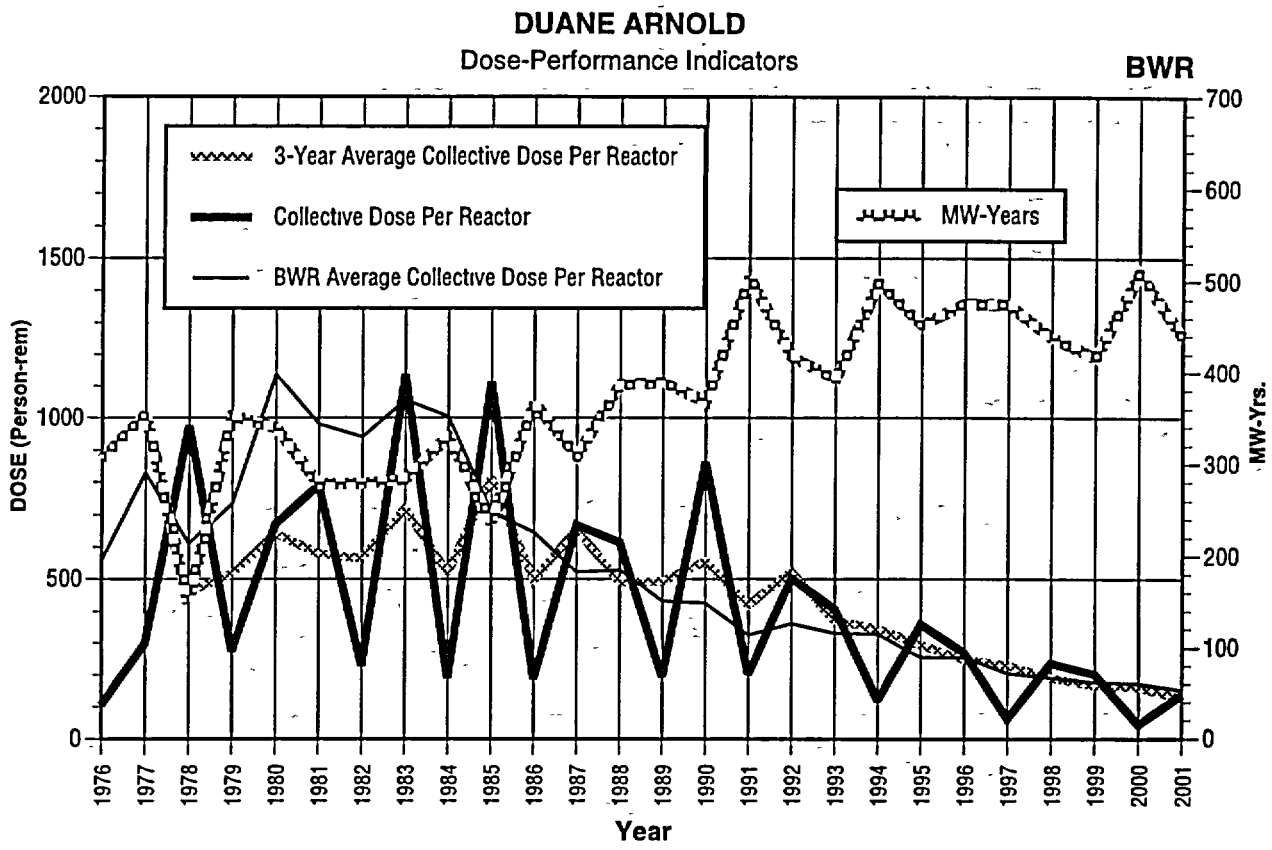
Dose-Performance Indicators

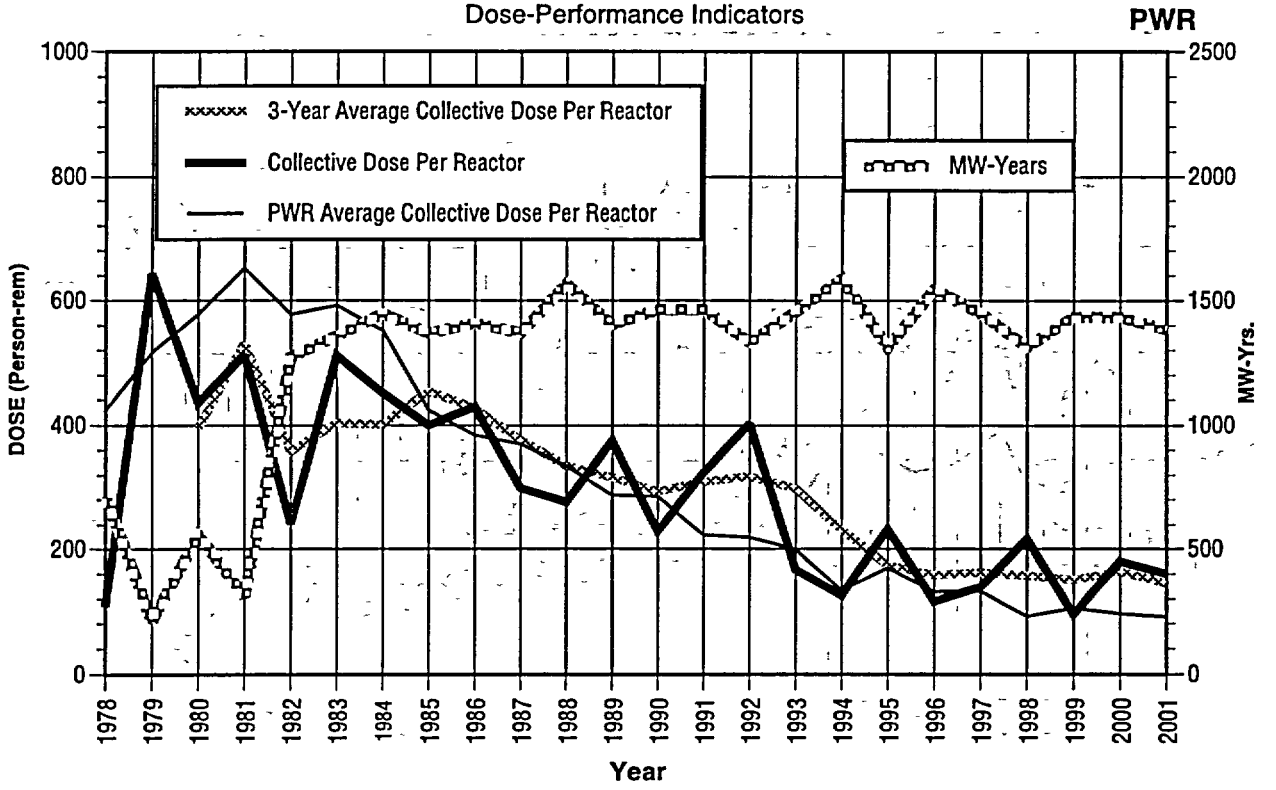


DRESDEN 2, 3

Dose-Performance Indicators



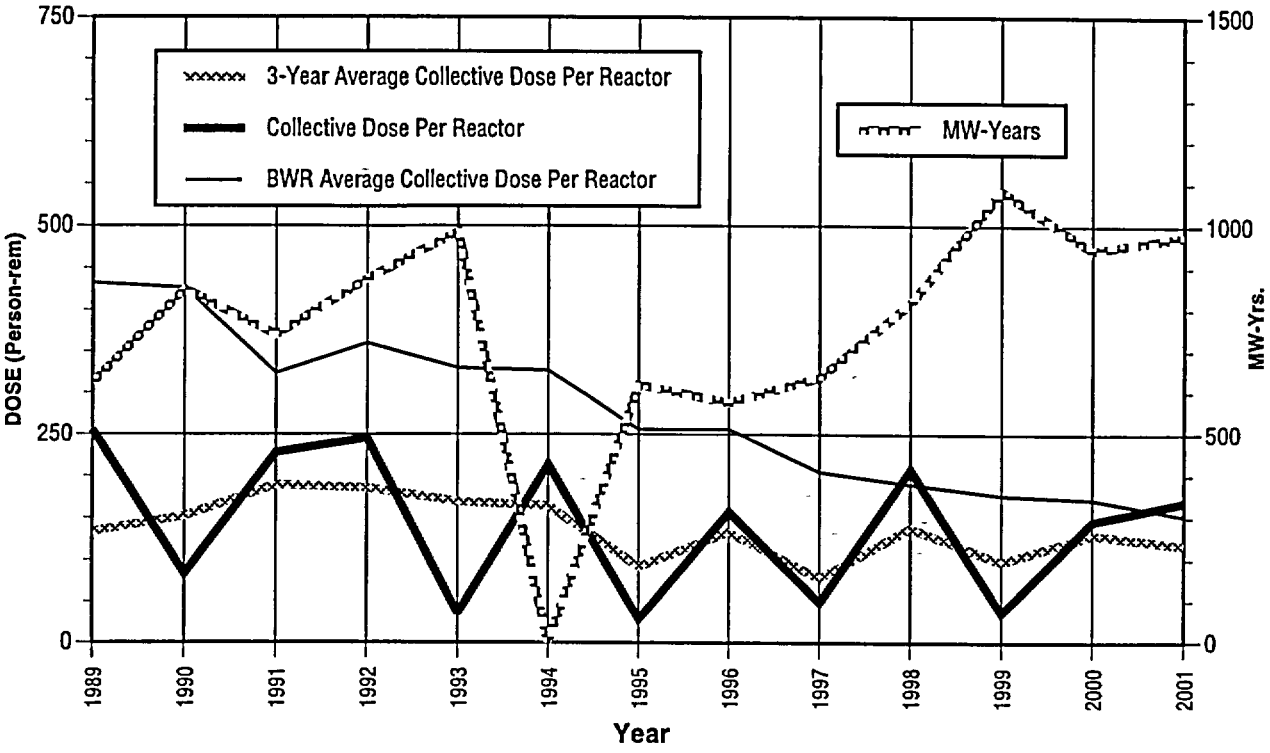

DUANE ARNOLD
Dose-Performance Indicators
BWR
3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
BWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year


