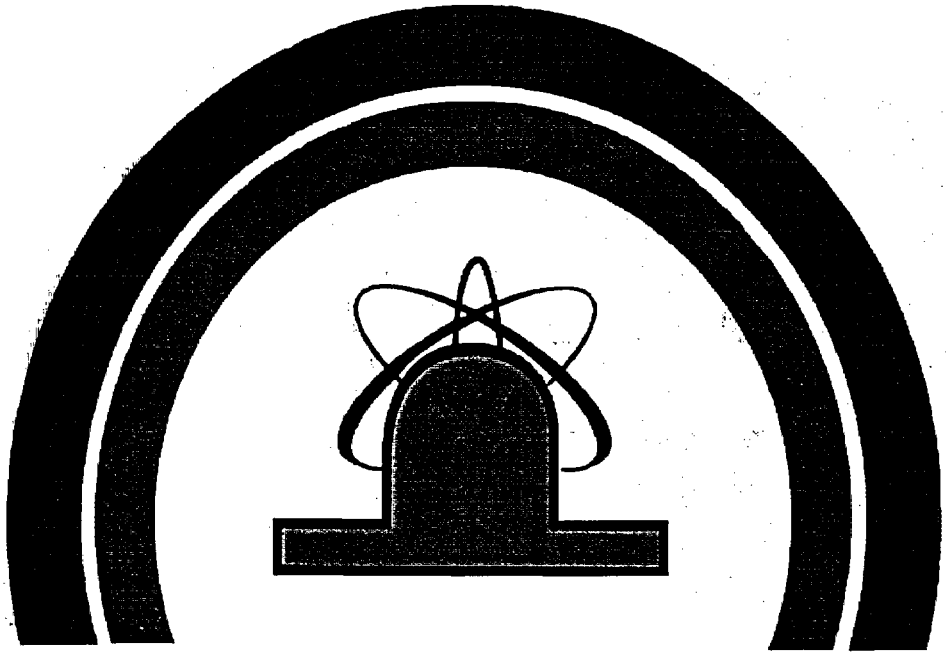
BSEP 03-0004
Enclosure

ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT FOR 2002

RADIOLOGICAL
ENVIRONMENTAL OPERATING



REPORT
2002

BRUNSWICK STEAM ELECTRIC PLANT

PROGRESS ENERGY CAROLINAS, INC.

SHEARON HARRIS ENERGY &
ENVIRONMENTAL CENTER
PROGRESS ENERGY CAROLINAS, INC.
NEW HILL, NORTH CAROLINA

RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT
FOR
BRUNSWICK STEAM ELECTRIC PLANT
JANUARY 1 THROUGH DECEMBER 31, 2002

Prepared by:

Sharon P. Langdon

Reviewed by:

Gregory K. Barley

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

EXECUTIVE SUMMARY

The Brunswick Steam Electric Plant (BSEP), Unit Nos. 1 and 2, is operated by Progress Energy Carolinas, Inc. (formerly known as Carolina Power & Light Company), under licenses granted by the Nuclear Regulatory Commission (NRC). BSEP Technical Specification 5.6.2 and BSEP Offsite Dose Calculation Manual (ODCM) establish the requirements of the Radiological Environmental Monitoring Program (REMP). This report provides the results of the REMP from January 1, 2002 through December 31, 2002.

The REMP was established in 1973. Radiation and radioactivity in various environmental media have been monitored for more than 25 years, including monitoring in excess of a year prior to commencing operation. Monitoring is also provided for control locations which would not be impacted by operations of BSEP. Using the data from the control locations and the historical data collected prior to operation, analyses of data from locations which could potentially be impacted by the operations of BSEP were performed. Radiation levels show no measurable change from pre-operational radiation levels.

Monitoring results for environmental media are summarized as follows:

- Air-monitoring results are similar or less than the concentrations of radioactivity from pre-operation monitoring. These observations are also consistent with past operational data.

- Milk was unavailable due to no milk (milch) animals (goat or cow) currently identified within the environs of the plant; therefore, no exposure pathway exists.

- Terrestrial vegetation includes broadleaf vegetation and results indicate no detectable activity.

- Aquatic organism monitoring includes fish (free swimmers and bottom feeders), invertebrates (shellfish (SH)), and Benthic organisms ((BO) organisms that live on the bottom of the ocean). Results indicated no detectable activity.

- Surface water results indicate no detectable activity.

- External radiation dose showed no measurable change from pre-operational data.

The continued operation of BSEP has not significantly contributed radiation or the presence of radioactivity in the environmental media monitored. The measured concentrations of radioactivity and radiation are well within applicable regulatory limits.

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

PURPOSE AND REQUIREMENTS FOR THE RADIOLOGICAL MONITORING PROGRAM

Although the operation of a nuclear generating station results in the raising of background radiation only a small amount, it is important to measure these emissions of radioactivity and radiation to assess their impact on the surrounding populations. The purpose of the REMP is to measure accumulation of radioactivity in the environments, to determine whether this radioactivity is the result of operations of BSEP and to assess the potential dose to the off-site population based on the cumulative measurements of radioactivity of plant origin. Radiological monitoring programs provide an additional verification of the containment and radiological controls of nuclear generating stations.

The radiological monitoring program was established in 1973 and continues to collect samples and evaluate them.

Requirements are established for the radiological monitoring program as follows:

- Technical Specifications
- Off-Site Dose Calculation Manual (ODCM)
- Various procedures

Additional guidance regarding the radiological monitoring program may be found in the following:

- NRC Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I"
- NRC Regulatory Guide 4.13, "Performance, Testing, and Procedural Specifications for Thermoluminescence Dosimetry: Environmental Applications"
- NRC Regulatory Guide 4.15, "Quality Assurance for Radiological Monitoring Programs (Normal Operations) - Effluent Streams and the Environment"

General Site Description

BSEP consists of two boiling water reactors with a design rating of 2923 megawatts thermal. Commercial production was initiated by Unit 2 on November 3, 1975 and by Unit 1 on March 18, 1977. BSEP is located in Brunswick County, North Carolina. The site is along state route 87 approximately two and a half miles north of Southport and is displayed on the map of southeastern North Carolina (Figure 1). The community of Boiling Spring Lakes is about three miles northwest of the site. The towns of Caswell Beach and Oak Island are on a barrier island south of the plant. The site is also approximately 16 miles south of Wilmington, North Carolina.

Figure 1: Location of Brunswick Steam Electric Plant

The Cape Fear River is east of the plant, and cooling water is drawn from the river through a canal. The cooling water is discharged to the Atlantic Ocean through a canal, pumping station, and piping. The discharge point is south of the town of Caswell Beach.

The plant site varies in elevation from sea level to 30 feet above mean sea level (MSL). It is surrounded by extensive marshes. The lower Cape Fear River is an important nursery area for shellfish, and other marine species.

The local economy supports significant recreational, industrial, agricultural, and government contributions. There is well-developed recreational use of the barrier islands south and east of the site. Fishing and boating are popular activities. Commercial fishing is also an important industry in the community. Agriculture utilizes some of the land within 50 miles of the site; such as small truck farms, cattle, poultry, and row crops including corn, soybeans and tobacco. Industrial activity includes the Archer-Daniels-Midland Chemical (ADM) Company, a manufacturer of citric acid, located one and a half miles southeast of the plant. In conjunction with the citric acid plant is a small electrical generating station operated by Cogentrix, Inc. This coal-fired station is composed of two units rated at 55 Mwe each.

C01

Transportation is a significant industry in the local economy, with the Port of Wilmington north of the site. The shipping channel is just east of the site in the Cape Fear River. Also, the Sunny Point Military Ocean Terminal (MOT) is located approximately four and one half miles north of the plant site on the Cape Fear River.

RADIOLOGICAL MONITORING PROGRAM QUALITY ASSURANCE

A required component of the REMP is the Quality Assurance Program. The standards for the quality assurance program are established in NRC Regulatory Guide (R.G.) 4.15, "Quality Assurance for Radiological Monitoring Programs." According to R.G. 4.15, the purpose of the quality assurance program is "(1) to identify deficiencies in the sampling and measurement processes to those responsible for these operations so that corrective action can be taken, and (2) to obtain some measure of confidence in the results of the monitoring programs in order to assure the regulatory agencies and the public that the results are valid." This provides the opportunity to implement corrective actions that address possible deficiencies. Examples of the activities of the quality assurance program include:

- regular review of sample collection and records
- regular review of laboratory procedures and methods
- participation in the Analytics, Inc., Environmental Cross-Check Program, which provides an independent assessment of the quality of laboratory results.
- the use of known concentrations of radioactivity in test samples by the laboratory to ensure consistent quality results on an ongoing basis.