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

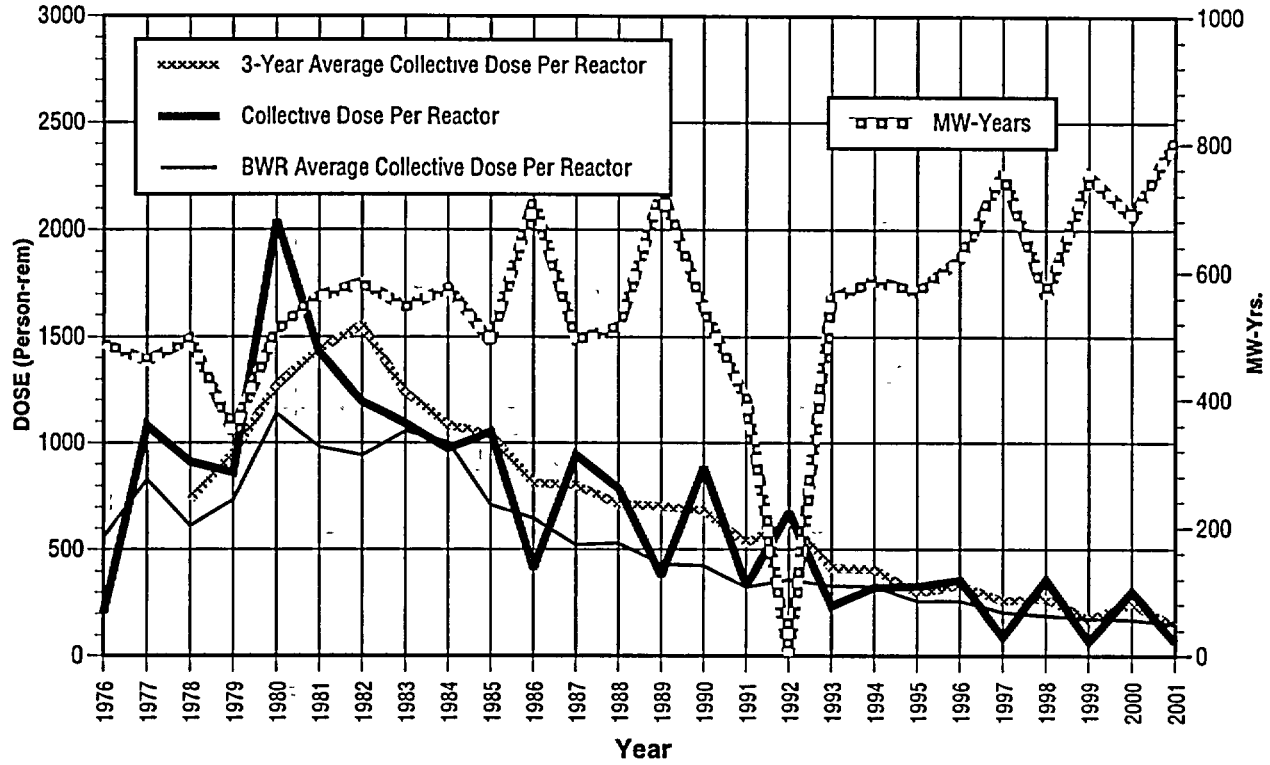
BWR



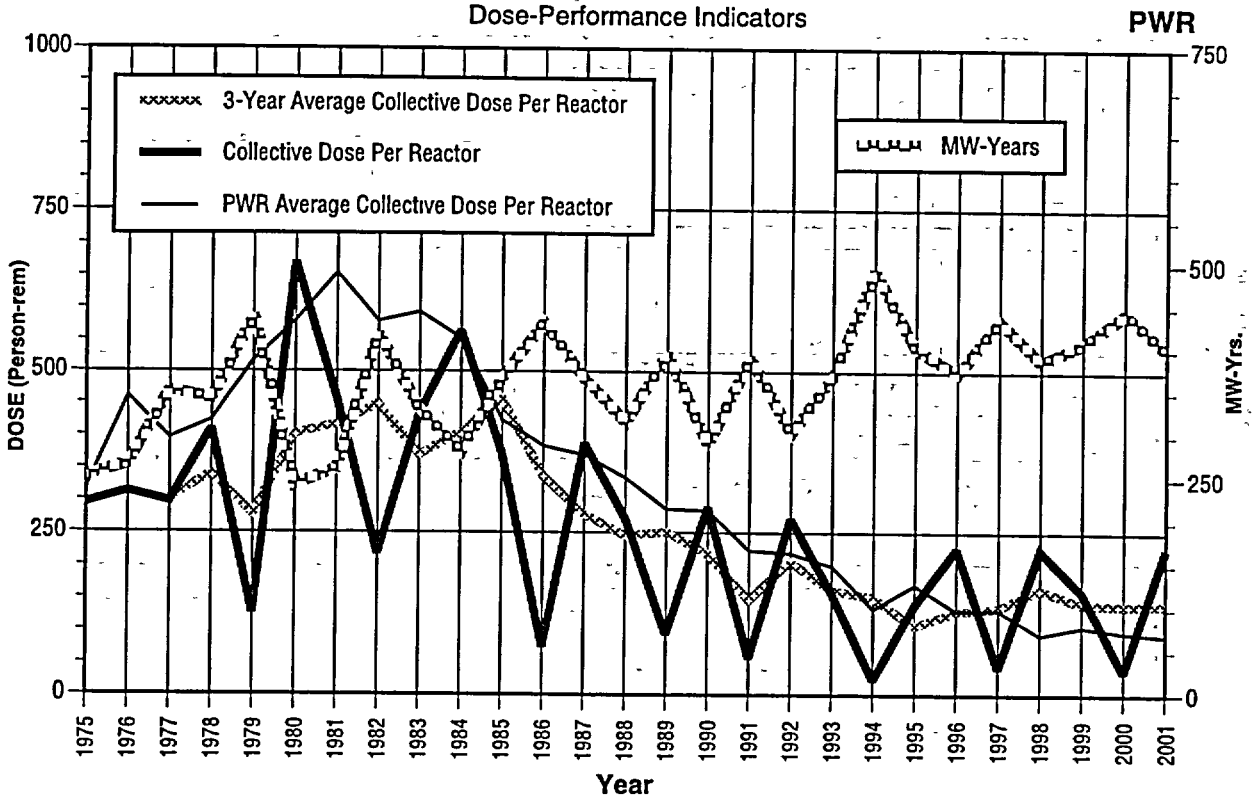
FITZPATRICK

Dose-Performance Indicators

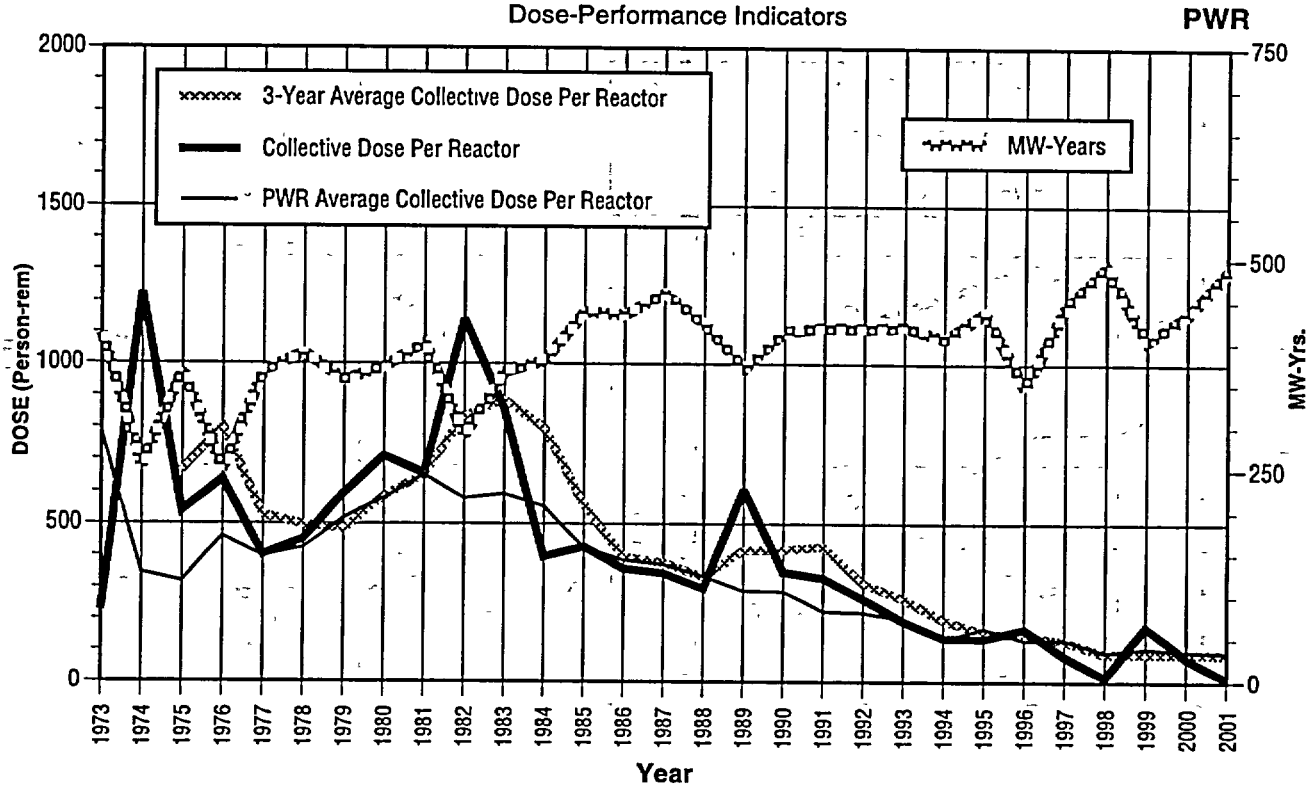
BWR

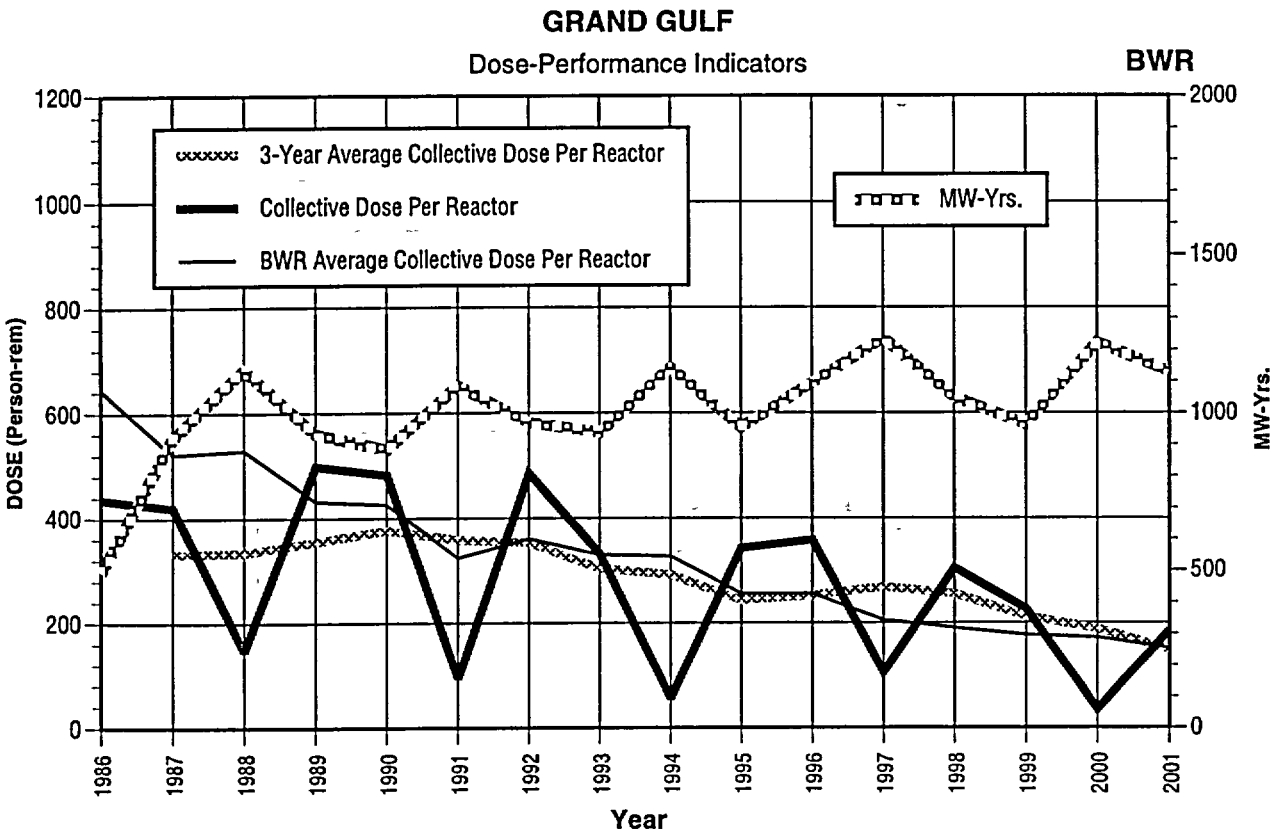


FORT CALHOUN



GINNA




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
500
1000
1500
2000
1986
1987
1988
1989
1990
1991
1992
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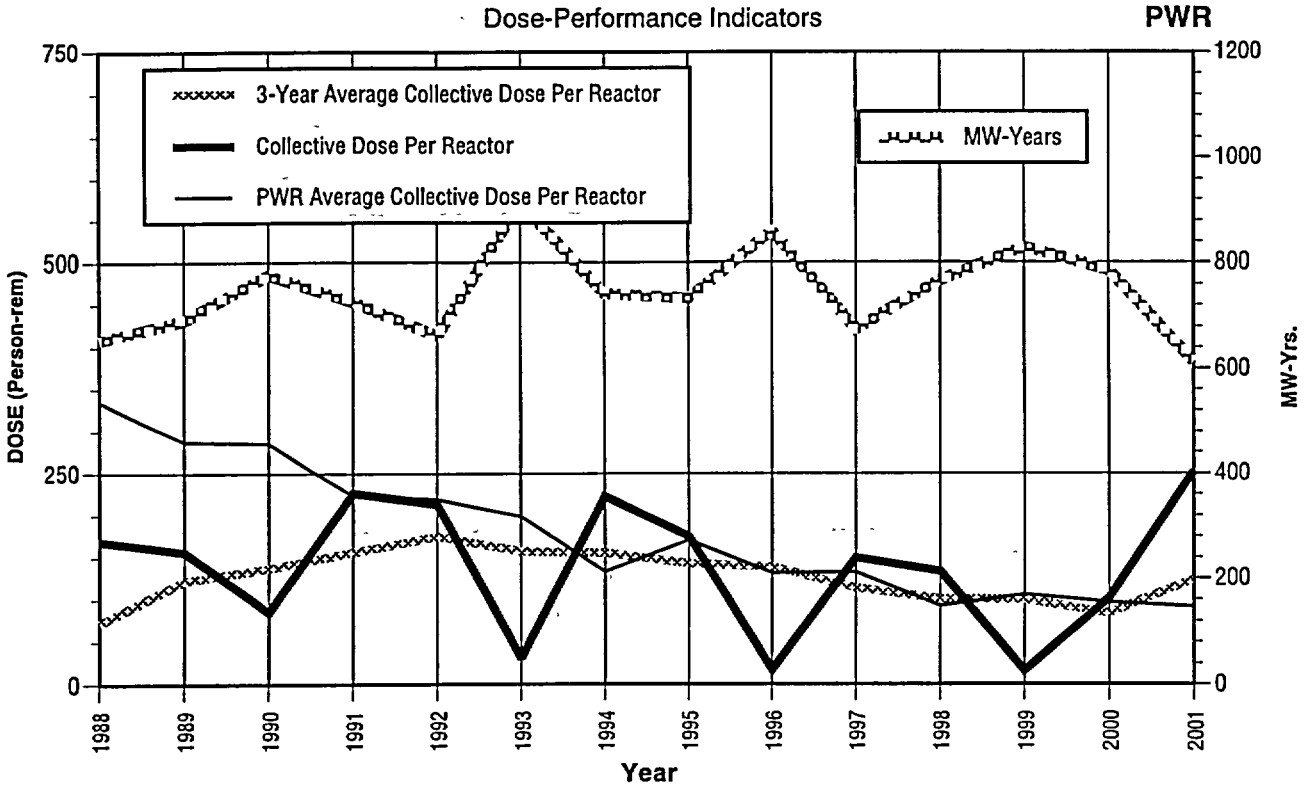
HARRIS
Dose-Performance Indicators
PWR
3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
PWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year
0
250
500
750
200
400
600
800
1000
1200
1988
1989
1990
1991
1992
1993
1994
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1997
1998
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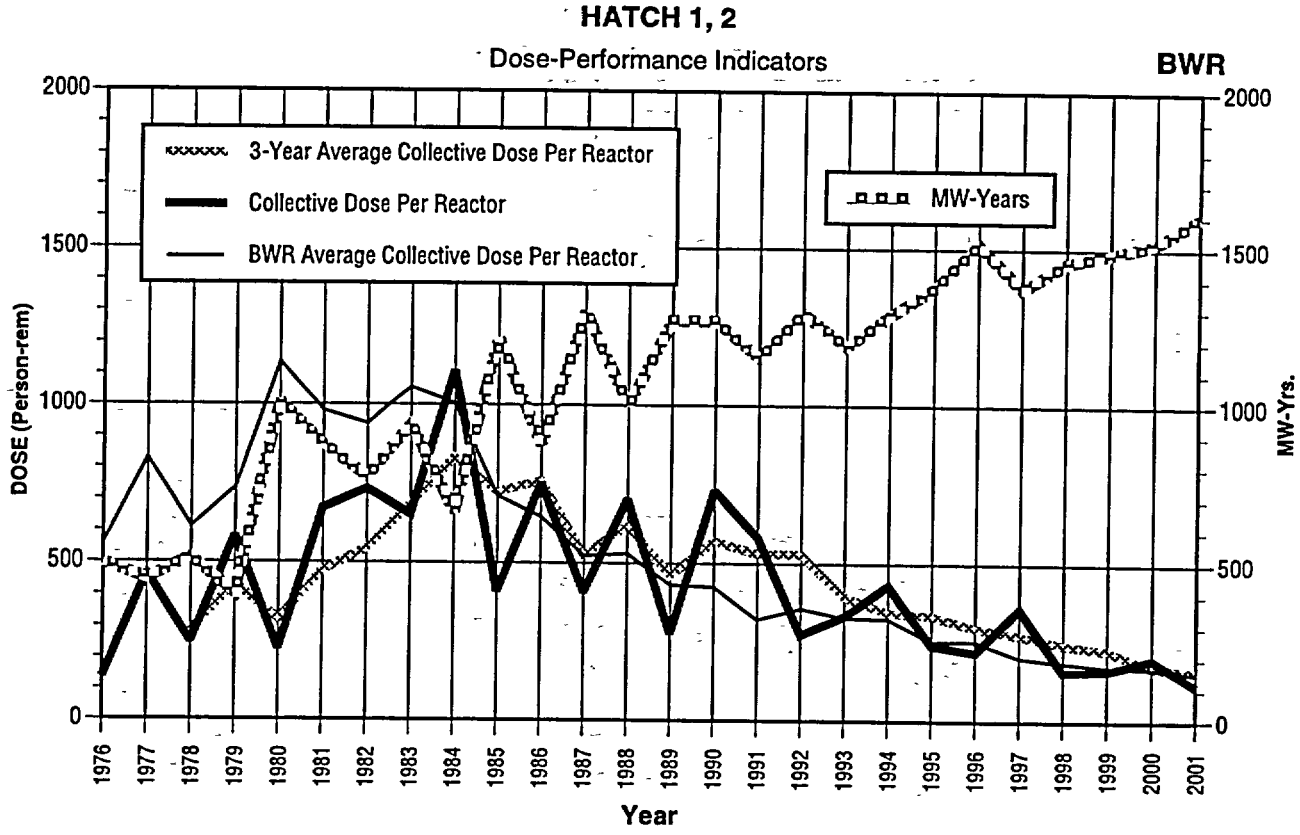
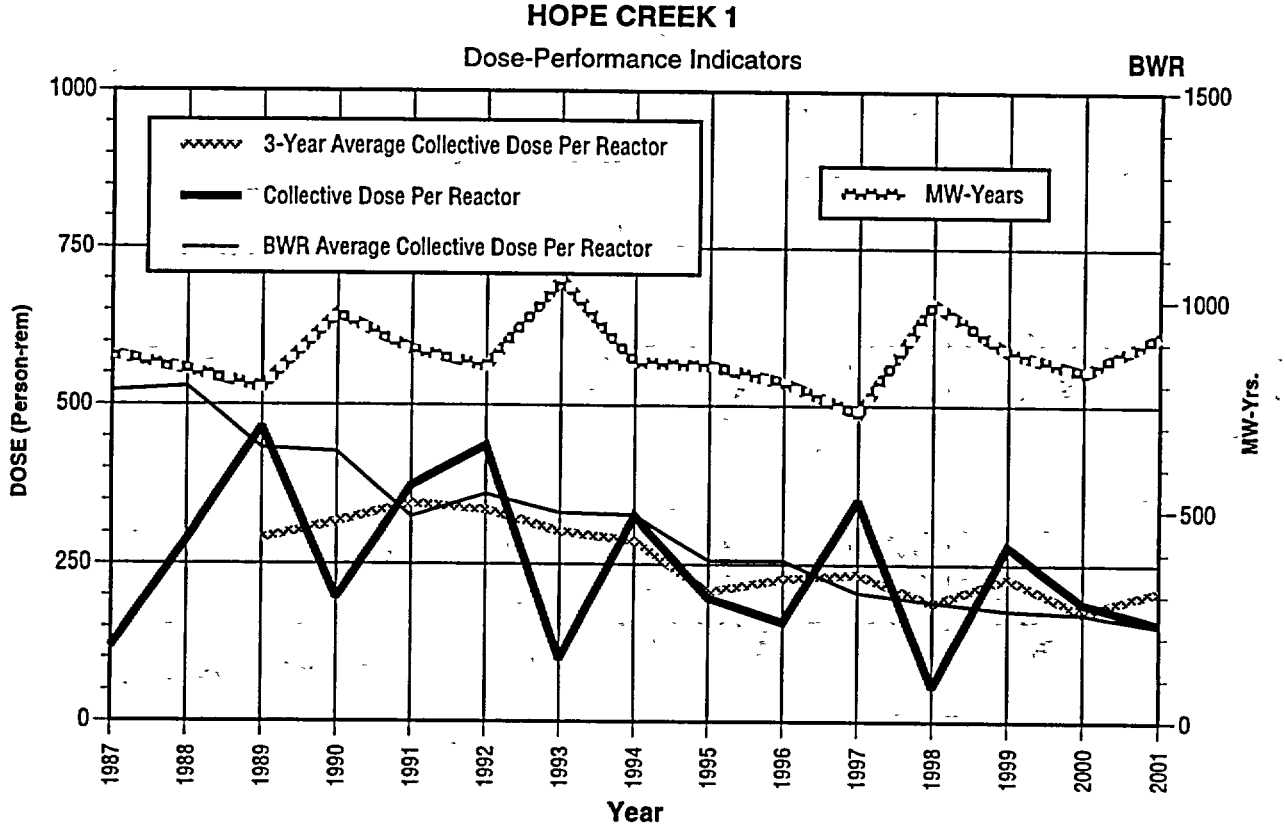
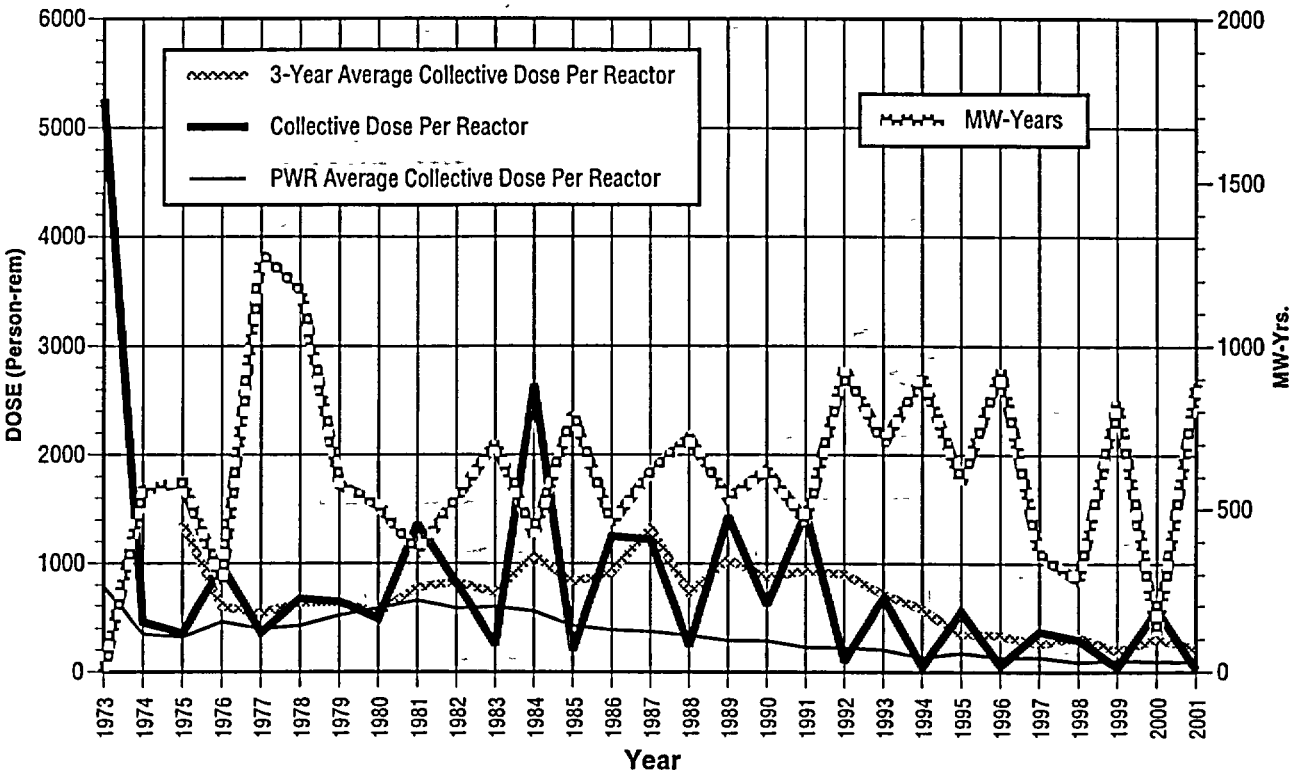
2000
2001