RADIOLOGICAL MONITORING PROGRAM GENERAL DESCRIPTION

Although the contribution to background radiation is small, Progress Energy Carolinas, Inc. has established this program to measure the exposure pathways to man. An exposure pathway describes the source of the radiological exposure. The primary forms of potential radiological emissions from the plant are airborne and liquid discharge. The following pathways are monitored external dose, ingestion of radioactive materials, and the inhalation of radioactive material. Specific methods and different environmental media are required to assess each pathway. Table 1 provides a list of the media used to assess each of these pathways.

Table 1

Media Used to Assess Exposure Pathways to Man

Pathway of Exposure to Man	Media Sampled
External Dose	Thermoluminescent Dosimetry (TLD) Shoreline Sediment
Ingestion	Broadleaf Vegetation Fish and Invertebrates Surface Water
Inhalation	Air Samples (Particulate & Radioiodine)

Sampling Locations

Sampling locations are chosen based upon meteorological factors, preoperational monitoring, and results of the land use surveys. A number of locations are selected as controls. Control stations are selected because they are very unlikely to be affected by operation of the plant. Sample locations may be seen in Figures 2 and 3. A description of each sample location may be found in Table 2.

Radiological Sampling Locations

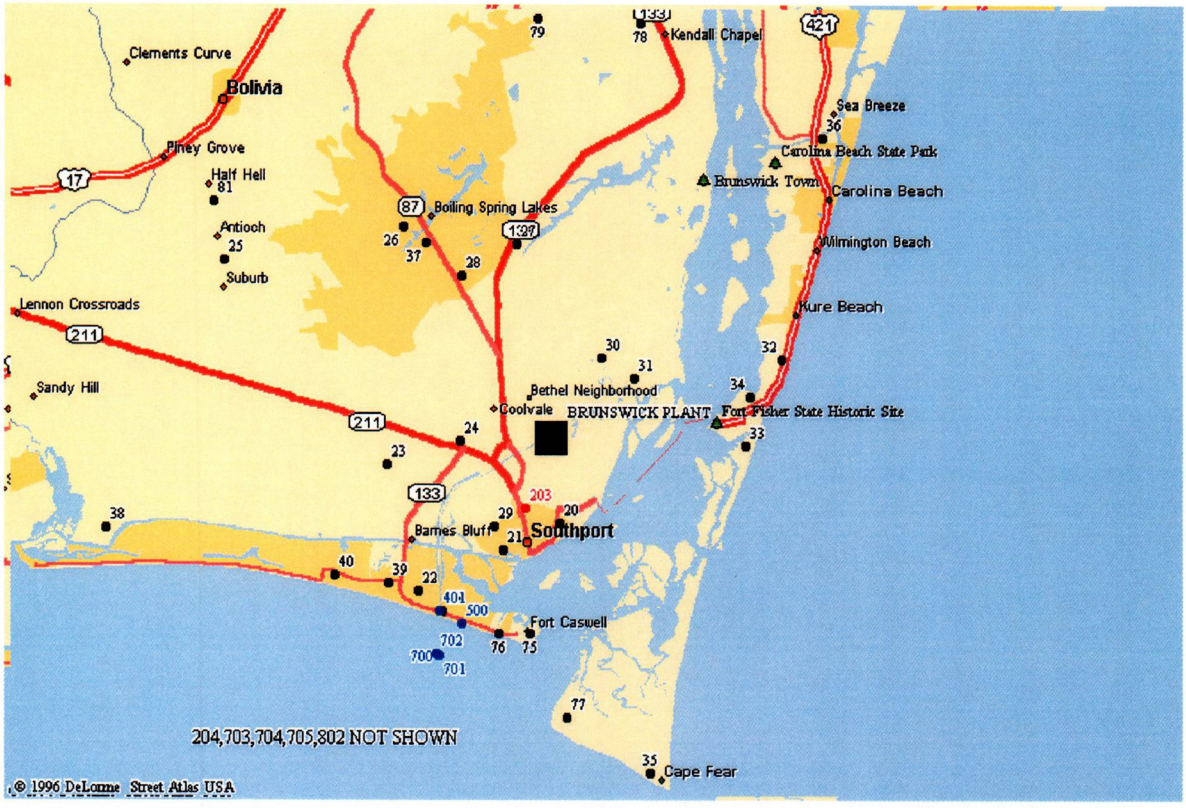


Figure 2: Radiological Sampling Locations (Distant from Plant) (Scale 1 inch = 3.08 miles)

Stations not illustrated:

204 (Sutton Plant in Wilmington) (Control Air Station)

703, 704, 705 (Location not Specified in the Atlantic Ocean)(Control Fish Station)

802 (Location not specified) (Control Vegetation)

C02

Radiological Sampling Locations

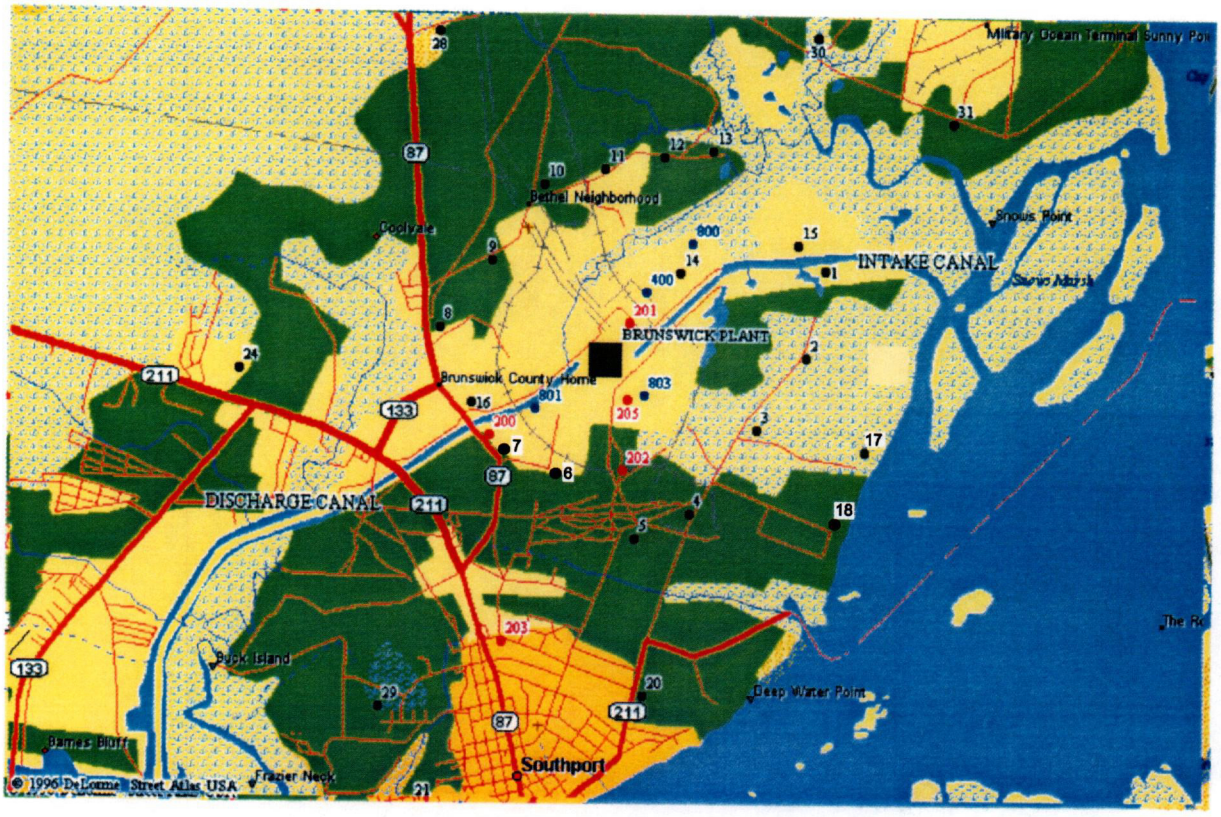


Figure 3: Radiological Sampling Locations (Nearest Plant)

Figure 3 (above) is an expanded view of the previous figure (Figure 2 page 6).

C03

Table 2

Brunswick Steam Electric Plant

Radiological Monitoring Sampling Locations

Sample Type	Location & Description	Frequency	Sample Size	Analysis
Air Cartridge (AC)	200--1.0 mile SW Visitors Center 201--0.6 mile NE PMAC (Highest D/Q) 202--1.0 mile S substation--construction rd. 203--2.3 miles SSW Southport substation 204--23 miles NNE Sutton Plant* 205--0.6 mile SSE Spoil Pond	Weekly	10,000 ft^3 (300 m^3)	Iodine-131
Air Particulate (AP)	200--1.0 mile SW Visitors Center 201--0.6 mile NE PMAC (Highest D/Q) 202--1.0 mile S substation-construction rd. 203--2.3 miles SSW Southport substation 204--23 miles NNE Sutton Plant* 205--0.6 mile SSE Spoil Pond	Weekly	10,000 ft^3 (300 m^3)	Gross Beta (Weekly) Composite Gamma (Quarterly)
Fish (FI)	700--5.5 miles SSW Atlantic Ocean @ discharge (free-swimmers) 701--5.5 miles SSW Atlantic Ocean @ discharge (bottom-feeders) 702--5.5 miles SSW Atlantic Ocean @ discharge (invertebrates) 703--Atlantic Ocean; location not specified* (free-swimmers) 704--Atlantic Ocean; location not specified* (bottom-feeders) 705--Atlantic Ocean; location not specified* (invertebrates)	Semiannual (In Season)	500 grams (wet)	Gamma (Edible portions)
Broadleaf Vegetation (BL)	800--0.7 mile NE intake canal 801--0.6 mile SW discharge canal 802--10 miles; location not specified* 803--0.6 mile SSE Spoil Pond	Monthly (As available)	500 grams (wet)	Gamma Iodine-131
Shoreline Sediment (SS)	500--4.9 miles SSW discharge; beach near OD pumps	Semiannual	500 grams	Gamma
Surface Water (SW)	400--0.7 mile NE intake canal* 401--4.9 miles SSW discharge canal @ OD pumps	Monthly Composite	4 liters	Gamma Tritium

* Control Stations

Table 2 (Continued)

Brunswick Steam Electric Plant

Radiological Monitoring Sampling Locations

Sample Type	Location & Description	Frequency	Sample Sz	Analysis
Thermoluminescent Dosimetry (TLD)	1 1.1 miles E 2 1.0 mile ESE 3 0.9 mile SE 4 1.1 miles SSE 5 1.1 miles S 6 1.0 mile SSW 7 1.0 mile SW 8 1.2 miles W 9 1.0 mile WNW 10 0.9 mile NW 11 0.9 mile NNW 12 1.0 mile N 13 1.2 miles NNE 14 0.5 mile NE 15 0.9 mile ENE 16 1.0 mile WSW 17 1.5 miles ESE 18 1.7 miles SE 20 2.0 miles S 21 2.9 miles SSW 22 5.3 miles SW 23 4.6 miles WSW 24 3.0 miles W 25 8.7 miles WNW 26 5.9 miles NW 27 5.0 miles NNW 28 4.2 miles NW 29 2.6 miles SSW 30 2.0 miles NE 31 2.6 miles ENE 32 5.7 miles ENE 33 4.0 miles E 34 5.5 miles ENE 35 7.5 miles SSE 36 9.3 miles NE 37 5.5 miles NW 38 11.0 miles W 39 5.3 miles SW 40 6.9 miles WSW 75 4.5 miles S 76 4.8 miles SSW 77 5.3 miles S 78 10.0 miles NNE 79 9.5 miles N 81 10.0 miles WNW*	Quarterly	Not Applicable	TLD Reading

*Control Station

SUMMARY OF RADIOLOGICAL MONITORING PROGRAM

This report presents the results of the Radiological Environmental Monitoring Program conducted during 2002 for BSEP. The program was conducted in accordance with the ODCM, and applicable procedures.

The 2002 Annual Radiological Environmental Operating Report (REOR) has been prepared and submitted in accordance with Technical Specification 5.6.2 and ODCM 7.4.1. The report applies to both BSEP Unit Nos. 1 and 2 (License Nos. DPR-71 and DPR-62, respectively).

A total of 936 sample measurements were performed on 912 collected samples from indicator and control locations from six environmental media types during the year. No detectable radioactivity (or radioactivity which did not differ significantly from the corresponding control) was observed in any of the 783 measurements performed on the 771 indicator location samples in 2002. All samples analyzed met the Lower Limit of Detection (LLD) requirements as established by ODCM Table 7.3.15-3.

The radiological environmental data indicates that BSEP operations in 2002 had no significant impact on the environment or public health and safety. No measurable radiation exposure is attributed to any off-site member of the public due to the operations of BSEP.

A statistical summary of all the data gathered in 2002 has been compiled in Table 3.

Comparison of the current data with preoperational (1973, 1974) information (Tables 4 and 5) indicates that air particulate filter gross beta activity and ambient gamma radiation levels were lower in 2002.

TABLE 3
BRUNSWICK STEAM ELECTRIC PLANT
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM DATA SUMMARY

Brunswick Steam Electric Plant
Brunswick County, North Carolina

Docket Numbers - 50-324 and 325
Calendar Year 2002

Medium or Pathway Sampled or Measured (Unit of Measurement)	Type and Total No. of Measurements Performed	Lower Limit of Detection (LLD)[1]	All Indicator Locations[2] Mean Range	Location w/Highest Annual Mean: Name, Distance, and Direction	Location w/Highest Annual Mean: Mean Range[2]	Control Locations Mean Range[2]
Air Cartridge (pCi/m^3)	I-131 312[3]	3.0E-2	All less than LLD		All less than LLD	All less than LLD
Air Particulate (pCi/m^3)	Gross Beta 311[3]	3.0E-3	1.55E-2 (259/260)[7] 3.27E-3 – 2.83E-2	PMAC (Highest D/Q) 0.6 miles NE	1.62E-2 (52/52)[7] 7.07E-3 – 2.83E-2	1.66E-2 (52/52)[7] 9.00E-3 – 2.64E-2
	Gamma[4] 24	See Table 6	All less than LLD		All less than LLD	All less than LLD
Broadleaf Vegetation (pCi/g, wet)	Gamma[4] 48	See Table 6	All less than LLD		All less than LLD	All less than LLD
Fish and Invertebrates (pCi/g, wet)	Gamma[4] 12	See Table 6	All less than LLD		All less than LLD	All less than LLD
Sediments--Shoreline (pCi/g, dry)	Gamma[4] 2	See Table 6	All less than LLD		All less than LLD	No control
Surface Water (pCi/l)	Gamma[4] 24	See Table 6	All less than LLD		All less than LLD	All less than LLD
	Tritium 24	3.25E+2(24/24)[6][7]	All less than LLD		All less than LLD	All less than LLD
TLD (mR per quarter)[5]	TLD Readout 179[3]		9.56E+0 (176/176)[7] 7.30E+0 - 1.36E+1	Caswell Beach 4.8 miles SSW	1.18E+1 (4/4)[7] 1.04E+1 -1.36E+1	1.09E+1 (3/4)[7] 9.40E+0 - 1.22E+1

FOOTNOTES TO TABLE 3

1. LLD is calculated based on 4.66 standard deviations above background using typical sample sizes and counting times. Due to counting statistics and varying volumes, occasionally lower LLDs are achieved. See Table 6.

2. Mean and range are based on detectable measurements only. The fractions of detectable measurements at specific locations are indicated in parentheses.

3. Missing samples are discussed in Missed Surveillances.

4. Summary of gamma analysis results in this report does not include the following naturally occurring isotopes since most environmental samples contained some or all of these: Be-7, K-40, Tl-208, Pb-212, Bi-212, Bi-214, Pb-214, Ra-226, and Ac-228.

5. TLD dose is reported in milliroentgen (mR) per 90-day period (quarter) beginning in 1995. This is the exposure standard used to compare data to the NRC.

6. The tritium LLD was lowered to 3.25E+2 pCi/L in June 1996. The LLD was lowered at the request of Progress Energy Carolinas, Inc. in order to maintain comparable LLD values with the North Carolina Division of Radiation Protection (NCDRP) laboratory.

7. The numbers in parentheses [i.e. Surface Water Tritium 3.25E+2 (24/24) for LLD] indicate how many samples that specific value and column apply to in relation to the total number of samples for that column heading.