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


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

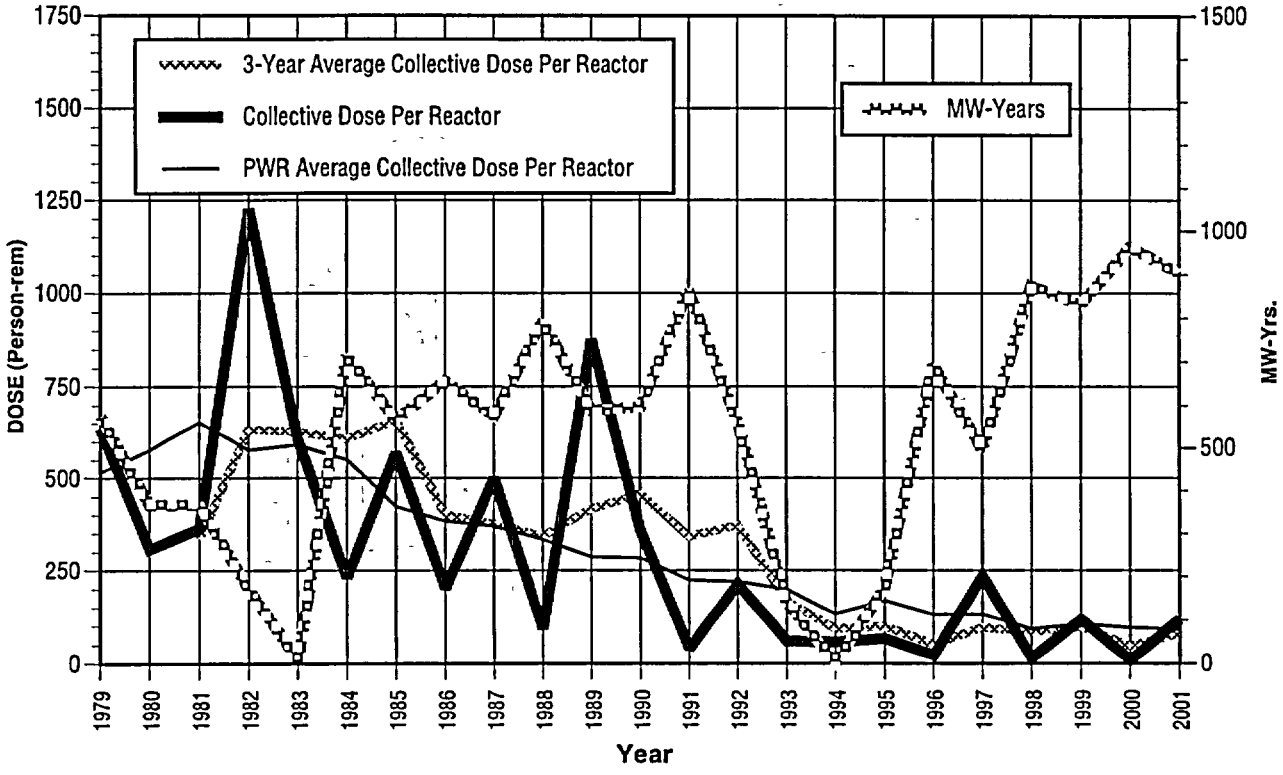
INDIAN POINT 2

Dose-Performance Indicators PWR

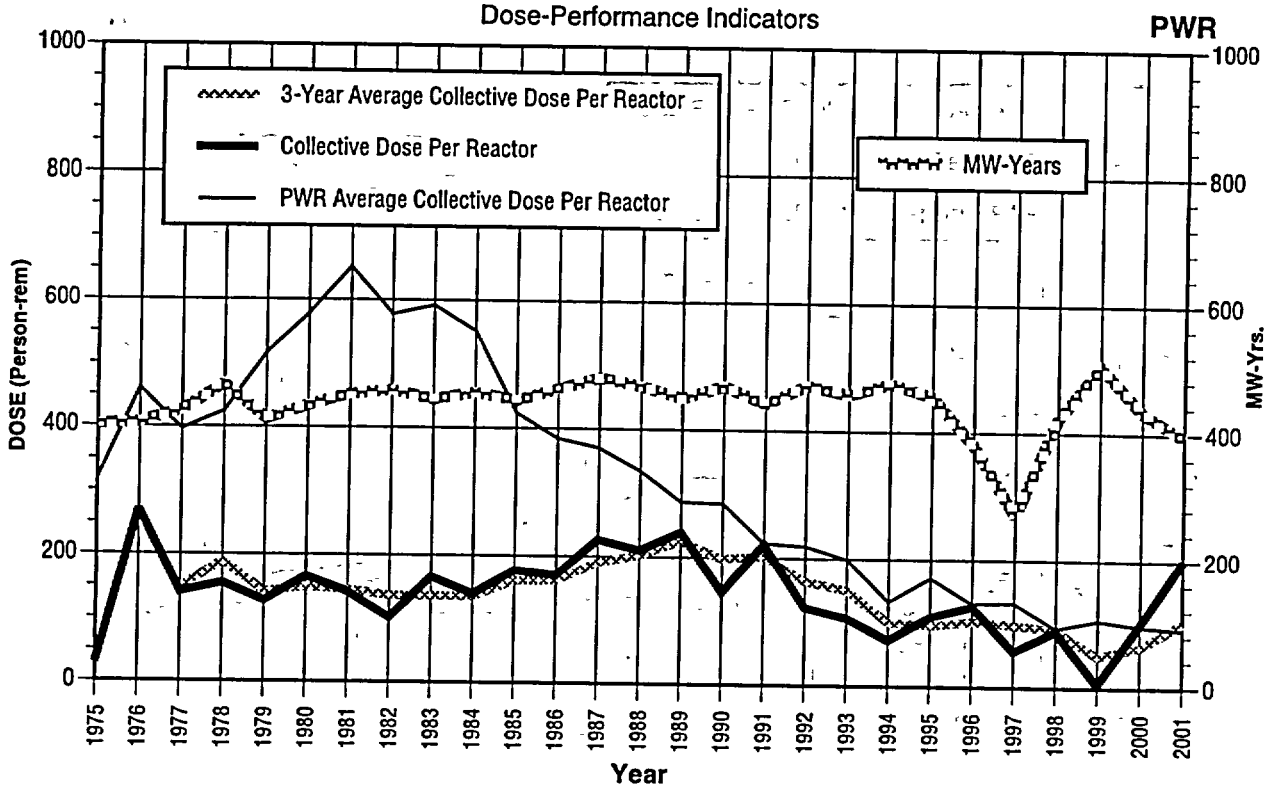


INDIAN POINT 3

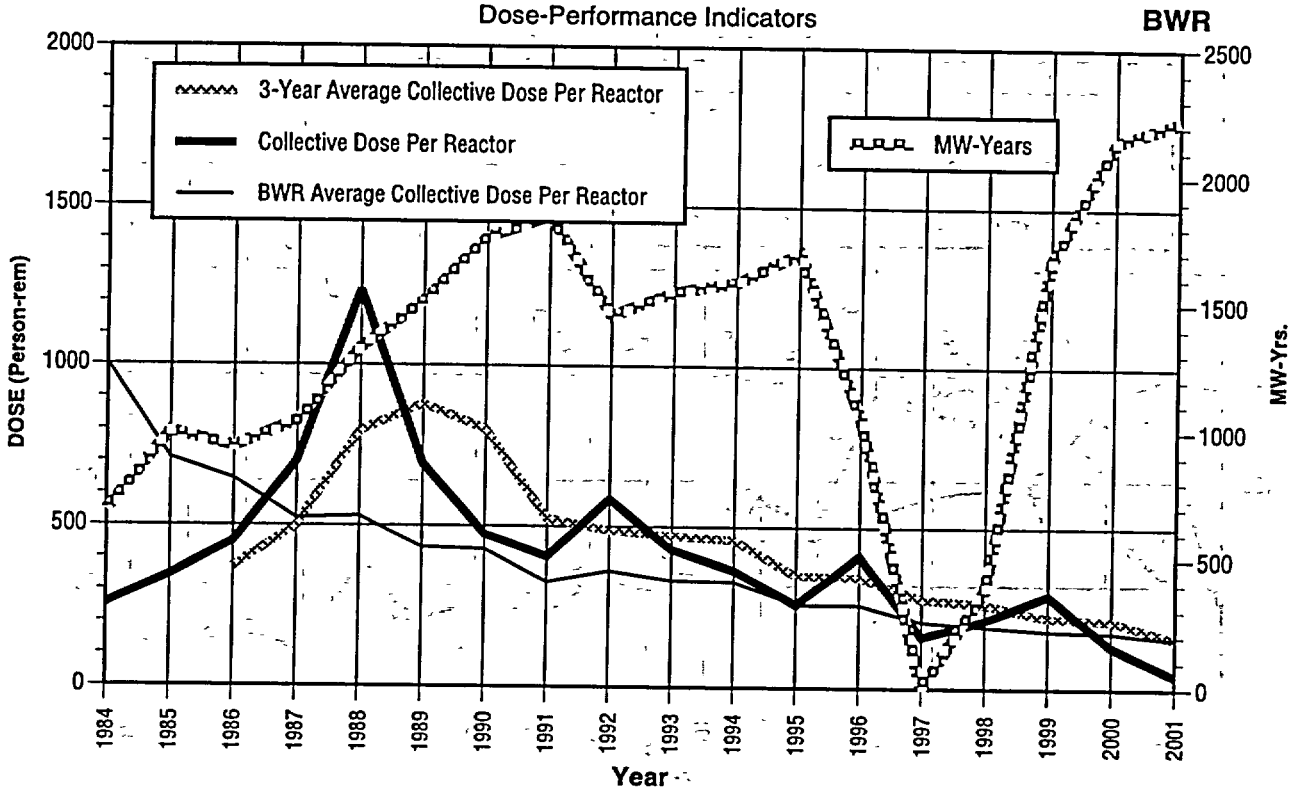
Dose-Performance Indicators PWR



KEWAUNEE



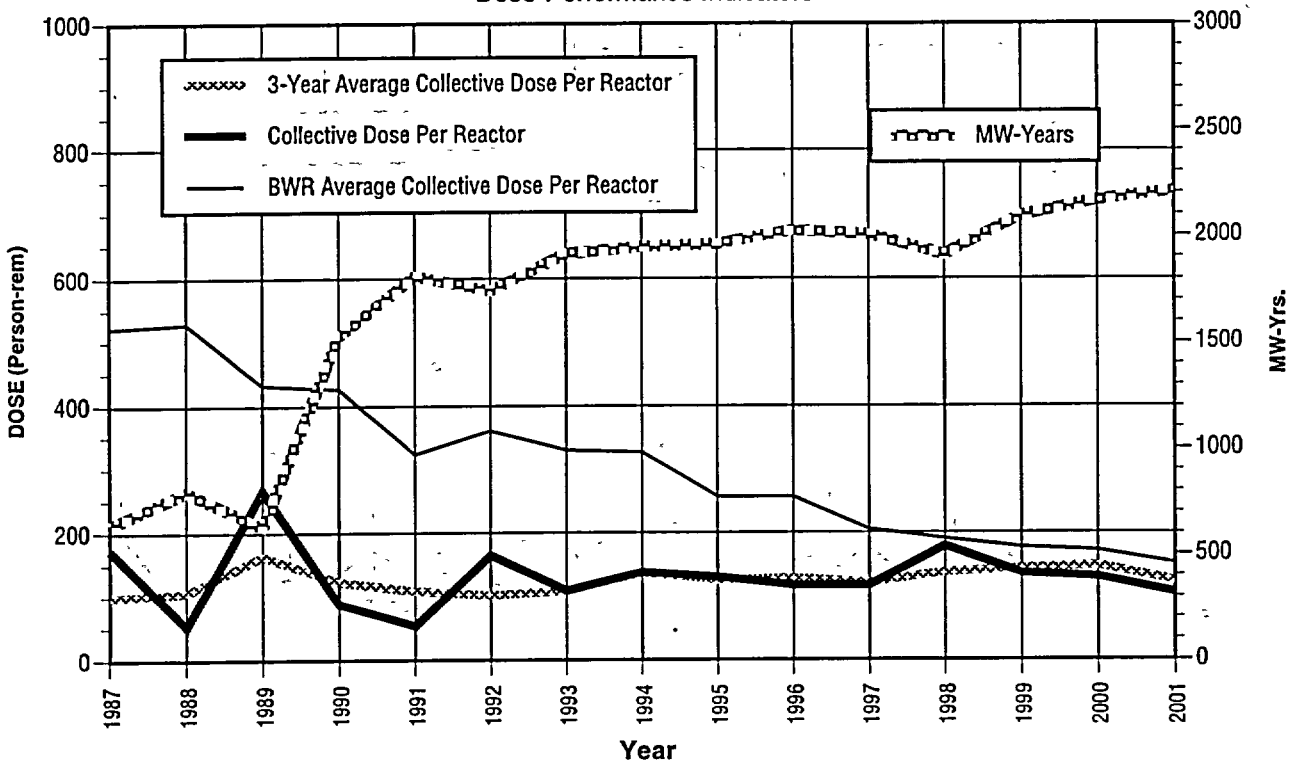
LASALLE 1, 2



LIMERICK 1, 2

Dose-Performance Indicators

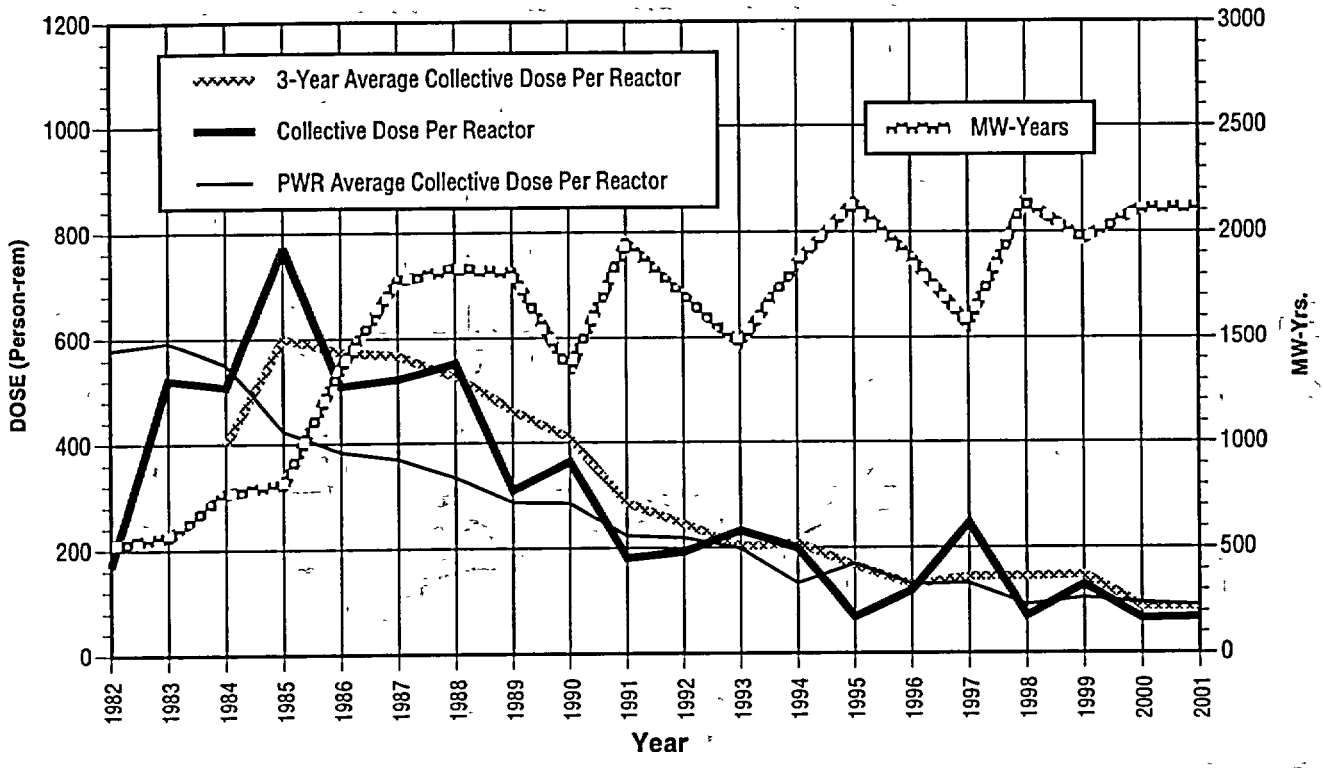
BWR

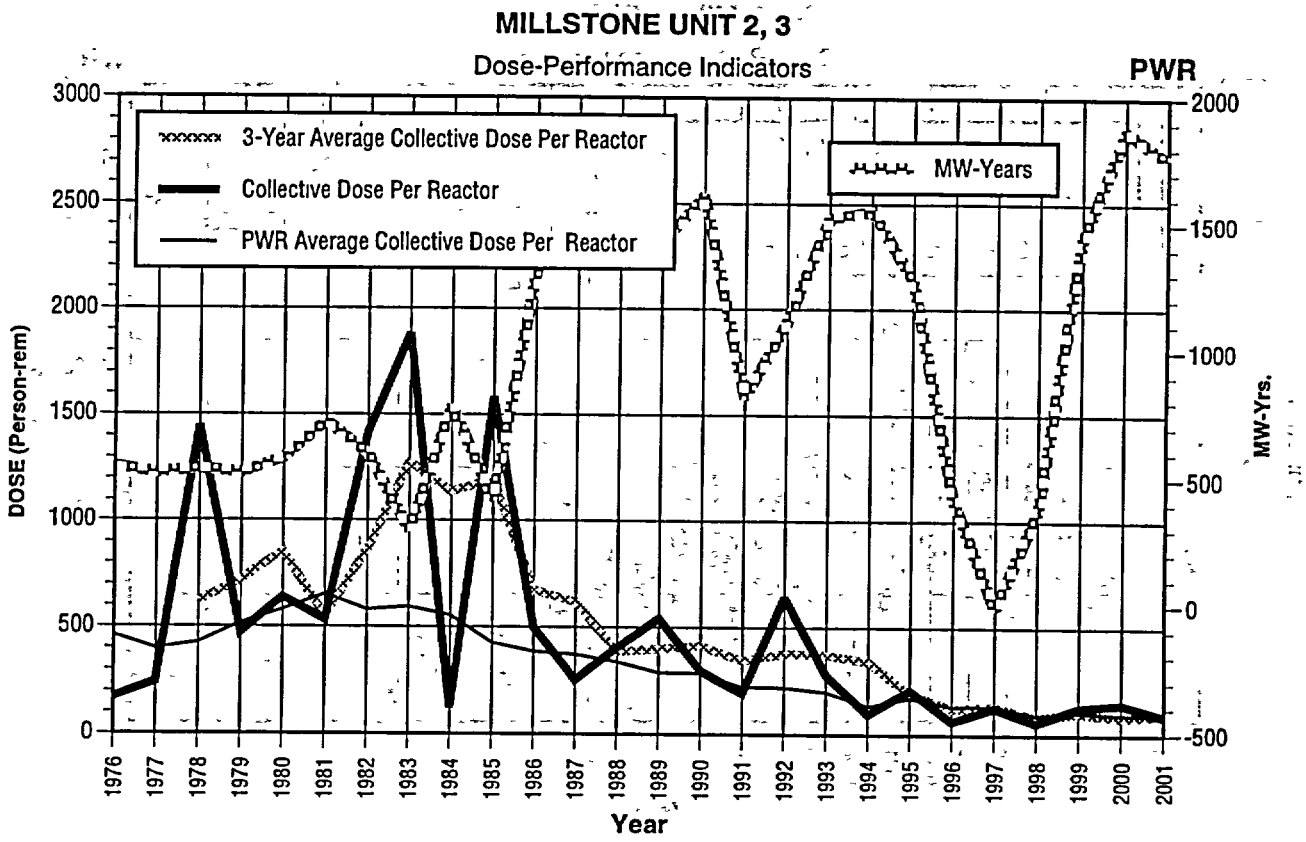


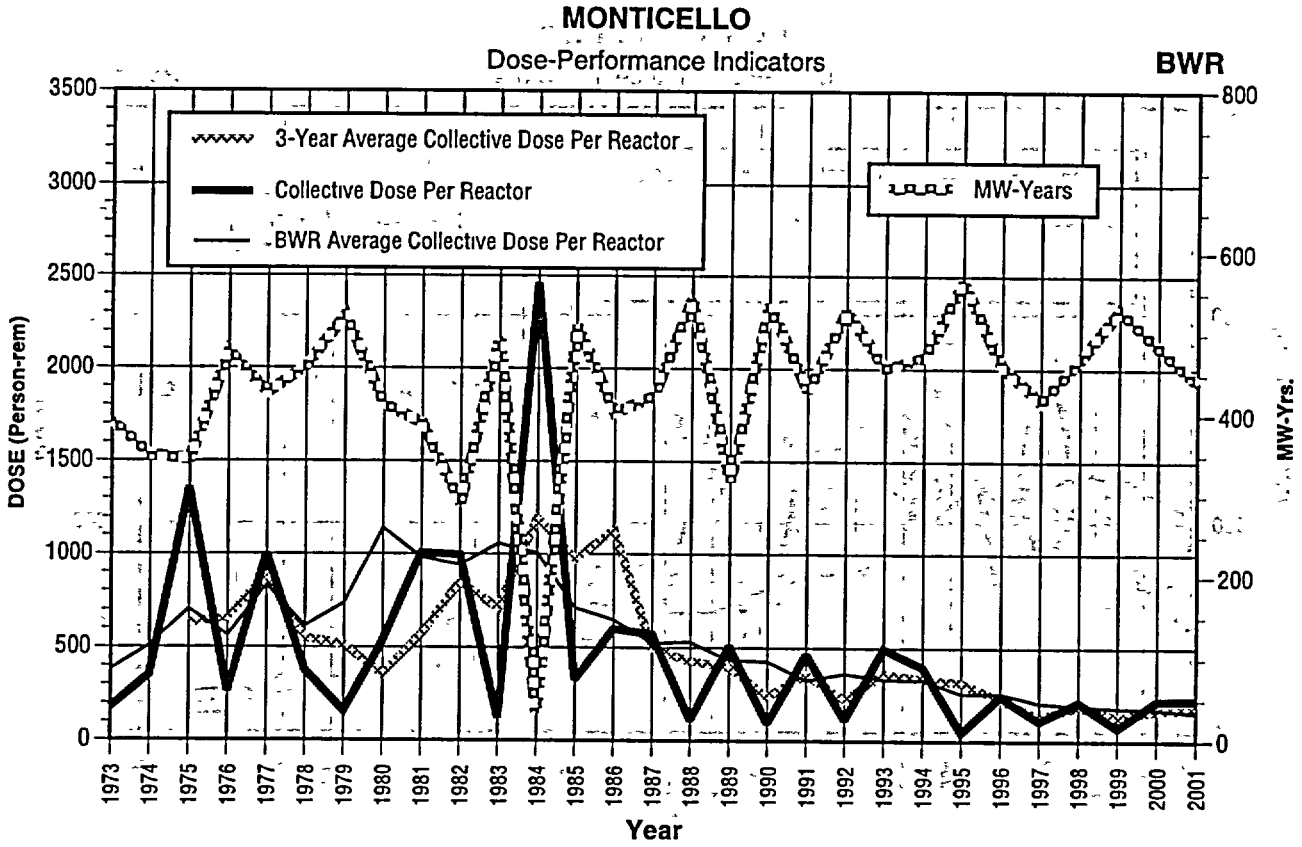
MCGUIRE 1, 2