INTERPRETATIONS AND CONCLUSIONS

Air Monitoring

The average gross beta concentration measured in 259 air particulate (AP) samples collected at indicator stations during 2002 was 1.55E-2 picocuries per cubic meter (pCi/m^3) and the average gross beta concentration measured in 52 AP samples collected at control stations during 2002 was 1.66E-2 pCi/m^3. The preoperational (1973-1974) average concentration was 8.2E-2 pCi/m^3, while the average activity in the recent past (1997-2001) was 1.82E-2 pCi/m^3 (Table 4). The airborne concentrations of gross beta activity in 2002 are indicative of natural background and do not indicate any abnormal activities originating from the nuclear operations at BSEP. Figures 4 through 8 depict the monthly variations of these values. AP-203 on 12-16-02 was listed as a missed surveillance due to a filter misalignment, which resulted in an anomalous low value.

Gamma analyses of the composite air particulate filters indicated that all of the radionuclides indicative of plant effluents were at concentrations less than their respective LLDs. All radionuclides positively identified by the radionuclide analyses were typical of naturally occurring materials.

Analyses of 260 indicator and 52 control air cartridges (AC) for the collection of radioiodines indicated that concentrations of those radionuclides, and particularly I-131, were less than the LLD.

Milk

No milk (milch) sampling locations are currently identified in BSEP environs; therefore, no sampling of this media was available.

Vegetation

Food crops were not grown in the vicinity of the plant in 2002, and this media was represented by indigenous vegetation samples consisting primarily of wild cherry and wax myrtle leaves. Thirty-six samples were collected from indicator locations and 12 from the control location. No detectable activities relating to plant effluents were detected in this sampling media in 2002.

Fish and Invertebrates

Fish (free swimmers and bottom feeders), invertebrate (SH), and BO samples are collected semiannually from two locations: (1) near the Atlantic Ocean discharge pipe at Caswell Beach and (2) a control location in the Atlantic Ocean not influenced by plant operations. In all 12 samples (indicator and control), the radionuclide content was determined to be less than the respective LLDs for the gamma-emitting radionuclides for 2002.

Shoreline Sediments

Two shoreline sediments in 2002 were drawn from the beach area near the pumping station location at Caswell Beach. In both samples, the radionuclide content was determined to be less than the respective LLDs for gamma-emitting radionuclides.

Surface Water

Surface water is sampled monthly from the intake and discharge canal. These samples are analyzed for gamma-emitting radionuclides and for tritium. The analyses indicated that no detectable concentrations of radionuclides appeared in the 12 indicator and 12 control samples. None of these samples (indicator or control) indicated any detectable concentrations of tritium. Figure 9 depicts the observed tritium concentrations for 2002.

External Radiation Exposure

The environmental data on external radiation exposure for 2002 was essentially unchanged from 1989-2001 with an average exposure for all of 2002 indicator locations of 9.6 mR per quarter. The average exposure observed over the preoperational period was 1.02 mR per week observed from the fourth quarter of 1972 through the second quarter of 1975. Table 5 provides a

comparison of recent data with the preoperational and historical data.

The highest average exposure occurred at Caswell Beach 4.8 miles SSW. The exposure was 11.8 mR per quarter. Figure 10 depicts average inner and outer ring TLD data for each quarter of 2002. This depiction does not indicate a significant higher exposure rate for the inner versus the outer ring. This is interpreted as demonstrating that no discernible off-site exposure has occurred from plant operations.

TABLE 4
Brunswick Steam Electric Plant
GROSS BETA AIR PARTICULATE ACTIVITY AVERAGES

	Gross Beta Activity (pCi/m^3)							
	Preoperational		Recent Operational					
Location	1973	1974	1997	1998	1999	2000	2001	2002
AP-200	2.2E-2	1.4E-1	1.7E-2	1.8E-2	1.7E-2	2.0E-2	1.8E-2	1.5E-2
AP-201	3.1E-2	1.4E-1	1.7E-2	1.9E-2	1.8E-2	2.0E-2	1.9E-2	1.6E-2
AP-202	3.4E-2	1.4E-1	1.7E-2	1.8E-2	1.7E-2	2.0E-2	1.8E-2	1.6E-2
AP-203	2.4E-2	1.3E-1	1.7E-2	1.9E-2	1.8E-2	2.1E-2	1.8E-2	1.6E-2
AP-204*	2.5E-2	1.3E-1	1.8E-2	1.8E-2	1.8E-2	2.0E-2	1.9E-2	1.7E-2
AP-205	**	**	1.7E-2	1.8E-2	1.7E-2	1.9E-2	1.7E-2	1.4E-2

* Control location

** This sample point added post-operational.

TABLE 5

Brunswick Steam Electric Plant

HISTORICAL TLD RESULTS (1972-2002)

Year	Average Exposure of All TLD Monitoring Locations (mR per week)
1972 (4th Qtr.)	0.80
1973	1.25
1974	0.97
1975 (1st, 2nd Qtr)	0.80
1976	0.98
1977	1.32
1978	1.24
1979	0.93
1980	0.90
1981	0.96
1982	1.18
1983	1.21
1984	0.98
1985	1.03
1986	0.89
1987	0.92
1988	0.86
1989	0.75
1990	0.76
1991	0.76
1992	0.75
1993	0.78
1994	0.77
1995	10.1 (mR per quarter)*
1996	10.1 (mR per quarter)
1997	10.1 (mR per quarter)
1998	9.7 (mR per quarter)
1999	9.7 (mR per quarter)
2000	9.7 (mR per quarter)
2001	10.0 (mR per quarter)
2002	9.6 (mR per quarter)

*TLD exposure in mR per quarter beginning in 1995. The equivalent weekly exposure is 0.78 mR.

MISSED SURVEILLANCES

Air Cartridge and Air Particulates

Any REMP weekly air samples (Air Cartridge – AC or Air Particulate – AP) that exceed 30 hours of down time in a surveillance period will be reported as a "missed surveillance". However, this sample will still be counted and the data reported; whereas a "missed sample" will have no data reported.

All AP samples were available in 2002, except for one AP sample.
Missed Samples:

- AP-203, December 16 – Down time none, missed sample due to filter misalignment – Sample was counted with an anomalous low value (AR #79711).

All AC samples were available in 2002.

Food Crops / Vegetation

No food crops were grown in the vicinity of the plant in 2002; therefore, none were collected. The media were represented by indigenous vegetation samples (broadleaf vegetation) consisting primarily of wild cherry and wax myrtle leaves.

Thermoluminescent Dosimeters (TLDs)

One of a possible 180 TLD samples, was missing during 2002. The missing TLD occurred:

Second Quarter - TLD 81 was missing in the field (the power pole that the TLD was located on has been replaced) (AR # 64806).

Note: TLD points 41 thru 74 are not ODCM TLD sample points and are not listed. TLD sample points 19 and 80 have been retired.

ANALYTICAL PROCEDURES

Gross Beta

Gross beta radioactivity measurements are made utilizing a Tennelec Low-Background Alpha/Beta Counting System. The LLD for air particulates is approximately 3.0E-3 pCi/m^3.

AP samples are mounted in two-inch stainless steel planchets and are typically counted directly for 50 minutes.

Tritium

Liquid samples requiring tritium analysis are treated with a small amount of sodium hydroxide and potassium permanganate crystals and then distilled. Five milliliters of the distillate are mixed with 13 milliliters of liquid scintillation cocktail and counted in a liquid scintillation counter typically for 150 minutes. The LLD for this count time was approximately 3.25E+2 pCi/L. This lower LLD was established in June 1996 to compare BSEP tritium LLDs and NCDRP's reportable concentrations, in the Split Sample Program's Annual Report.

Iodine-131

Iodine-131 airborne concentrations are analyzed by the intrinsic germanium (Ge) gamma spectrometry systems. The cartridges are placed on the detector and each charcoal cartridge is typically counted individually for 1,500 seconds with an approximate LLD of 3.0E-2 pCi/m^3.

Gamma Spectrometry

Gamma spectrum analysis utilizes intrinsic germanium detectors with thin aluminum windows housed in steel and lead shields. The analyzer system is the Canberra Nuclear 9900 Gamma Spectroscopy System. Table 6 summarizes LLD values derived from instrument sensitivity based upon a blank sample background.