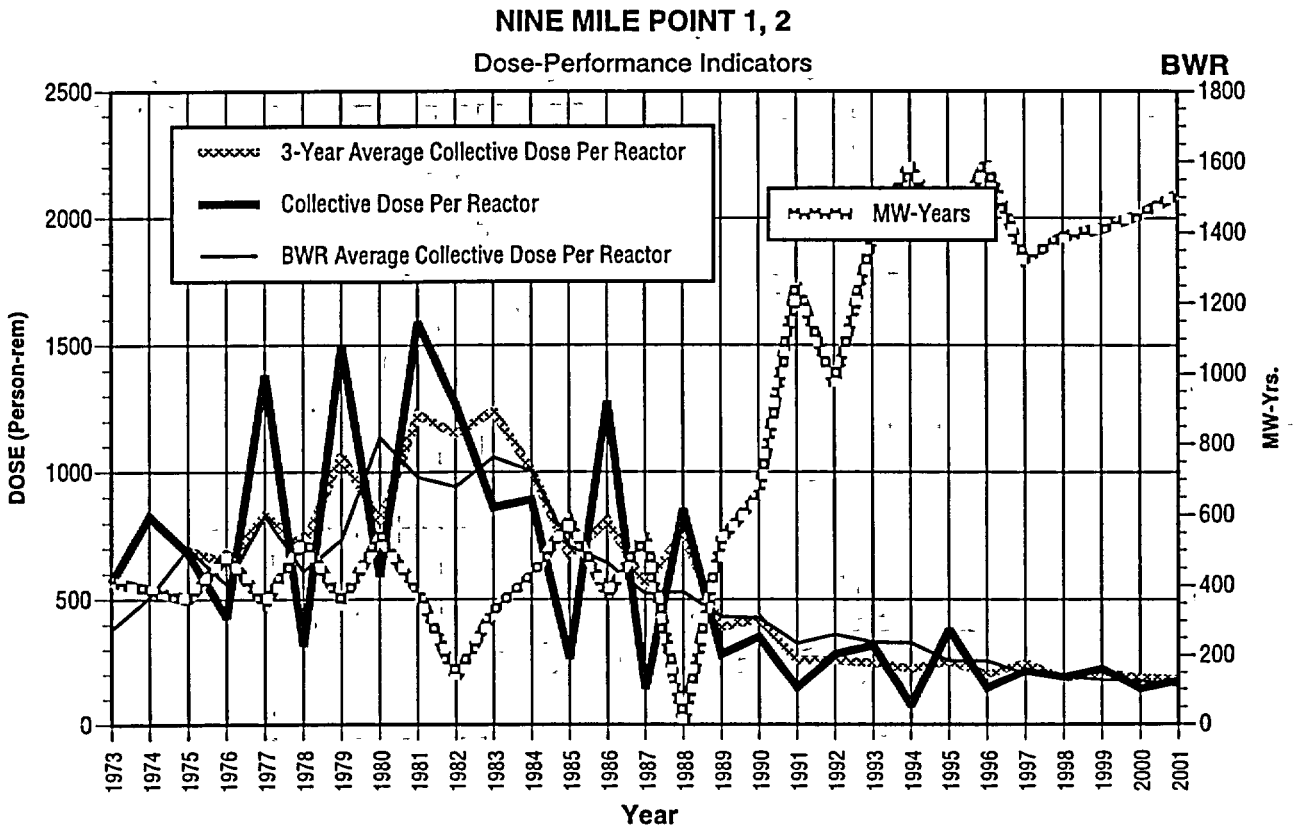
Dose-Performance Indicators

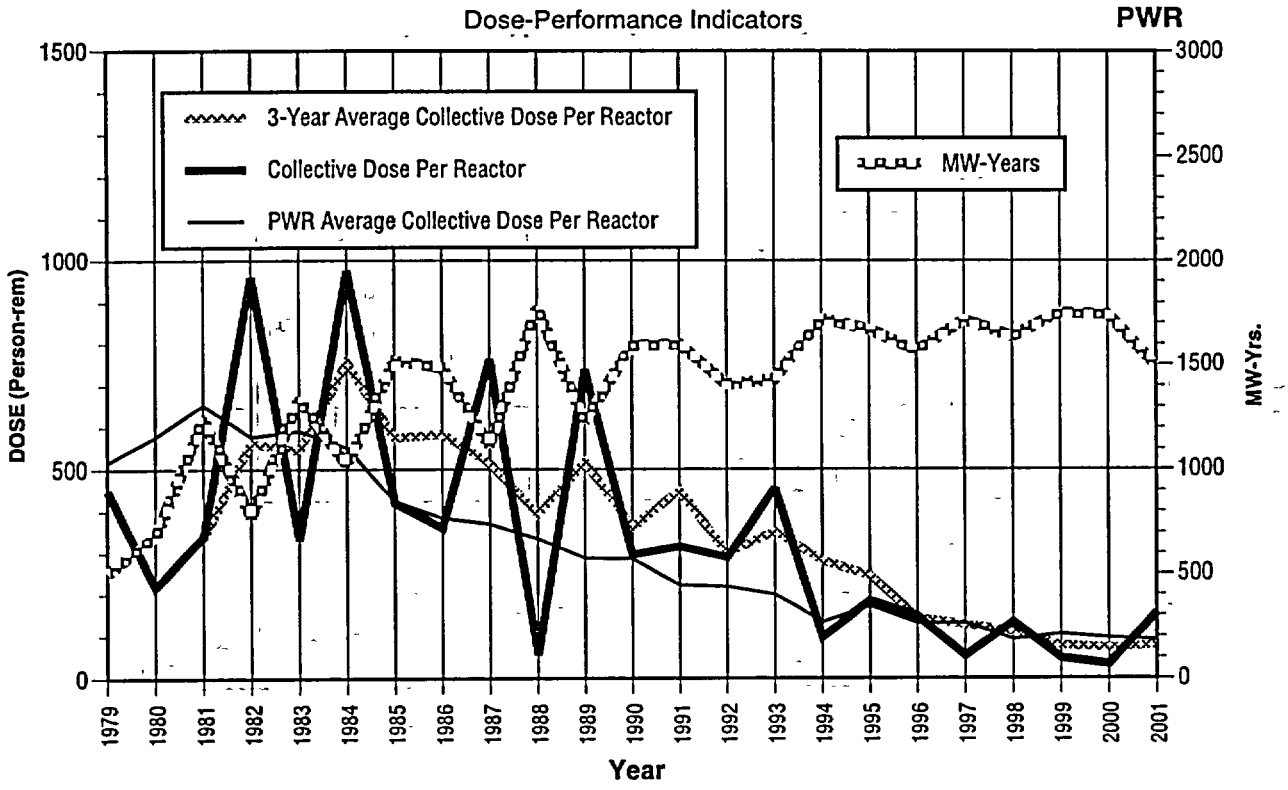
PWR

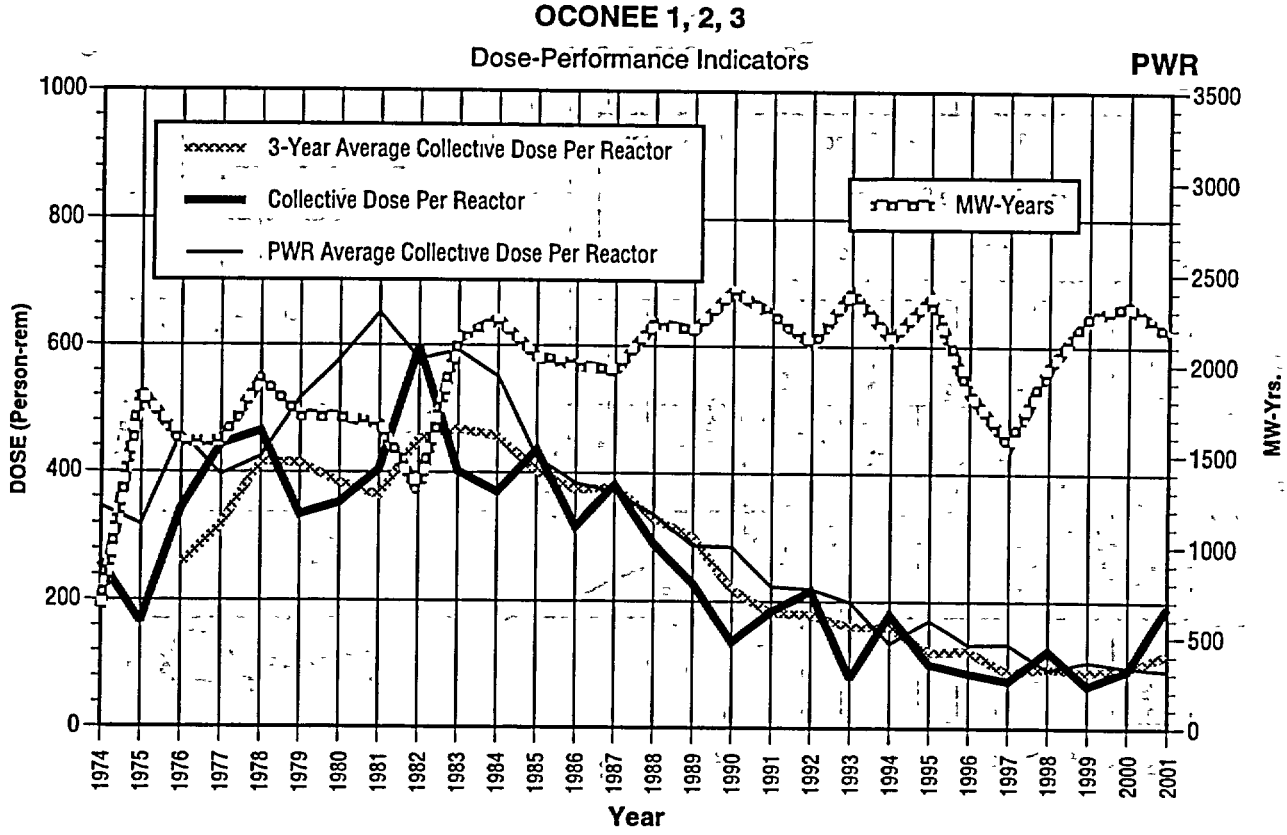


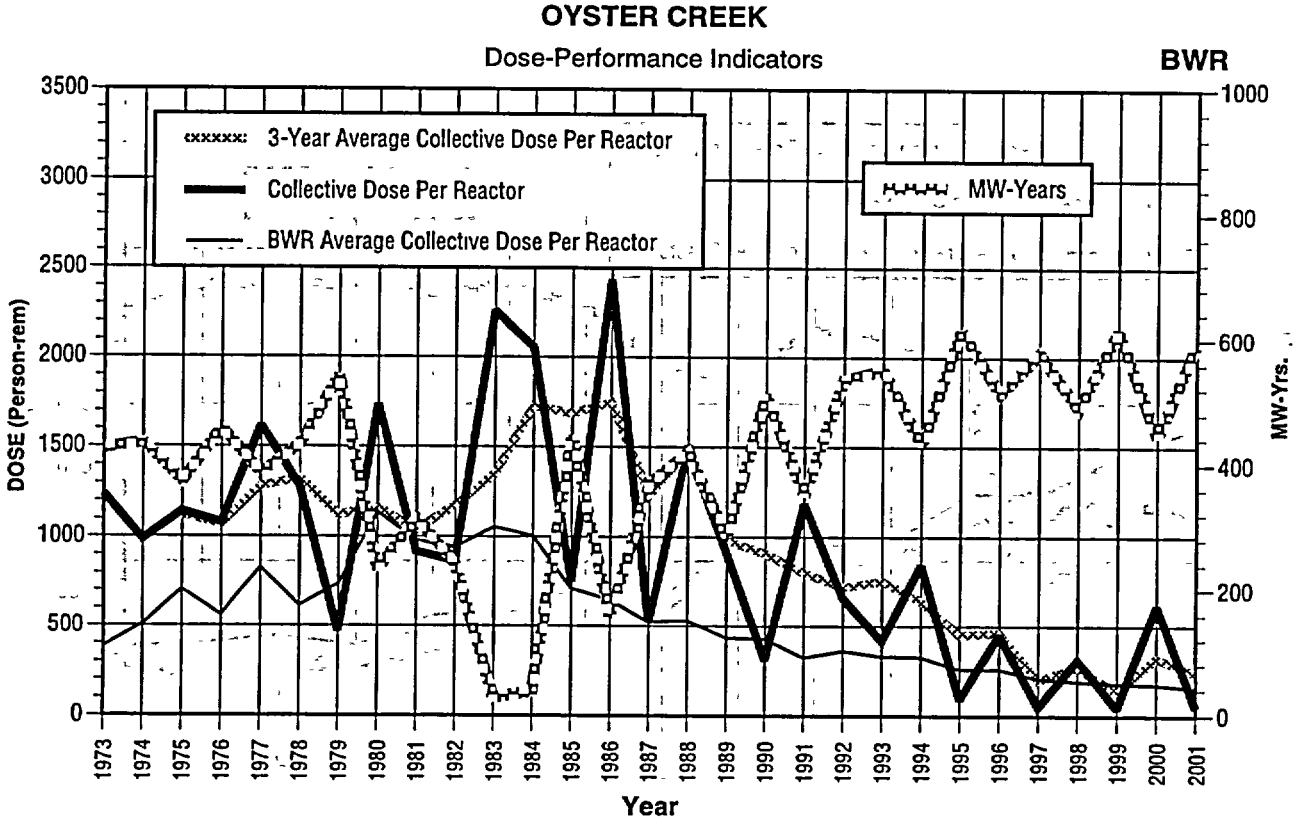

MILLSTONE UNIT 2, 3
Dose-Performance Indicators
PWR
3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
PWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year


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

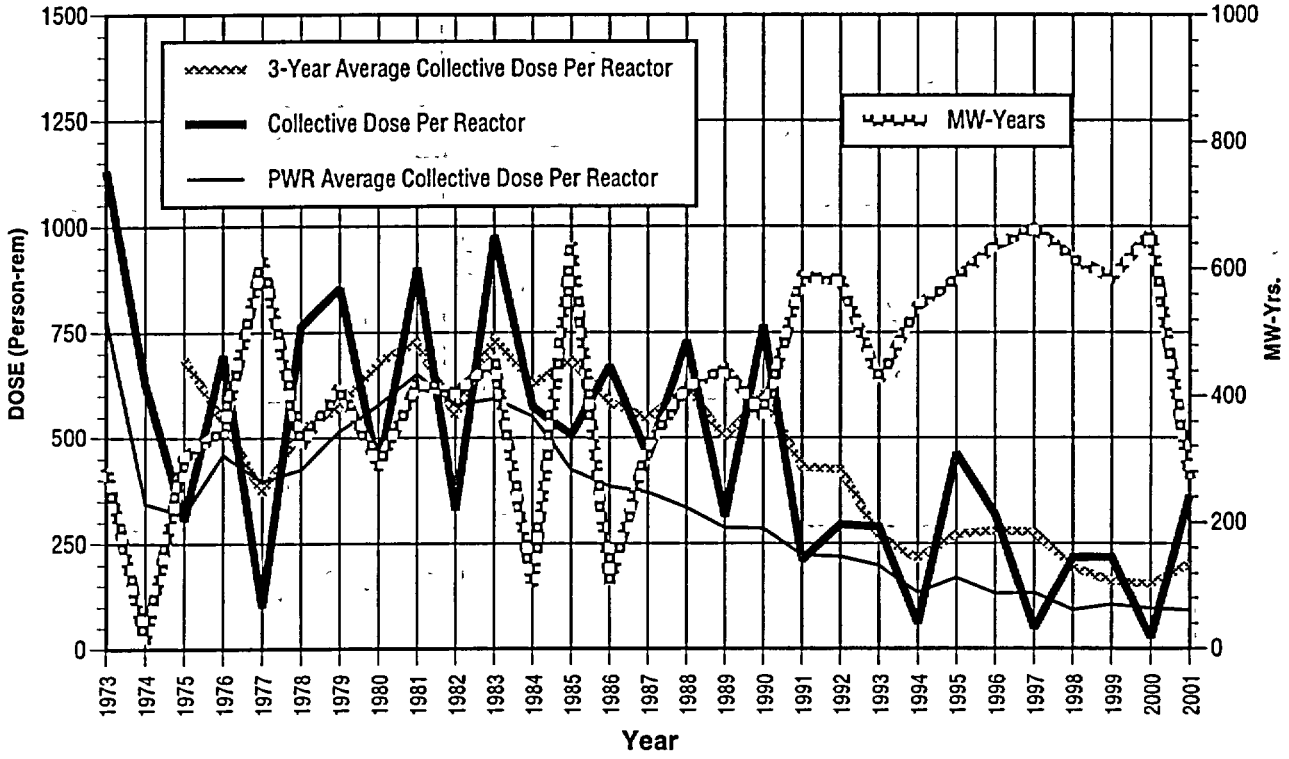

OCONEE 1, 2, 3
Dose-Performance Indicators
PWR
3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
PWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year


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

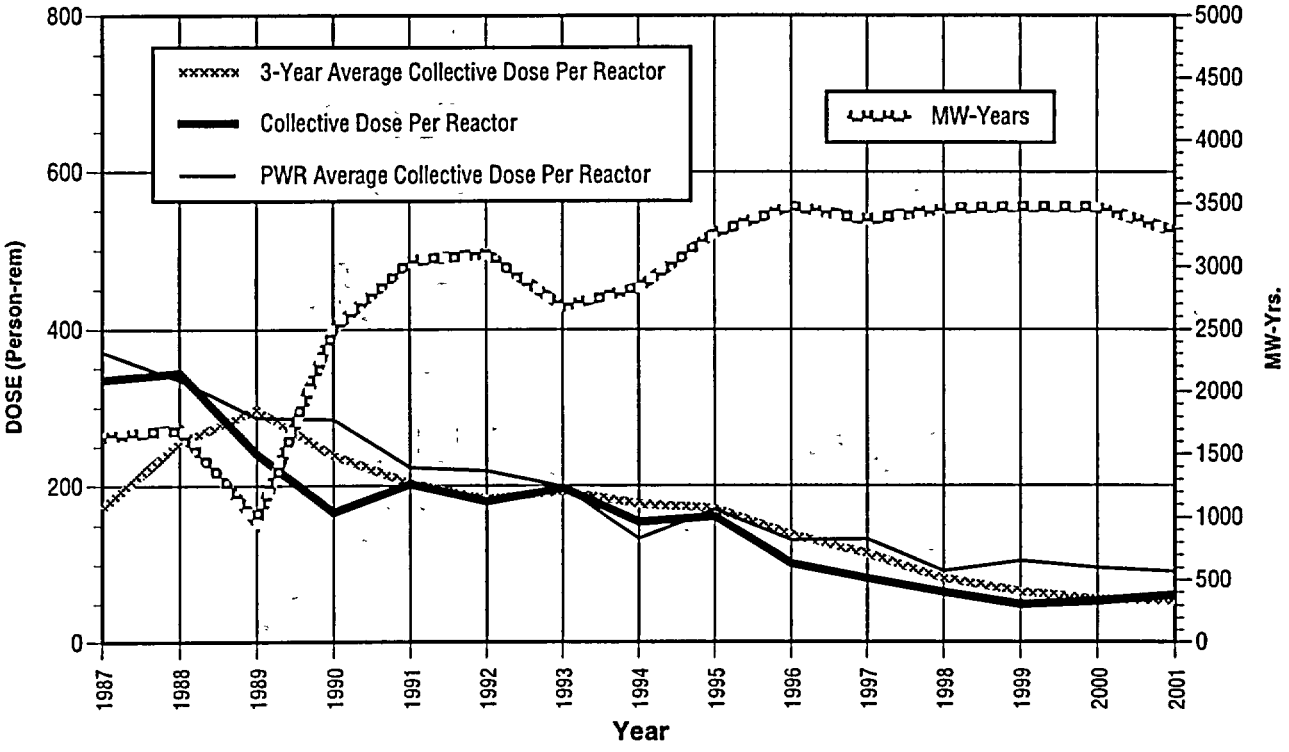
PWR

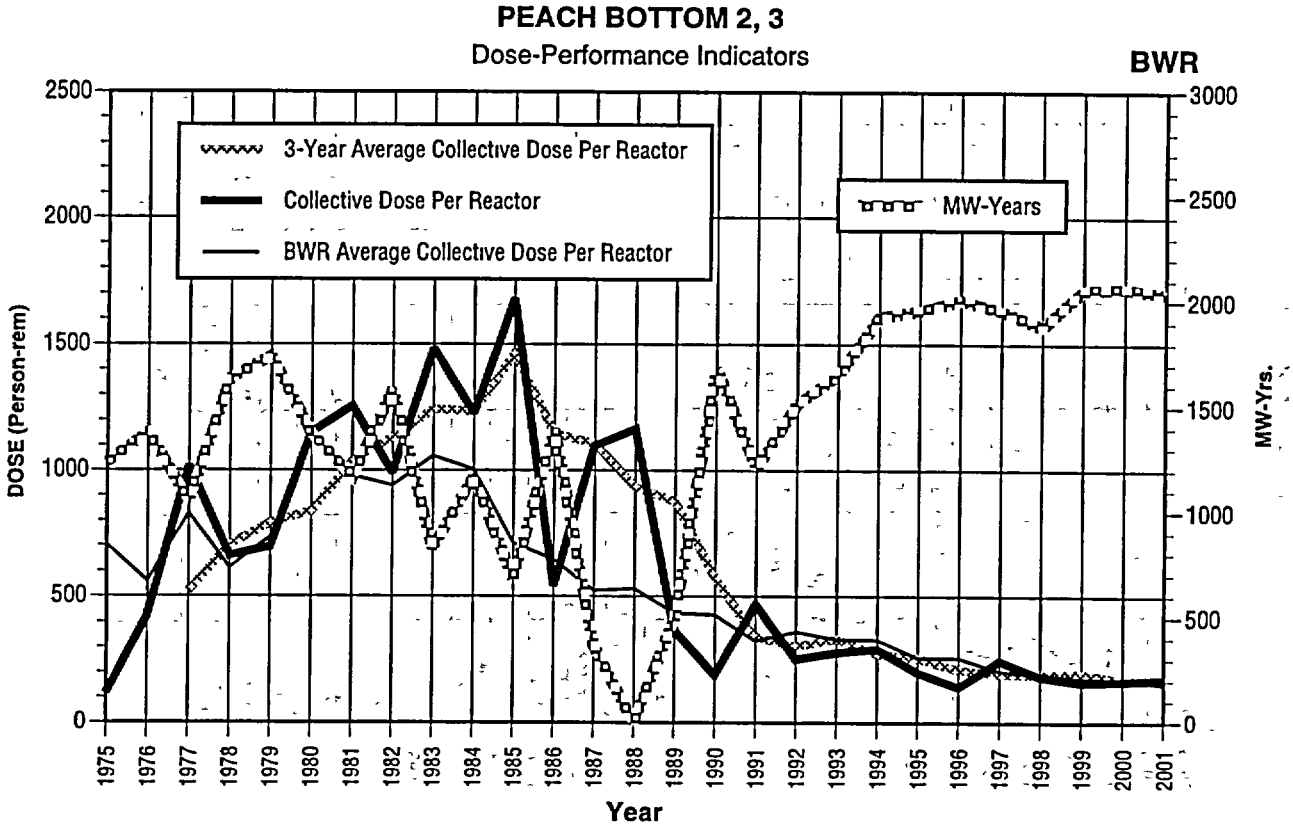


PALO VERDE 1, 2, 3

Dose-Performance Indicators

PWR




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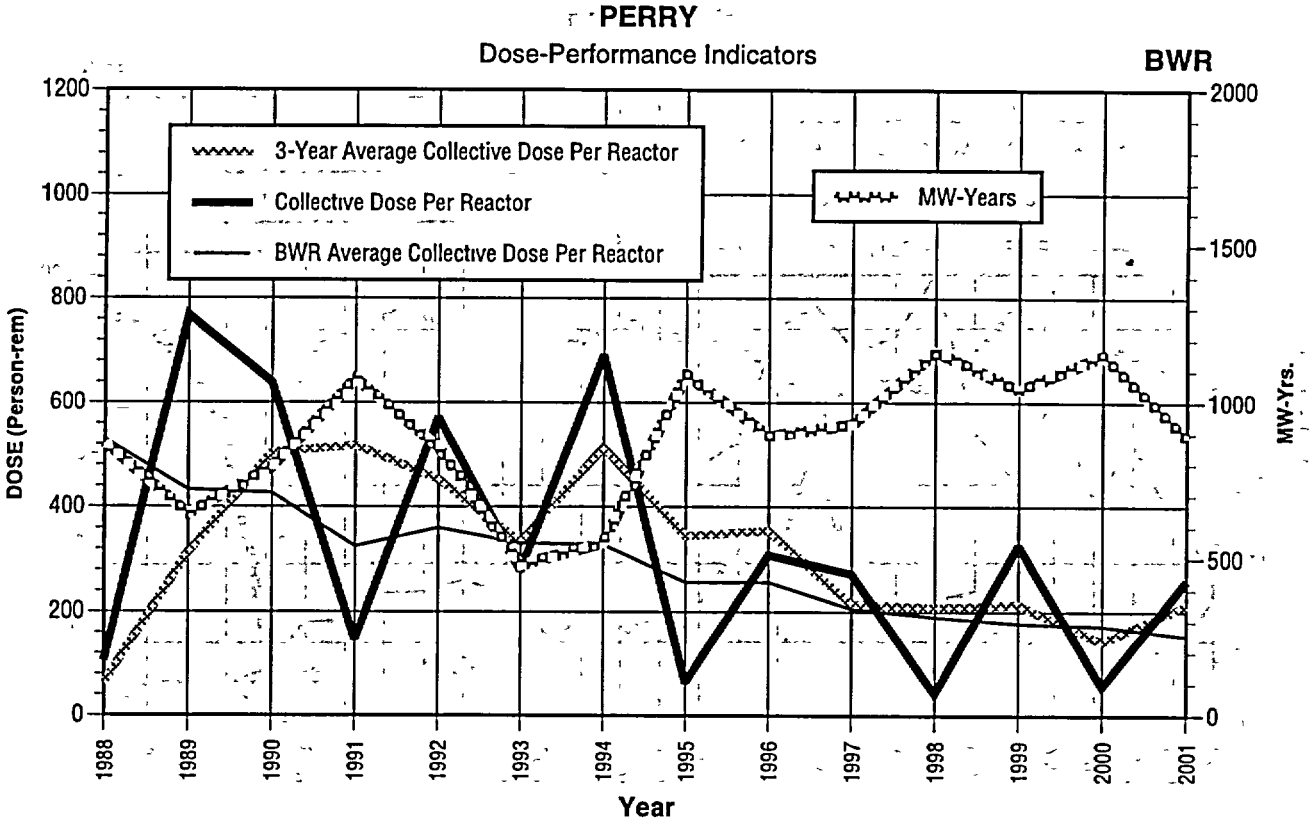
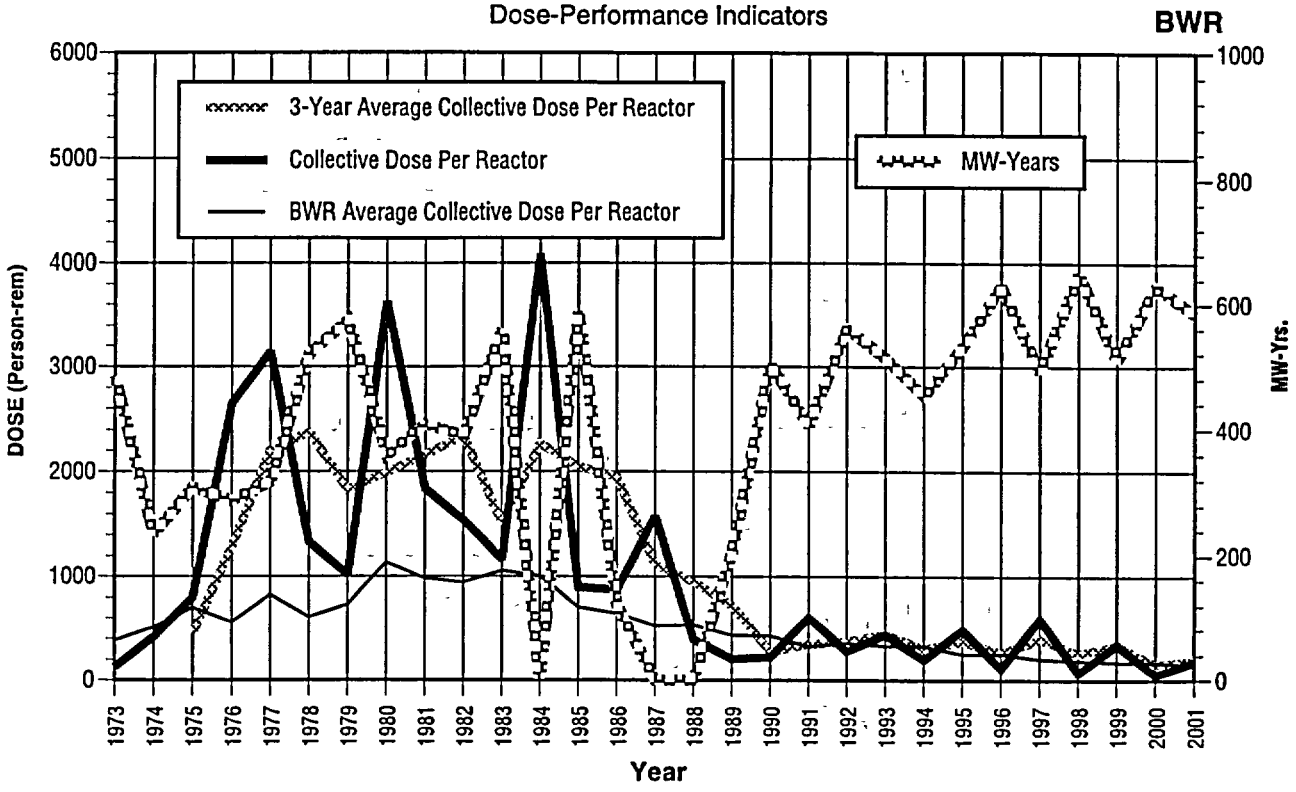
Collective Dose Per Reactor
BWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year