AP filter quarterly composites are placed in a Petri dish and analyzed directly for a typical count time of 7,000 seconds. The count time was increased in 1997 from 3,600 sec. to 7,000 sec. due to decreased sample volumes.

Liquid samples are boiled down to reduce the volume, transferred to a 1000-milliliter Marinelli beaker, and analyzed for a typical count time of 10,000 seconds.

Shoreline sediments are dried, ground, weighed, and then analyzed in a Marinelli beaker for a typical count time of 1,500 seconds.

Broadleaf vegetation is weighed wet and analyzed in a Marinelli beaker for a typical count time of 7,500 seconds.

Fish samples and edible portions of invertebrate organisms are cleaned, dressed, and placed in a Marinelli beaker for analysis for a typical count time of 1,500 seconds.

Thermoluminescent Dosimetry

Each area monitoring station includes a TLD packet, which is a polyethylene bag containing three calcium sulfate phosphors contained in a Panasonic UD-814 badge. The TLD is light tight, and the bag is weather-resistant.

Dosimeters are machine annealed before field placement. Following exposure in the field, each dosimeter is read utilizing a Panasonic TLD reader. This instrument integrates the light photons emitted from traps as the dosimeter is heated. Calibration is calculated using dosimeters irradiated to known doses for each set of dosimeters measured. Prior to the measurement of each dosimeter, the instrument is checked through use of an internal constant light source as a secondary standard.

The exposure reported is corrected for exposure received in transit and during storage through the use of control dosimeters.

Interlaboratory Comparison Program

The Radiochemistry Laboratory at the Harris Energy & Environmental Center in New Hill, North Carolina, provides radioanalytical services for Progress Energy Carolinas, Inc.'s nuclear plant

radiological environmental surveillance programs. In fulfillment of ODCM Operational Requirements, the laboratory is a participant in the Analytics, Inc., Environmental Cross-Check Program and uses its performance in this program as a major determinant of the accuracy and precision of its analytical results.

During 2002, 102 analyses were completed on 17 samples representing seven major environmental media (i.e., water, milk, air filters, air filters composite, soil, air cartridges, and simulated vegetation). Data on the known activities, the uncertainties, and the ratios to the known for the 102 analyses have been received from Analytics, Inc. The results shall be compared to the criteria established in the NRC Inspection Manual (Procedure 84750) for Radioactive Waste Treatment, Effluent, and Environmental monitoring.

One of 102 analyses exceeded the acceptance criteria. Any results that lie outside the ratio criteria will have an evaluation performed to identify any recommended remedial actions and to reduce anomalous errors. Complete documentation of the evaluation (AR#58375) will be available and provided to the NRC upon request.

Lower Limits of Detection

All samples analyzed met the LLD required by ODCM Table 7.3.15-3. Typical "a priori" LLD values for the samples analyzed are listed in Table 6.

TABLE 6
TYPICAL LOWER LIMITS OF DETECTION (A PRIORI)
GAMMA SPECTROMETRY

Surface Water Samples (Saline Water)	
Isotope	**LLD (pCi/l)**
Mn-54	7
Co-58	6
Fe-59	14
Co-60	6
Zn-65	15
Zr-Nb-95	7
Cs-134	8
Cs-137	6
Ba-La-140	9
Other Expected Gamma Emitters	4 to 117
Air Particulates (Quarterly Composite)	
Isotope	**LLD (pCi/m^3)**
Cs-134	0.001
Cs-137	0.001
Other Expected Gamma Emitters	0.001 to 0.043
Shoreline Sediment	
Isotope	**LLD (pCi/kg, dry)**
Cs-134	75
Cs-137	54
Other Expected Gamma Emitters	32 to 882
Fish	
Isotope	**LLD (pCi/kg, wet)**
Mn-54	49
Co-58	42
Fe-59	79
Co-60	64
Zn-65	126
Cs-134	66
Cs-137	44
Other Expected Gamma Emitters	36 to 1237
Food Products and Vegetation	
Isotope	**LLD (pCi/kg, wet)**
I-131	35
Cs-134	34
Cs-137	32
Other Expected Gamma Emitters	20 to 507

LAND USE CENSUS

PURPOSE OF THE LAND USE CENSUS

The land use census identifies the pathways (or routes) that radioactive material may reach the general populations near commercial nuclear generating stations. This is accomplished by completing studies each year that identify how the surrounding lands are used by the population. A comprehensive census of the use of the land within a five-mile distance of the plant is completed during the growing season each year. This information is used for dose assessment and to identify changes to the stations sampled and the type of samples. These results ensure that the Radiological Environmental Monitoring Program (REMP) is based upon current data regarding human activity in the vicinity of the plant. Therefore, the purpose of the land use census is both to ensure the monitoring program is current as well as to provide data for the calculation of estimated radiation exposure.

The pathways that are evaluated are:

- Ingestion Pathway - Results from eating food crops that may have radioactive materials deposited on them from the soil or atmosphere. Another pathway is through drinking milk from local cows or goats if these are present. The grass used to feed these animals may have incorporated or had deposited on it radioactive materials that can be transferred to the milk.

- Direct Radiation Exposure Pathway- Results from deposition of radioactive materials on the ground or from passage of these radioactive materials in the air.

- Inhalation Pathway- Results from breathing radioactive materials transported in the air.

Methodology

The following must be identified within the five-mile radius of the plant for each of the 16 meteorological sectors (compass direction from which the winds may blow, for example NNE [North North East]):

- The nearest resident
- The nearest garden of greater that 500 square feet, producing broadleaf vegetables
- The nearest milk animal

The primary method is visual inspection from roadside within the five-mile radius, with the exception of the Sunny Point MOT. This information is supplemented with data from aerial photographs, information from county extension agents, and farm supply businesses.

2002 Land Use Census Results

The 2001 and 2002 results of the survey for the nearest resident, garden, milk and meat animals in each sector are compared in Table 7.

The resident portion of the census conducted in June of 2002 did not identify a change in the distance of the nearest resident from plant center from 2001. The garden portion of the census identified changes in the distances of the nearest garden in two sectors.

The nearest garden location changed in the South (S) sector at 1.8 miles, the South Southwest (SSW) sector at 1.6 miles, the Southwest (SW) sector at 1.5 miles, the West (W) sector at 0.8 miles, and the Northwest (NW) sector at 4.8 miles. No milk animals are located within the 5 miles of the plant and the three beef cattle with pasture from 2001 were not located in 2002.

The 2002 Garden Census was conducted within 3 miles of BSEP and identifies all gardens of greater that 500 square feet that were found in the survey area. Results of the garden census are located in Table 8.

Results of the 2002 Land Use and Garden Census indicate stable use of land, confirming that current control locations are appropriate, and no changes are needed for dose assessment and environmental motoring.

TABLE 7
Brunswick Steam Electric Plant
LAND USE CENSUS COMPARISONS (2001-2002)
NEAREST PATHWAY (MILES)

SECTOR	RESIDENT		GARDEN		MILK/MEAT ANIMALS	
	2001	2002	2001	2002	2001	2002
N	0.7	0.7	0.9	0.9	None	None
NNE	0.8	0.8	1.2	1.2	None	None
NE	None	None	None	None	None	None
ENE	None	None	None	None	None	None
E	None	None	None	None	None	None
ESE	1.5	1.5	None	None	None	None
SE	0.9	0.9	None	None	None/0.9**	None*
SSE	1.0	1.0	None	None	None/0.9**	None*
S	1.1	1.1	1.1	1.8*	None	None
SSW	1.2	1.2	1.5	1.6*	None	None
SW	1.0	1.0	2.9	1.5*	None	None
WSW	1.2	1.2	1.2	1.2	None	None
W	0.8	0.8	1.1	0.8*	None	None
WNW	0.8	0.8	1.0	1.0	None	None
NW	0.9	0.9	1.0	4.8*	None	None
NNW	0.8	0.8	4.4	4.4	None	None

* Represents a change from the previous year.

** In the SE and SSE sectors no milk animals were found, but three beef cattle with pasture were located 0.9 miles from the plant in these sectors.