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

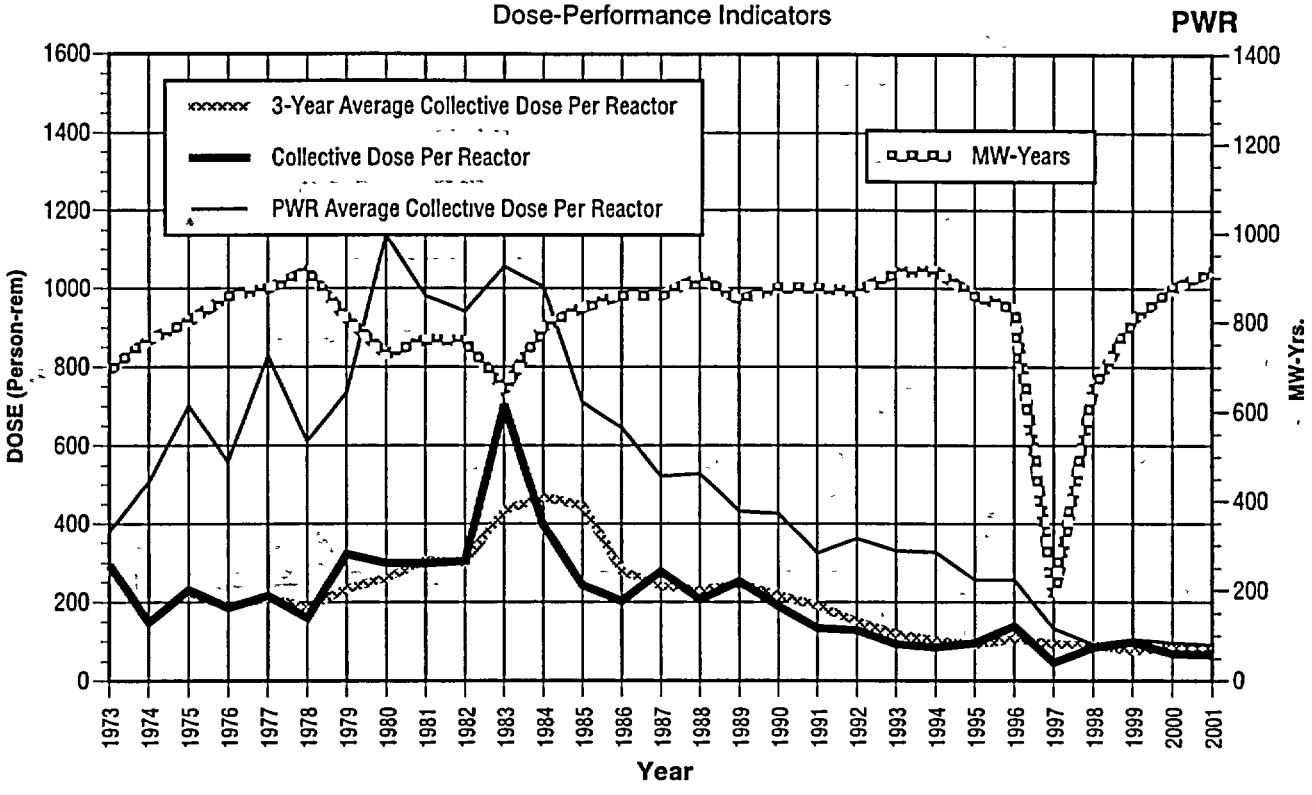
PILGRIM

Dose-Performance Indicators



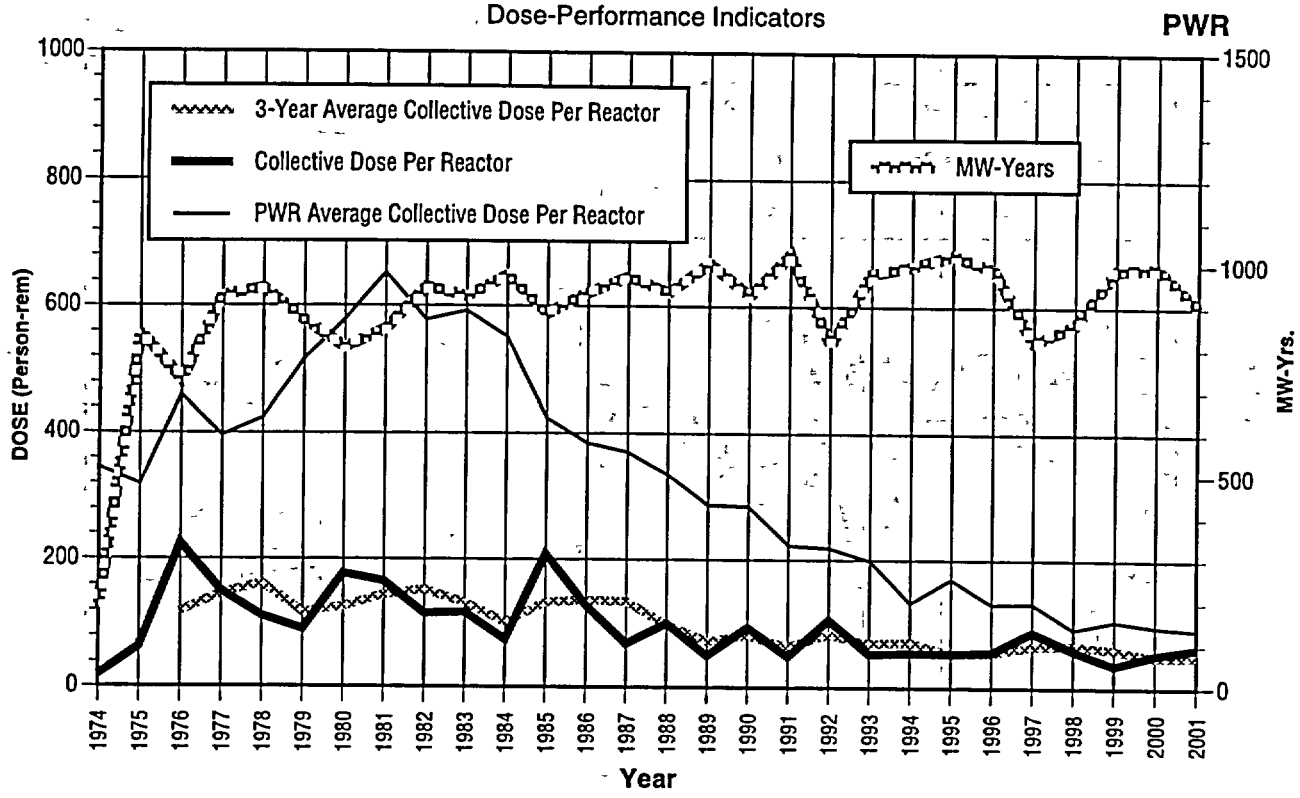
POINT BEACH 1, 2

Dose-Performance Indicators



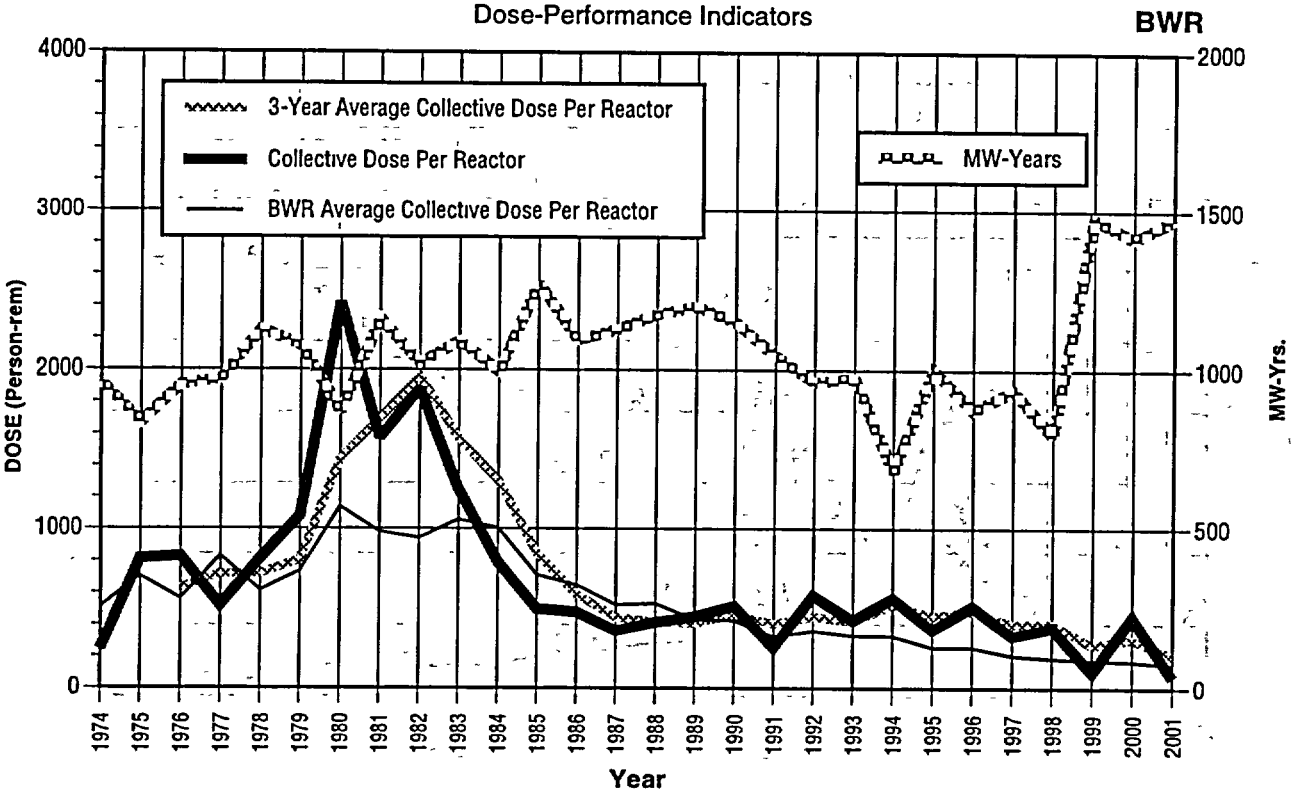
PRAIRIE ISLAND 1, 2

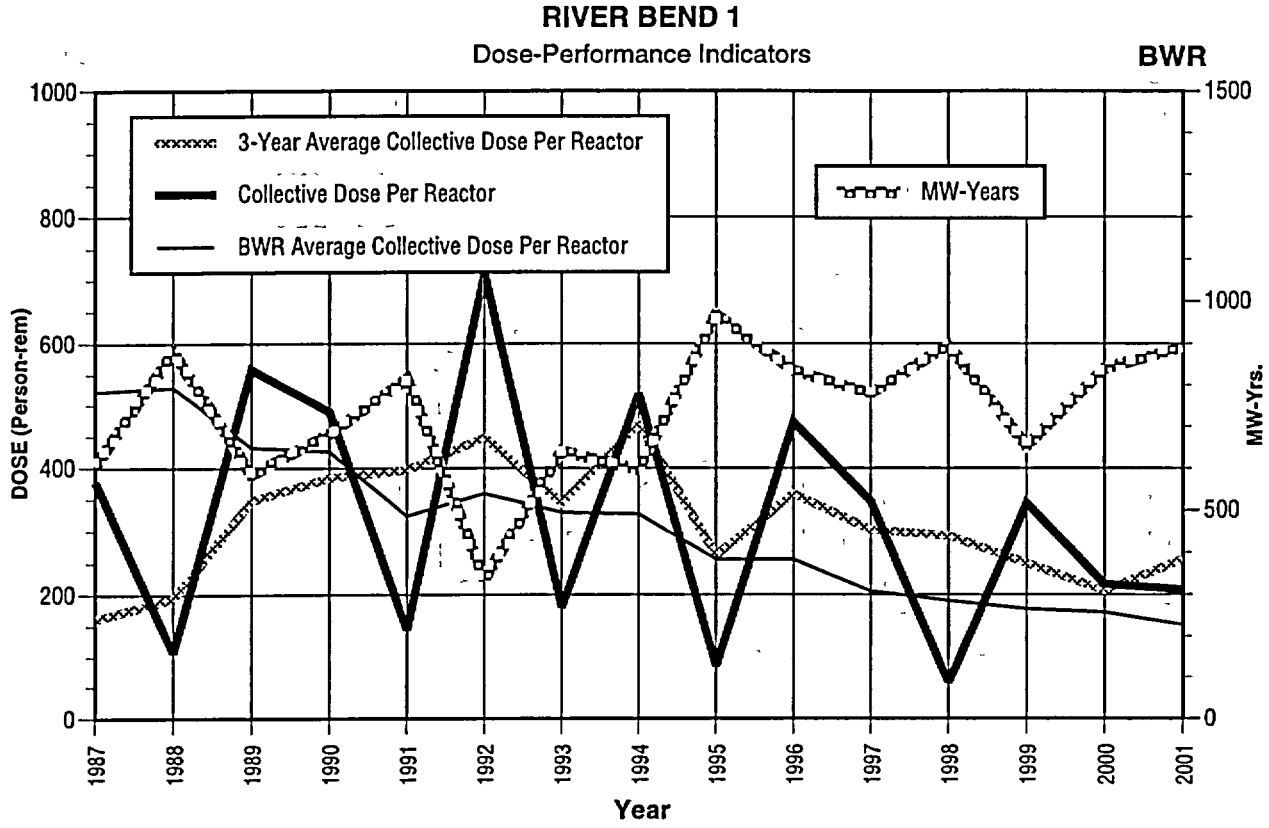
Dose-Performance Indicators



QUAD CITIES 1, 2

Dose-Performance Indicators

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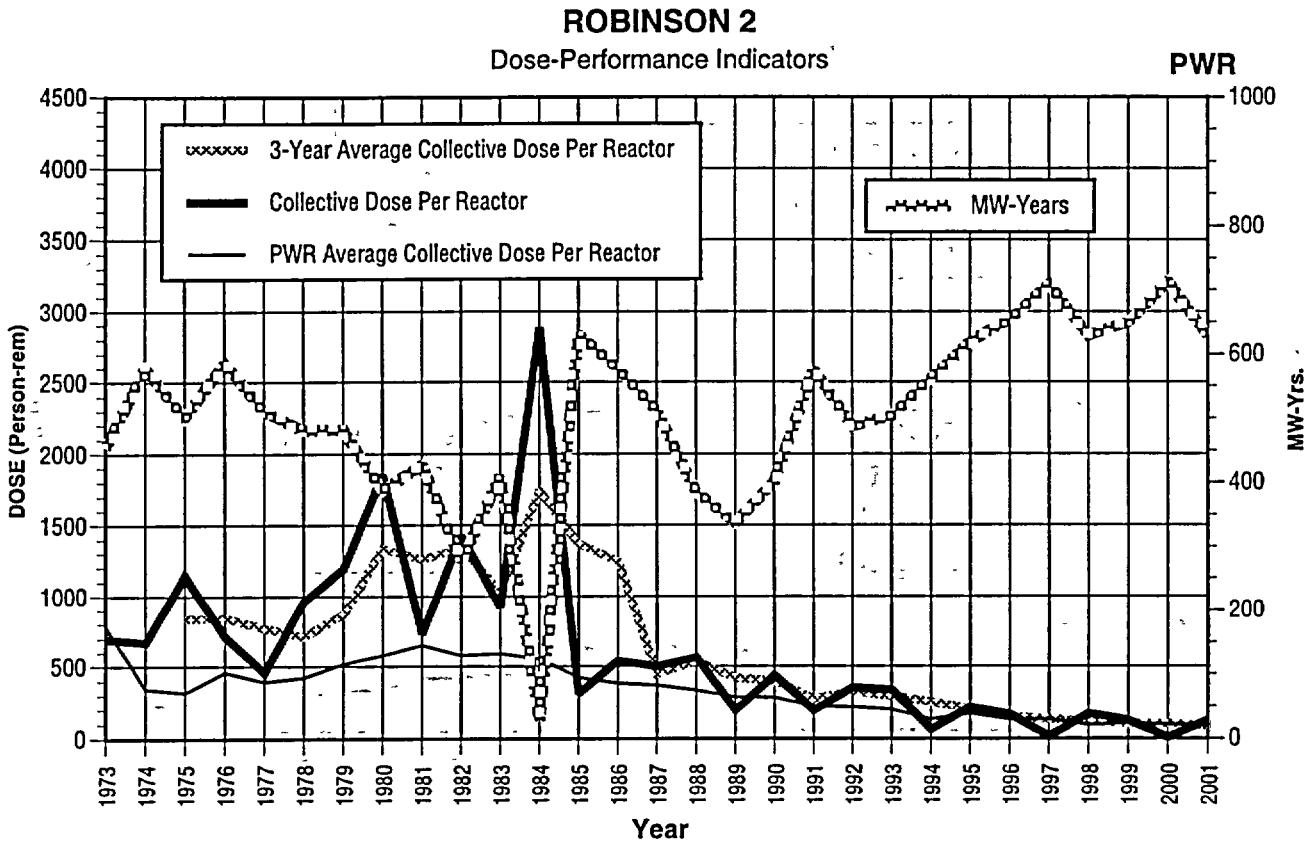
Collective Dose Per Reactor
BWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year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Dose-Performance Indicators
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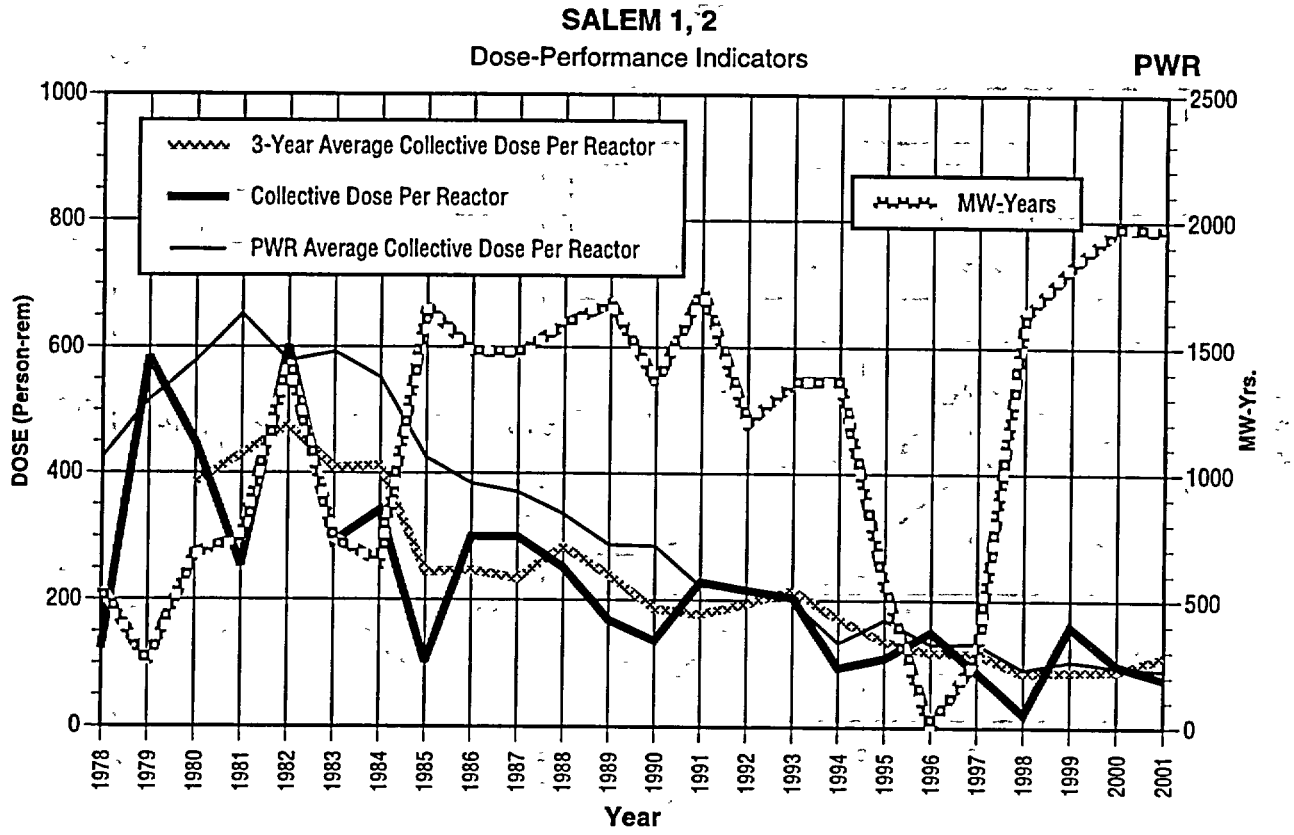
Collective Dose Per Reactor
PWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year


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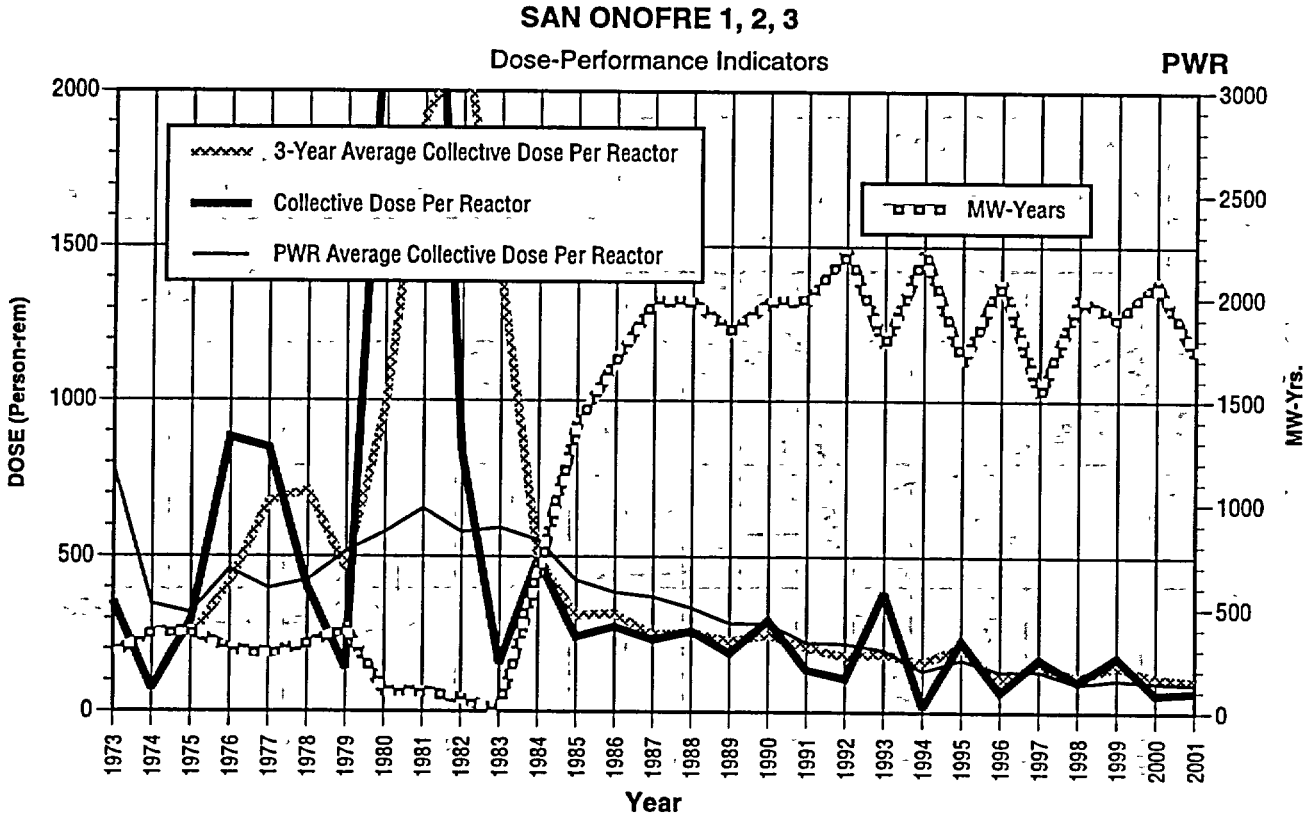
Collective Dose Per Reactor
PWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year


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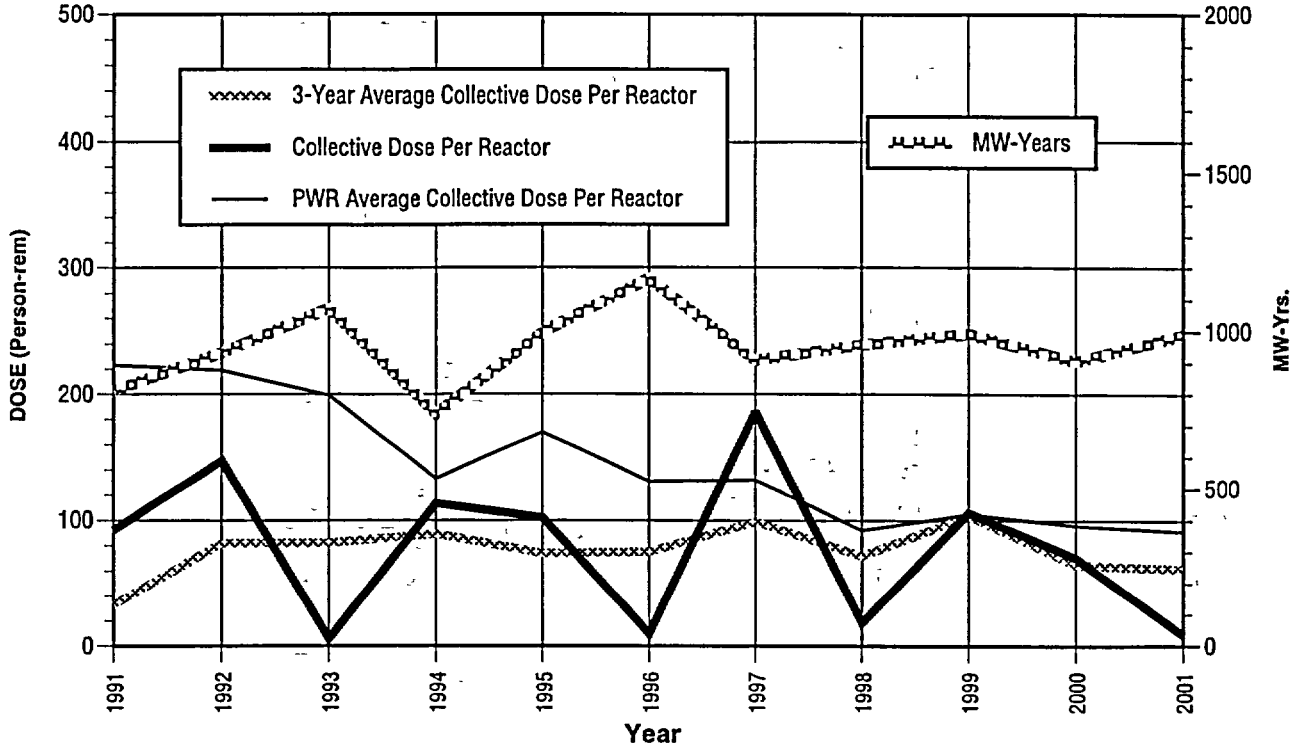
Collective Dose Per Reactor
PWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year