TABLE 8
Brunswick Steam Electric Plant
GARDEN CENSUS (2002)

SECTOR	DISTANCE (miles)		SECTOR	DISTANCE (miles)
N	0.9		W	0.8
NNE	1.2		W	1.2
NE	None		W	2.4
ENE	None		W	2.6
E	None		WNW	1.0
ESE	None		WNW	1.1
SE	None		NW	4.8
SSE	None		NNW	4.4
S	1.8			
S	1.9			
S	2.3			
SSW	1.6			
SSW	1.9			
SSW	2.2			
SSW	2.4			
SSW	2.8			
SW	1.5			
SW	2.9			
WSW	1.2			
WSW	1.2			
WSW	1.4			
WSW	1.8			
WSW	2.1			
WSW	2.8			
WSW	2.9			

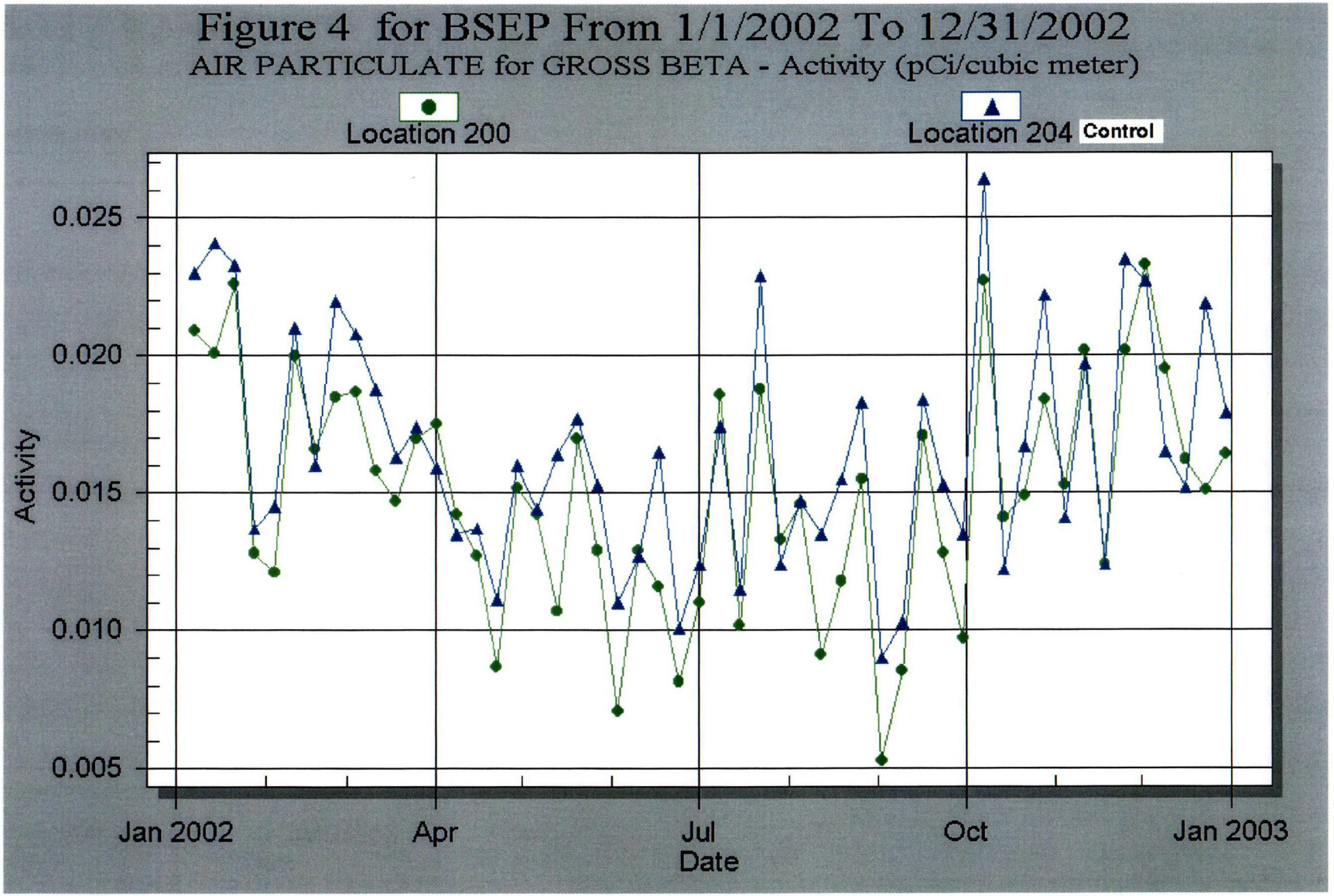


Figure 4 for BSEP From 1/1/2002 To 12/31/2002
AIR PARTICULATE for GROSS BETA - Activity (pCi/cubic meter)
Location 200
Location 204 Control
0.025
0.020
0.015
0.010
0.005
Activity
Jan 2002
Apr
Jul
Oct
Jan 2003
Date

C04

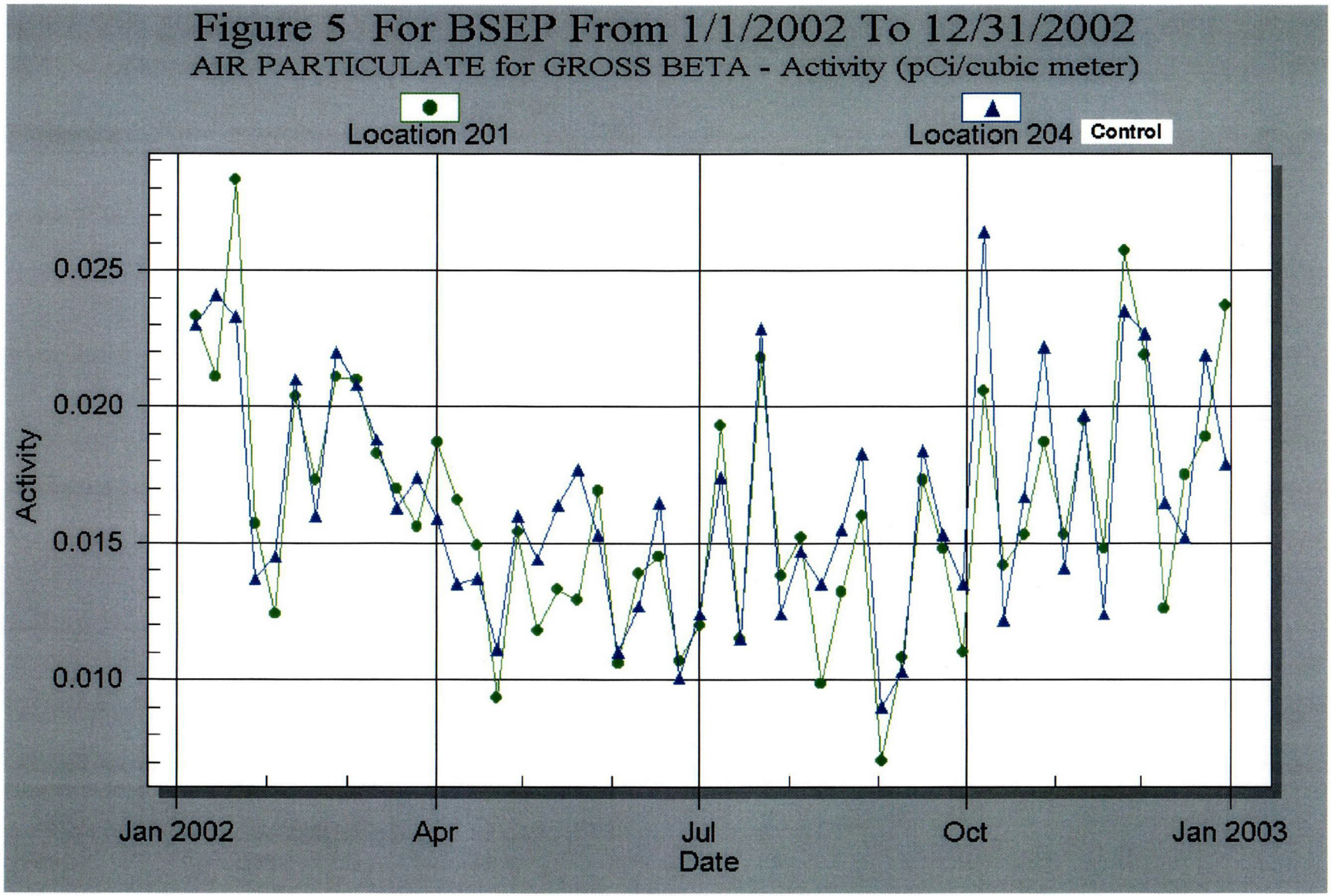


Figure 5 For BSEP From 1/1/2002 To 12/31/2002
AIR PARTICULATE for GROSS BETA - Activity (pCi/cubic meter)
Location 201
Location 204
Control
0.025
0.020
0.015
0.010
Activity
Jan 2002
Apr
Jul
Oct
Jan 2003
Date

C05

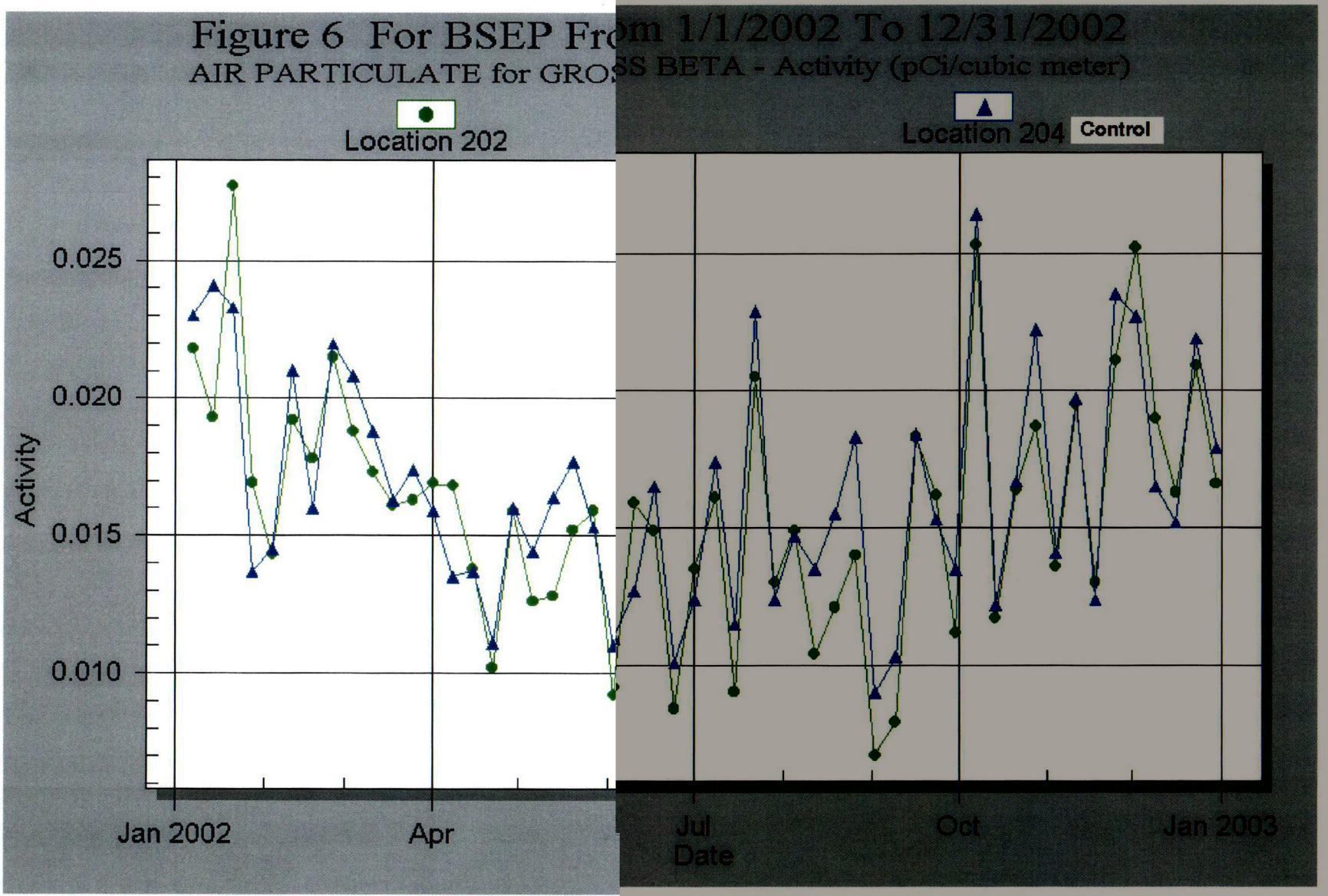


Figure 6 For BSEP From 1/1/2002 To 12/31/2002
AIR PARTICULATE for GROSS BETA - Activity (pCi/cubic meter)
Location 202
Location 204
Control
0.025
0.020
0.015
0.010
Activity
Jan 2002
Apr
Jul
Oct
Jan 2003
Date

C06

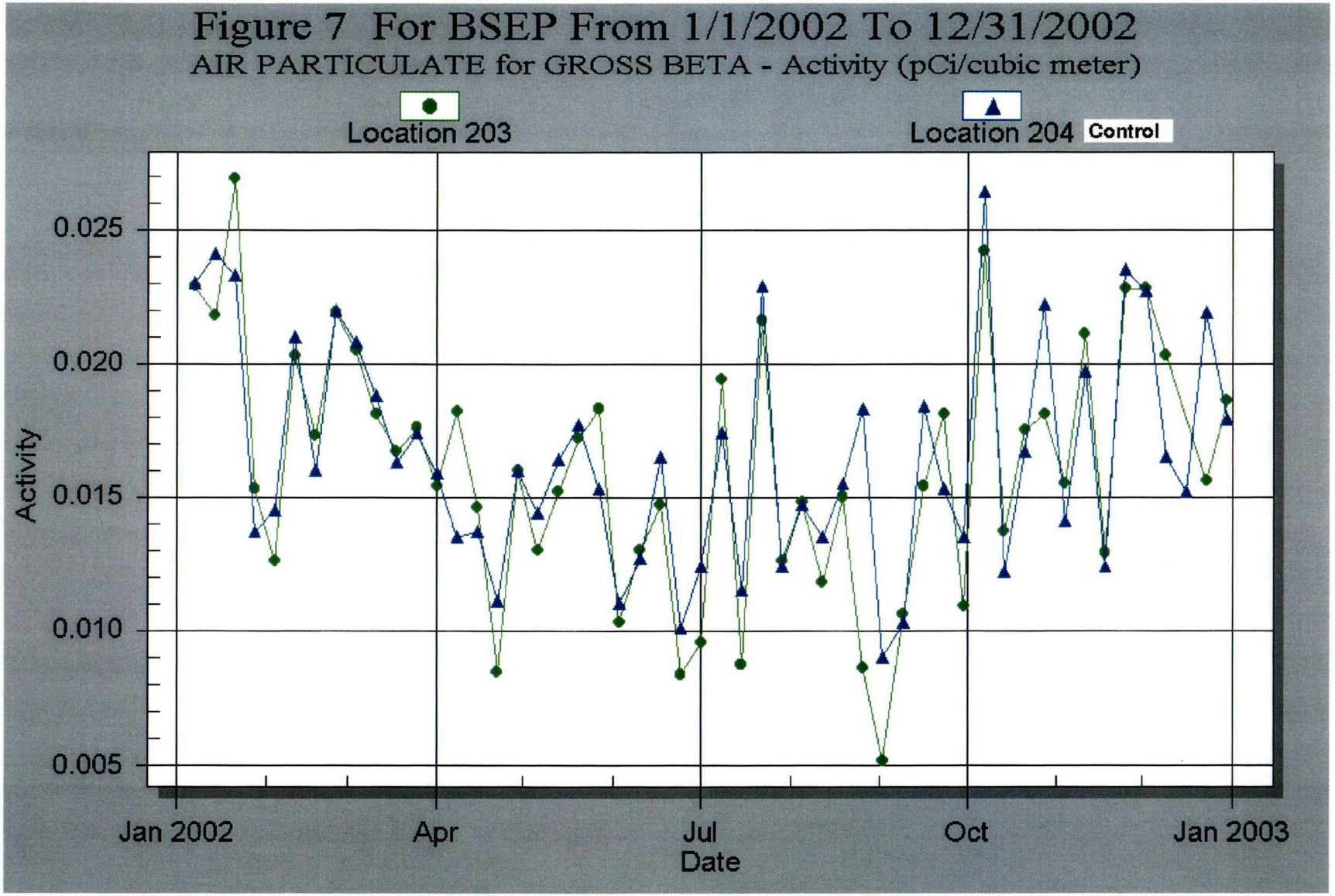


Figure 7 For BSEP From 1/1/2002 To 12/31/2002
AIR PARTICULATE for GROSS BETA - Activity (pCi/cubic meter)
Location 203
Location 204 Control
0.025
0.020
0.015
0.010
0.005
Activity
Jan 2002
Apr
Jul
Oct
Jan 2003
Date