SEABROOK

Dose-Performance Indicators

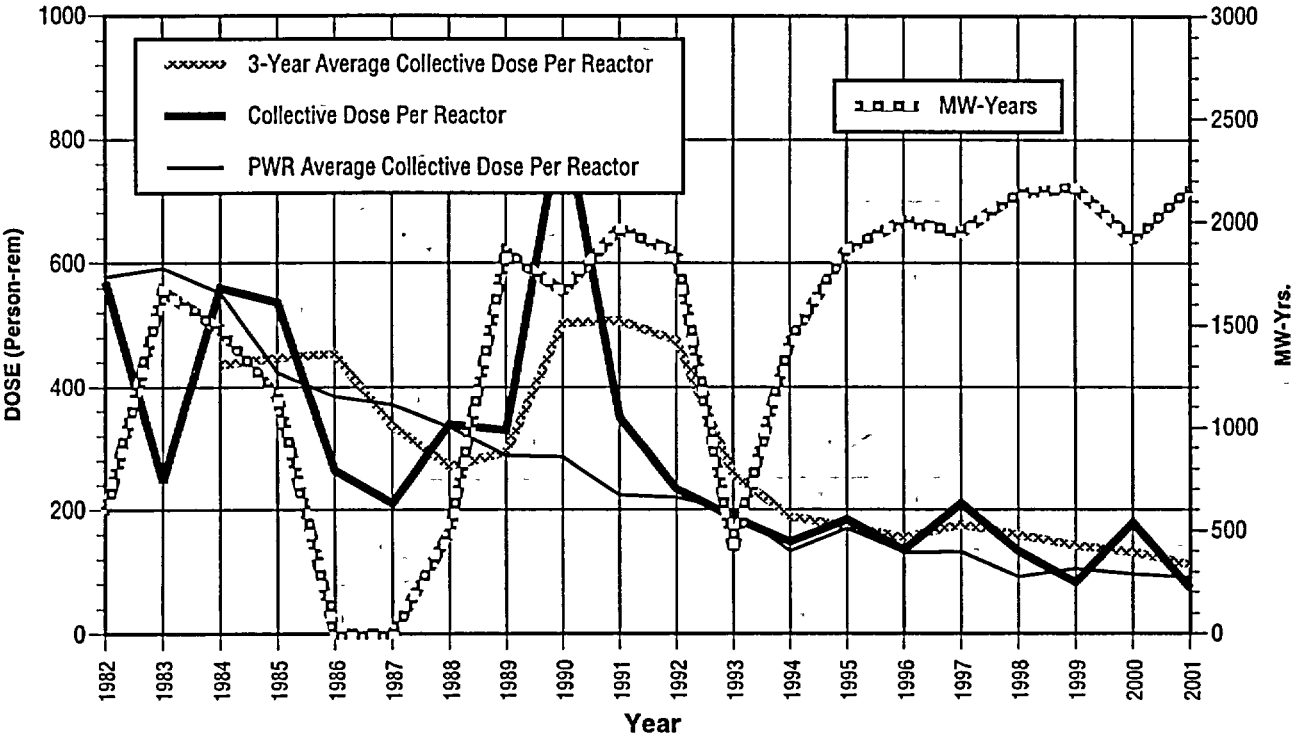
PWR

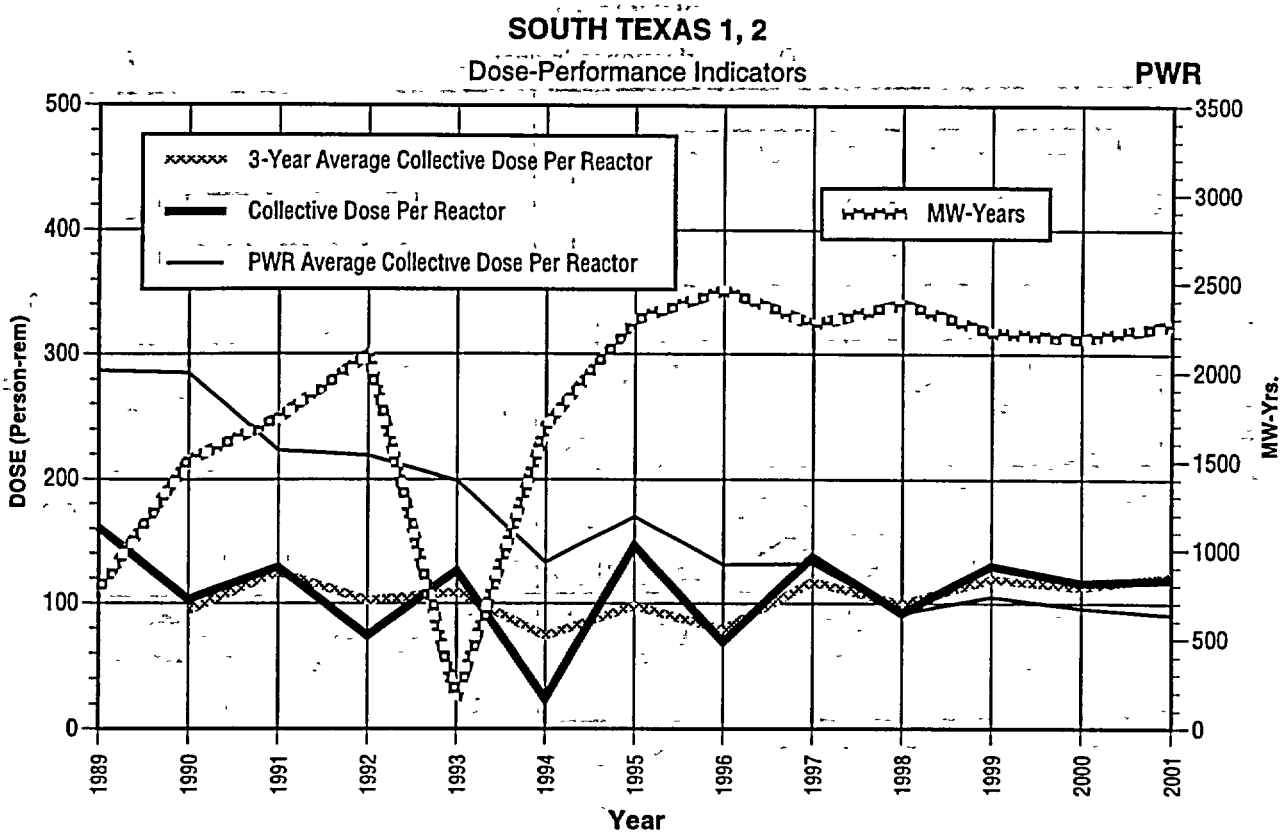


SEQUOYAH 1, 2

Dose-Performance Indicators

PWR




SOUTH TEXAS 1, 2
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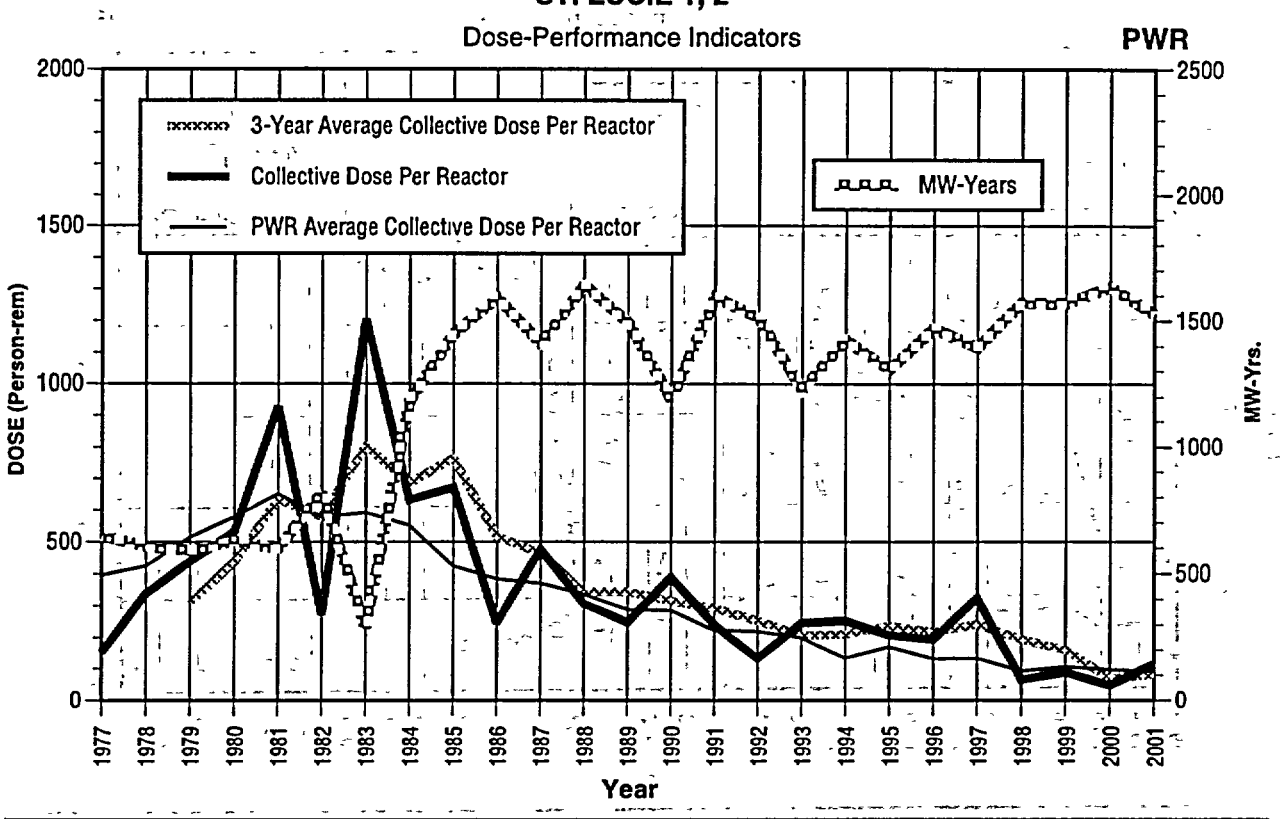
Collective Dose Per Reactor
PWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year


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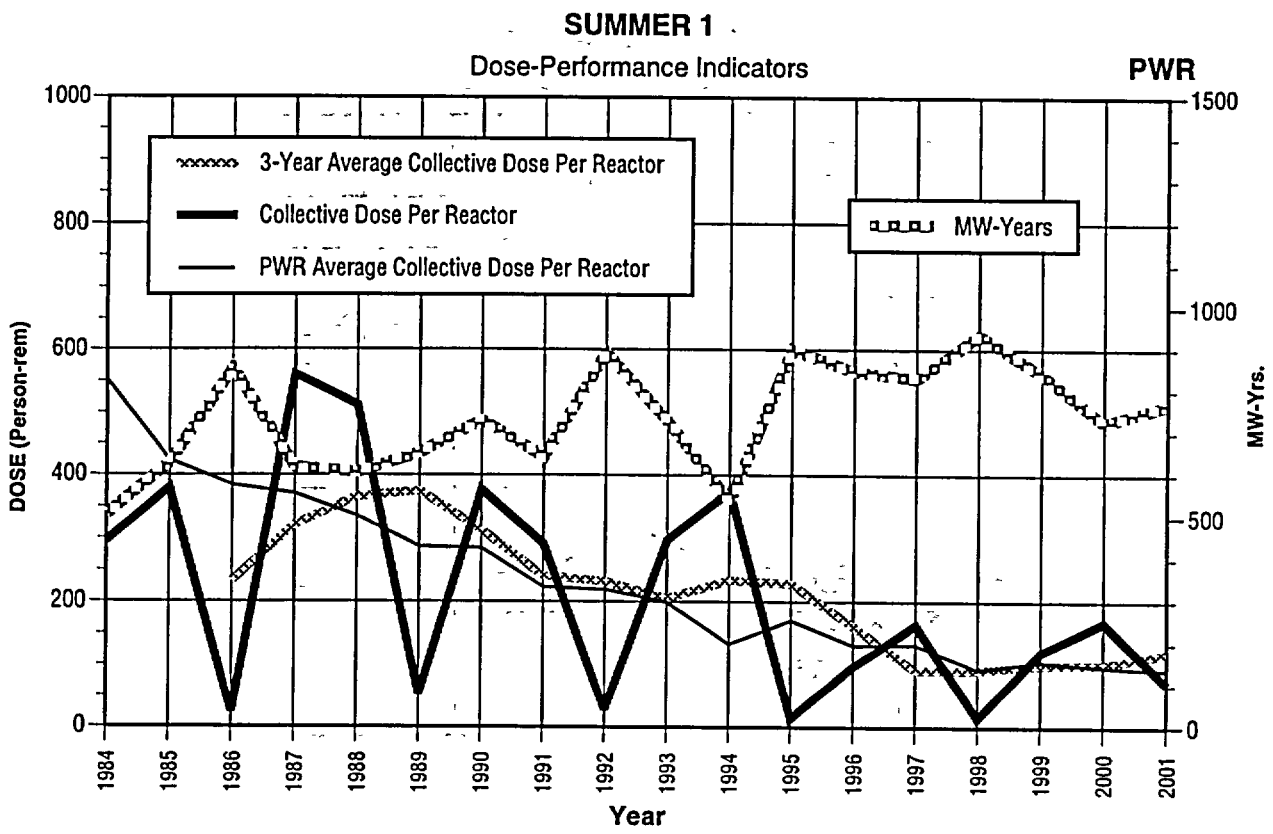
Collective Dose Per Reactor
PWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year


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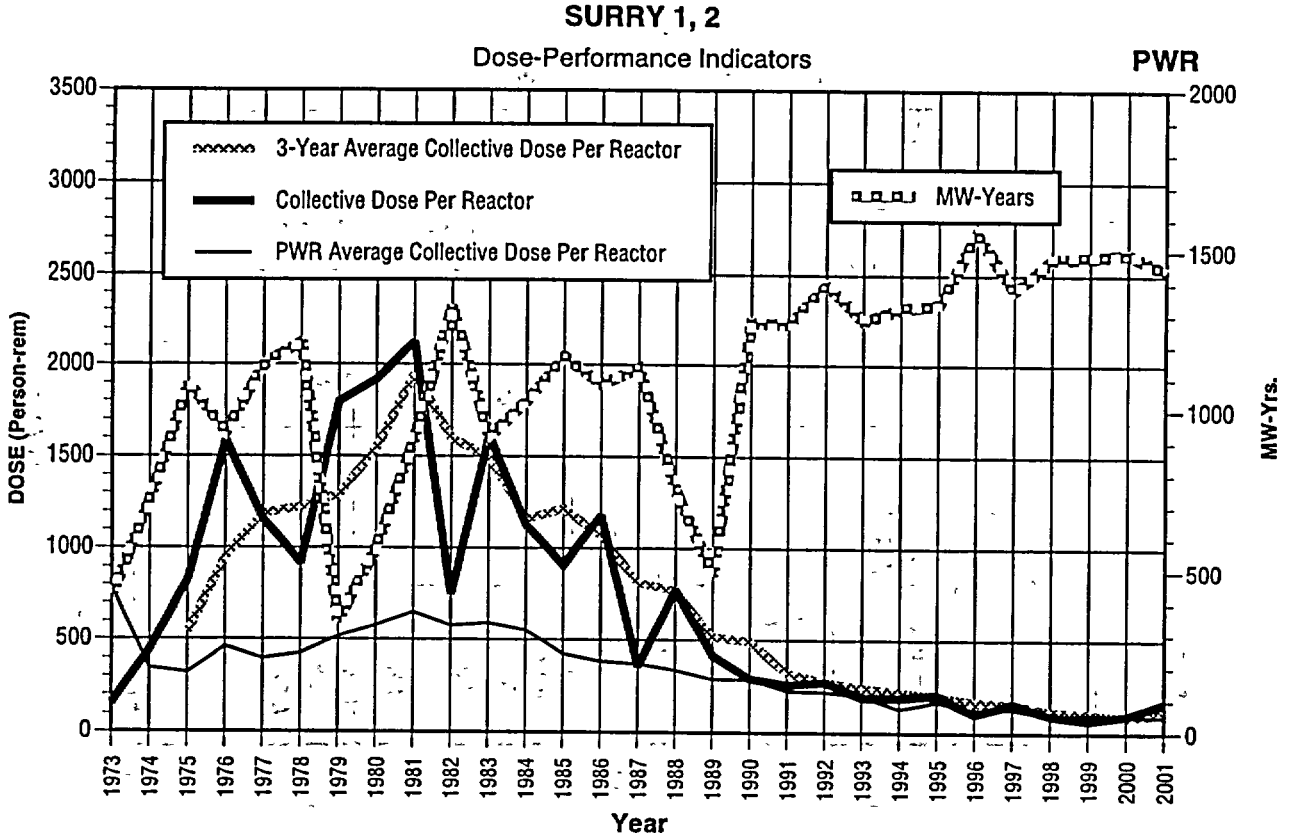
Collective Dose Per Reactor
PWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year


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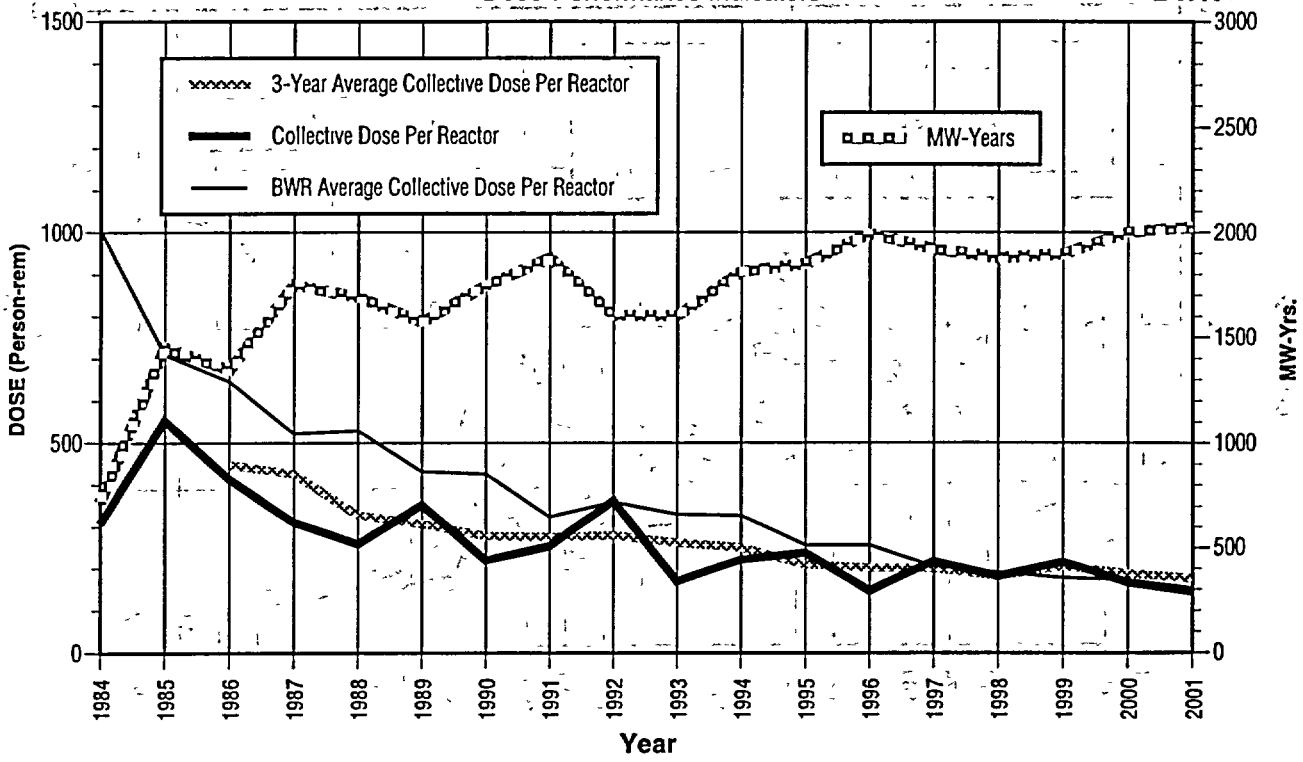
Collective Dose Per Reactor
PWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year

SUSQUEHANNA 1, 2

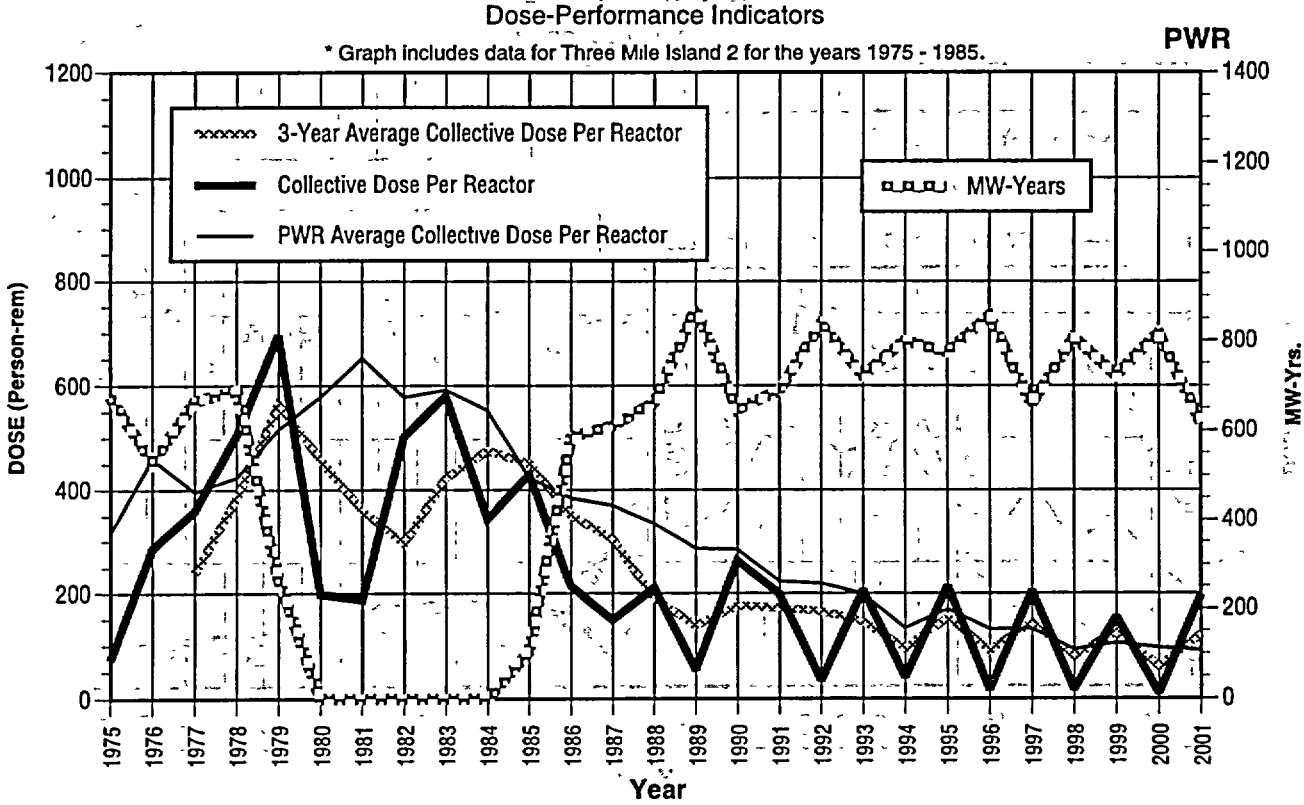
Dose-Performance Indicators



THREE MILE ISLAND 1*

Dose-Performance Indicators

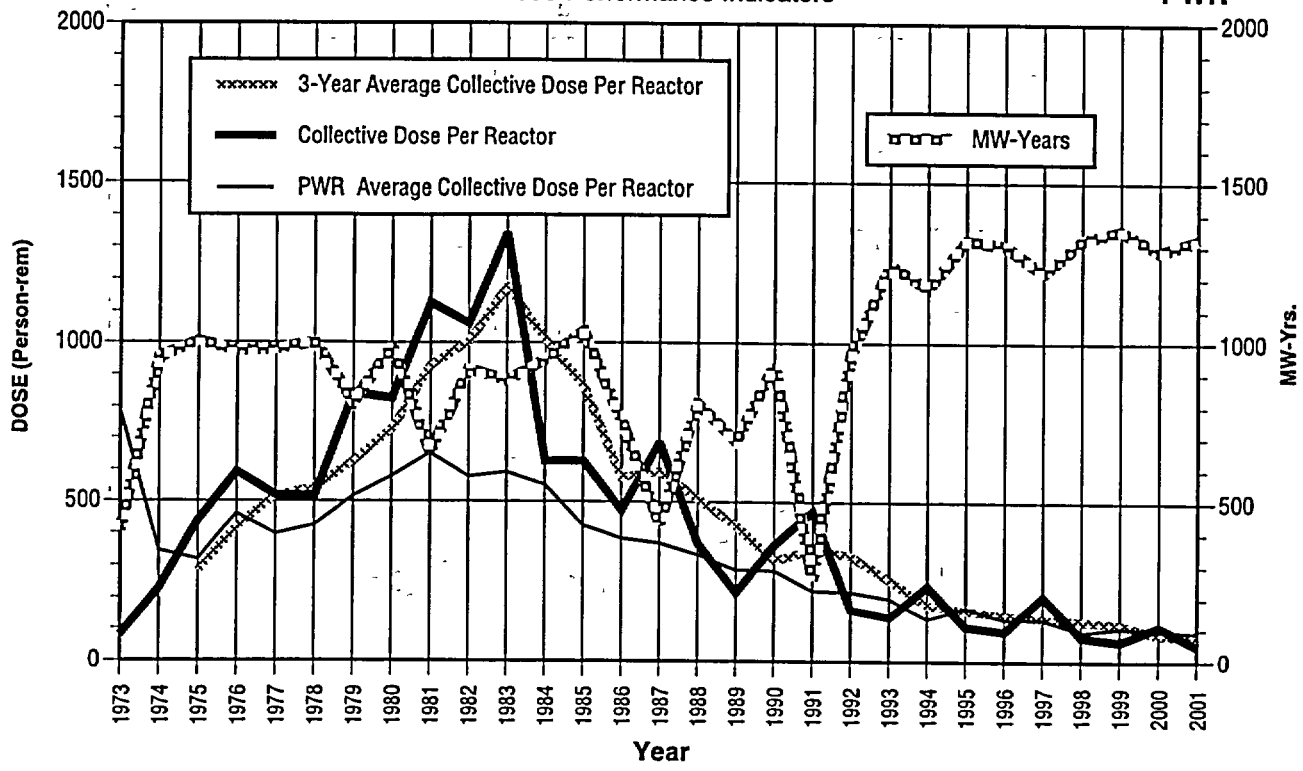
* Graph includes data for Three Mile Island 2 for the years 1975 - 1985.