C07

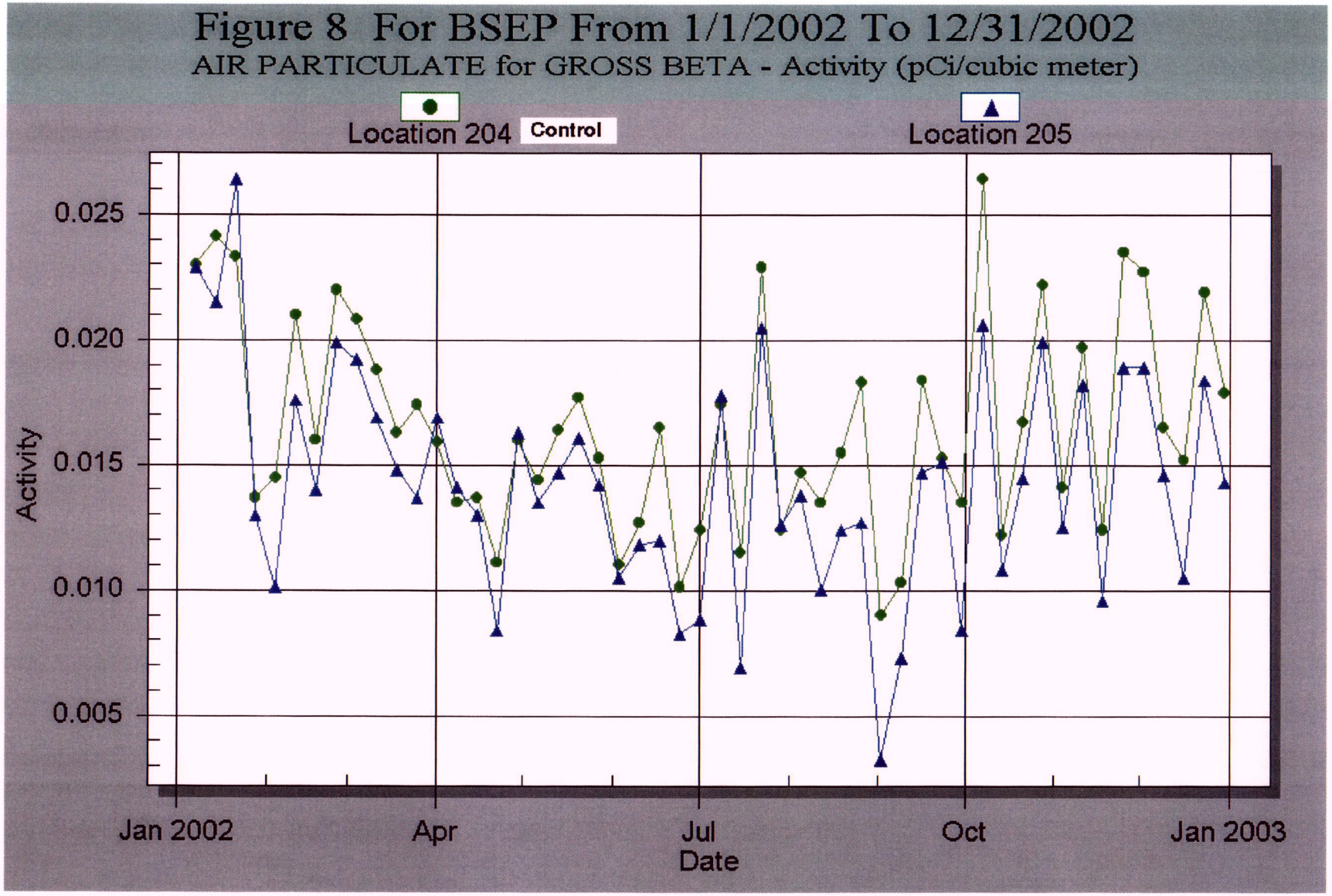
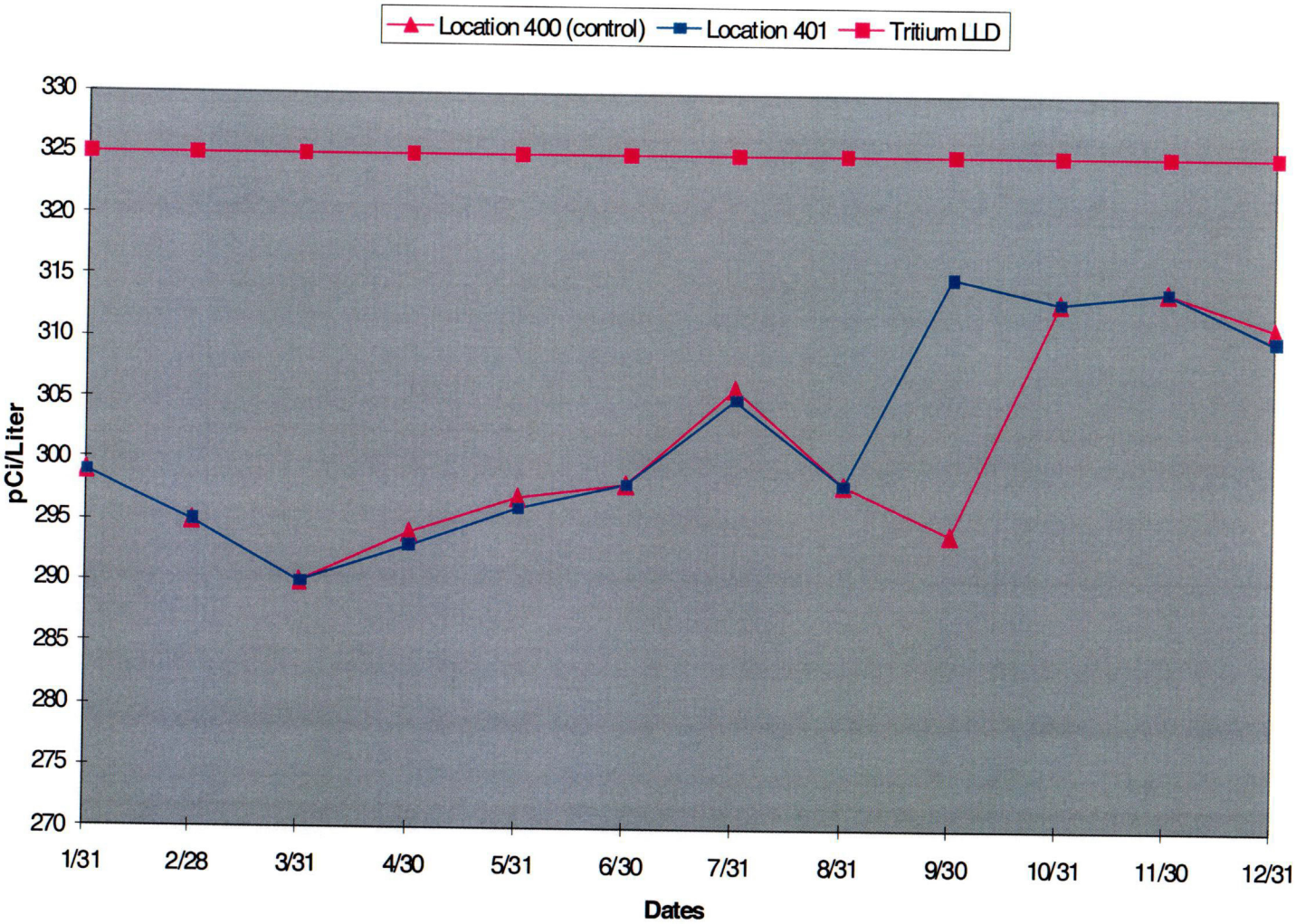


Figure 8 For BSEP From 1/1/2002 To 12/31/2002
AIR PARTICULATE for GROSS BETA - Activity (pCi/cubic meter)
Location 204
Control
Location 205
0.025
0.020
0.015
0.010
0.005
Activity
Jan 2002
Apr
Jul
Oct
Jan 2003
Date

C08

Figure 9 BSEP 2002 Surface Water Tritium



C09

Figure 10 BSEP 2002 TLD Averages for Inner and Outer Ring Locations