TURKEY POINT 3, 4

Dose-Performance Indicators

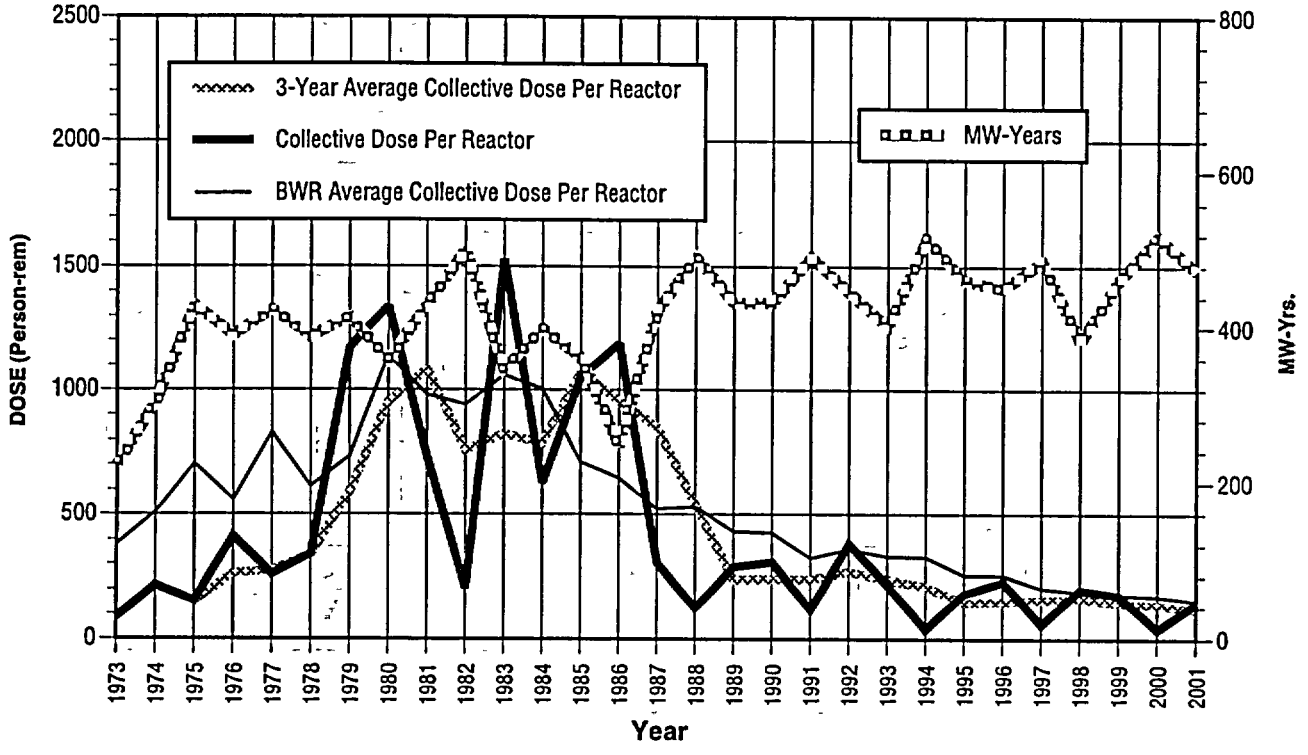
PWR

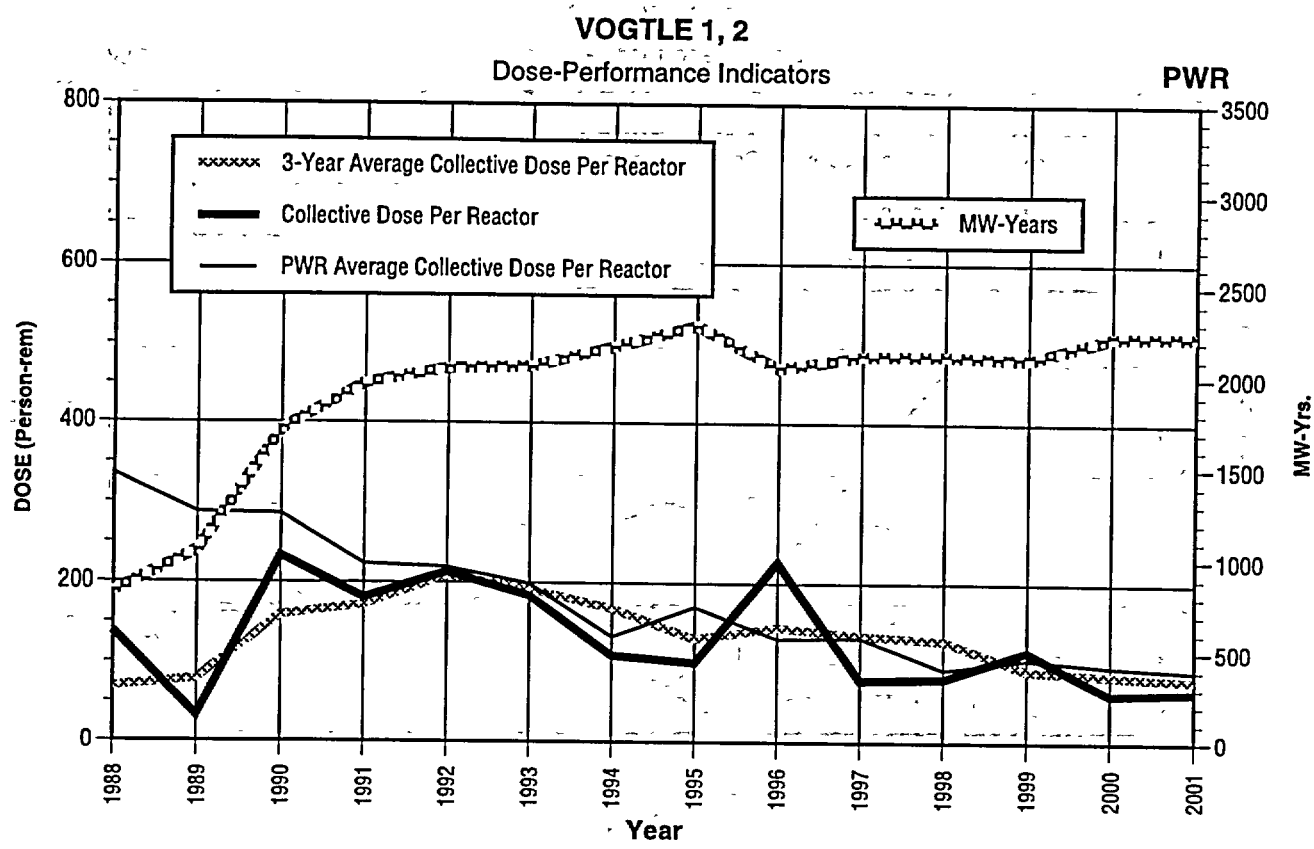


VERMONT YANKEE

Dose-Performance Indicators

BWR




VOGTLE 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
500
1000
1500
2000
2500
3000
3500
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
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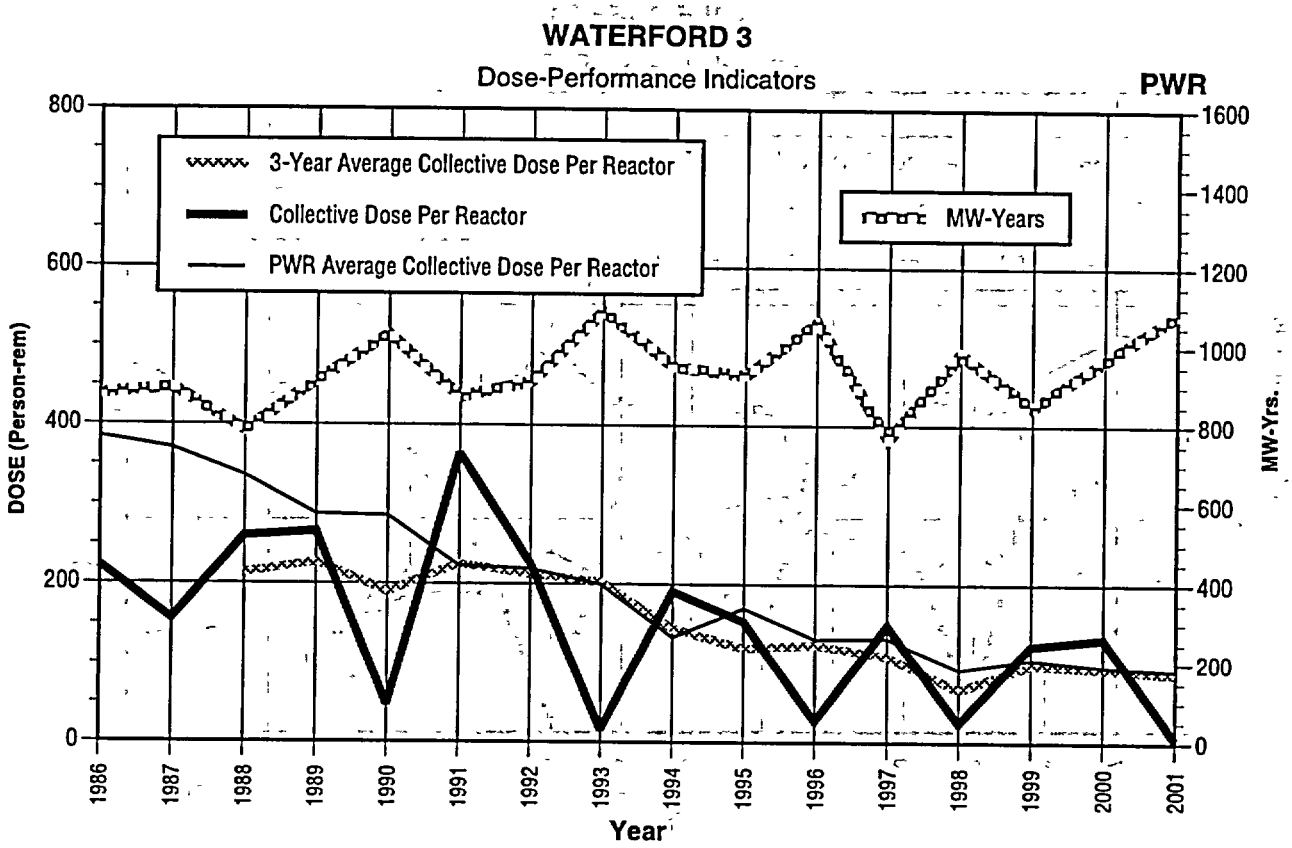
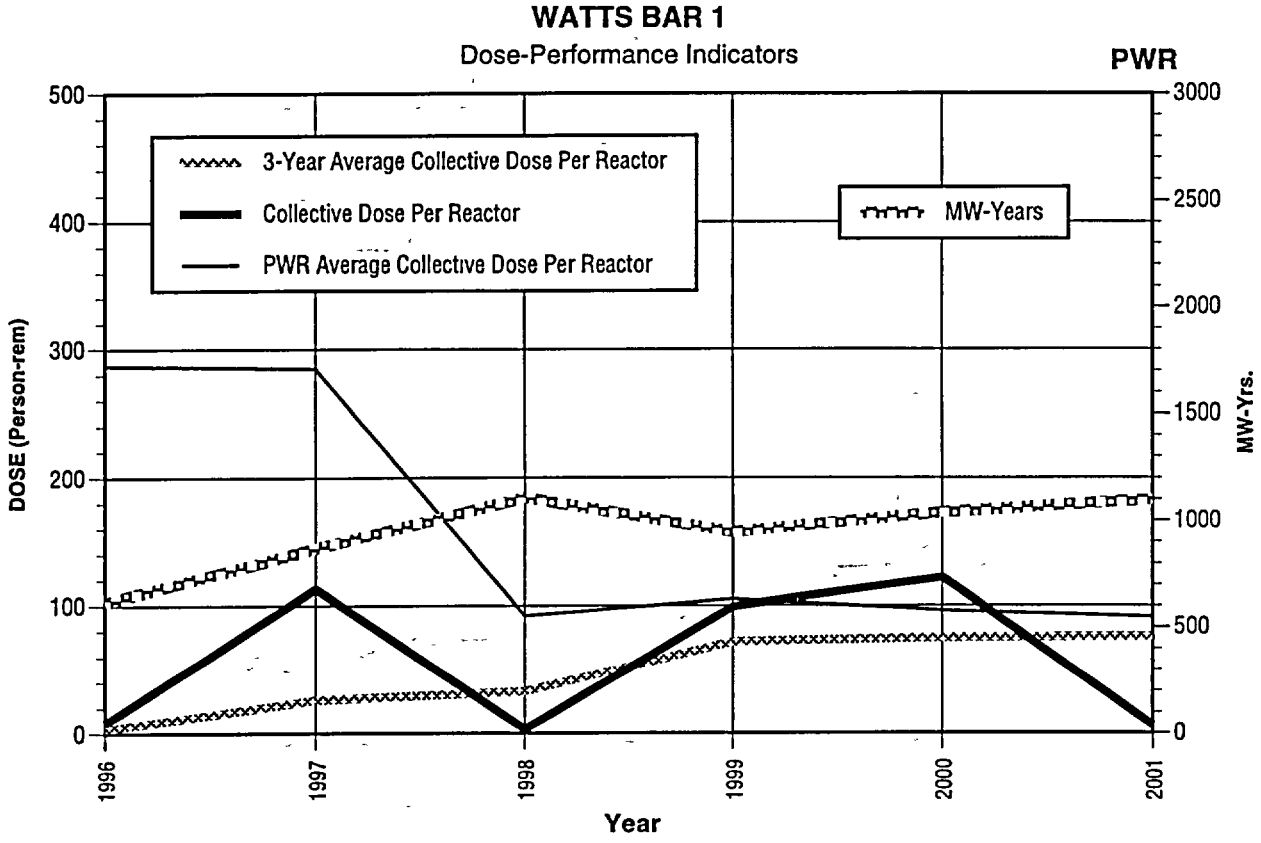
1999
2000
2001


WATERFORD 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
0
200
400
600
800
1000
1200
1400
1600
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001


WATTS BAR 1
Dose-Performance Indicators
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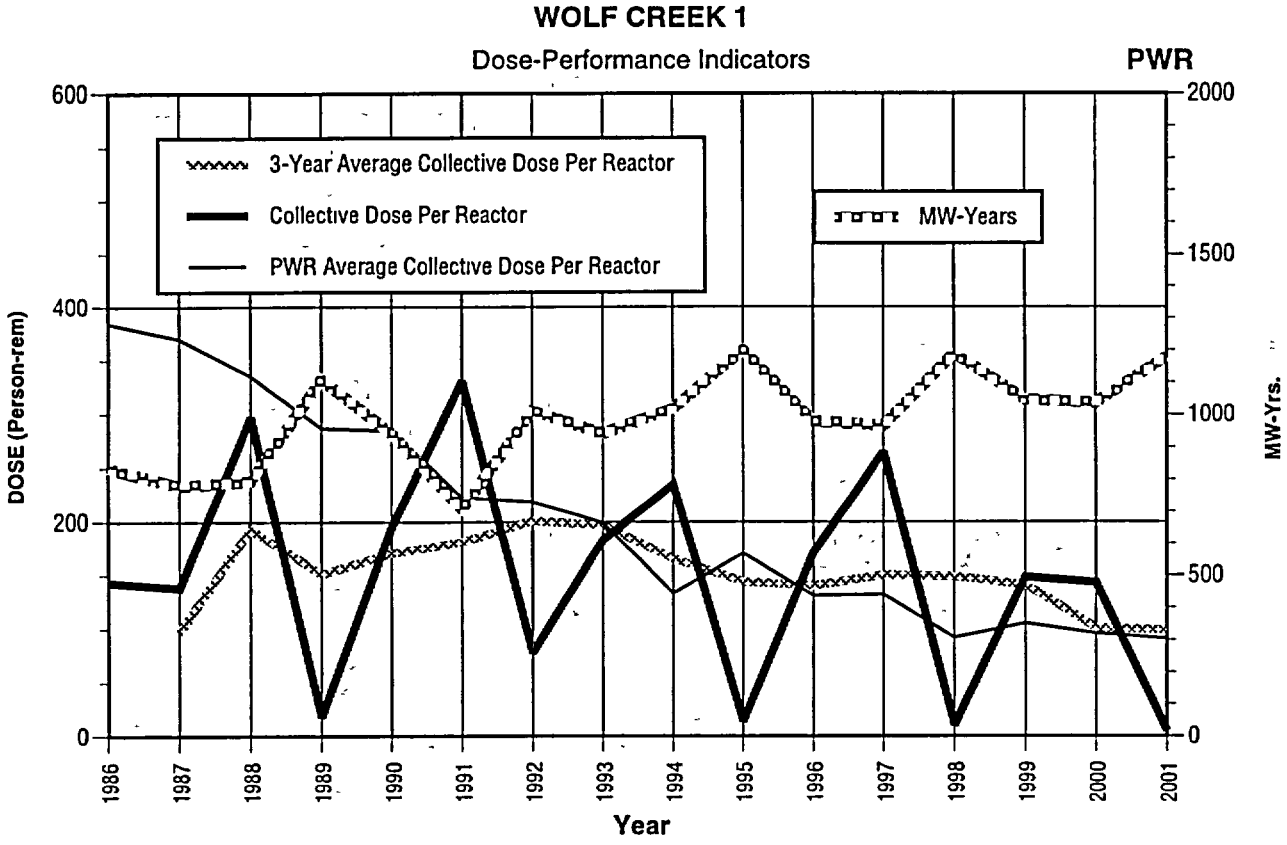
3-Year Average Collective Dose Per Reactor
Collective Dose Per Reactor
PWR Average Collective Dose Per Reactor
MW-Years
DOSE (Person-rem)
MW-Yrs.
Year
0
100
200
300
400
500
500
1000
1500
2000
2500
3000
1996
1997
1998
1999
2000
2001


WOLF CREEK 1
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
200
400
600
500
1000
1500
2000
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001

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Washington, DC 20555-0001

*Science Applications International Corporation
301 Laboratory Road
Oak Ridge, TN 37830

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10 SUPPLEMENTARY NOTES

11. ABSTRACT *(200 words or less)*

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 2001 annual reports submitted by six of the seven categories of NRC licensees subject to the reporting requirements of 10CFR 20.2206. Annual reports in 2001 were received from a total of 272 licensees, of which 104 were operators of nuclear power reactors in commercial operation.

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