

2018 PLAN
FOR
ENVIRONMENTAL RADIATION
SURVEILLANCE
IN
NORTH CAROLINA

DEPARTMENT OF Health and Human Services
Division of Health and Service
Regulation, Radiation Protection
Section

5505 Creedmor road
Raleigh, North Carolina 27612
Telephone: (919) 814-2250

TABLE OF CONTENTS

Page No.

INTRODUCTION

Purpose of Plan.	1
Present Objectives of Program	1-2

2018-PLAN FOR ENVIRONMENTAL RADIATION SURVEILLANCE

Summary.	3-4
Statewide Surveillance.	5-7
Nuclear Facility Surveillance.	8-10
Site and Sample Maps.	11

Introduction

The 2018 Environmental Radiation Surveillance Program will continue monitoring the radioactivity levels in the North Carolina environment. The purpose of this plan and the program's objectives are included in this brief introduction.

Purpose of Plan

The purpose of this plan is to present the environmental radiological sampling program in North Carolina. This plan will assist the program's sample collection staff in scheduling their sampling frequencies and time of sampling. Program staff document information concerning procedures used in the field and the State Laboratory of Public Health, such as field sampling, sampling preparation, counting equipment operation and data analyses. This information is available by contacting the environmental group in the Radioactive Materials Branch (RAM) of the Radiation Protection Section (RPS) in the Division of Health and Service Regulation. For more information about the section, please visit the RPS Web site at www.ncradiation.net.

Present Objectives

The program's basic objectives-is to monitor for potential releases of radioactivity from the three nuclear power plants operating in North Carolina, which have a combined total of five reactors, and one operating nuclear plant in South Carolina. The section also monitors one nuclear fuel (uranium) fabrication plant operating in North Carolina. (See map on page 8.) This environmental monitoring program plan is also intended to help the section meet its obligations required by NC General Statute 104E – 9(a)(6).

Due to limited resources, RPS is currently providing an independent review of the more extensive environmental surveillance programs maintained by the nuclear facilities themselves based upon data obtained through implementation of this environmental monitoring plan. To facilitate this objective, Split-sampling protocols are in place. If split sample results from both the laboratory of the nuclear facility and third party radio analytic laboratory results agree, then assumptions that all of the results of the nuclear facility surveillance programs are reliable for analysis. Facility monitoring reports will be reviewed for accuracy and ensure that any anomalous results will be investigated.

Another objective has been, and continues to be, the statewide monitoring of radiation levels in the interest of public health. This effort has assumed new importance because of homeland security concerns. Radiation levels monitored include radon, radium and uranium in drinking water, indoor radon in structures and fallout due to past atmospheric nuclear weapons testing. In addition, RPS monitors environmental radioactivity to address questions dealing with statewide natural ambient radiation levels, radiation exposure due to inactive low-level radioactive waste burial sites and low-level radioactive waste incinerators, and naturally occurring radioactive materials (NORM) from various industrial processes. Based upon the environmental radiation surveillance results in the past few years, the radiation levels for nuclear facility samples, as well as for statewide routine samples, are generally quite low and fluctuate around naturally occurring background levels. The low levels encountered are still of concern because of possible long-term hereditary effects due to genetic mutations and a possible increase in the incidence of diseases such as cancer. In the upcoming year, the section's staff will continue to review all available monitoring data around all of these major nuclear facilities and analyze the radiological impact on the environment due to the operation of these facilities.

In the event of a nuclear emergency, the section would be responsible for determining the area and intensity of radioactive contamination. The staff would use nuclear instruments in the mobile laboratory for field sample measurements, run dose projection computer programs to estimate the severity of radioactive contamination around the emergency site, and use specialized sensors to detect radioactivity on the ground. Since 2001, RPS has been involved in several anti-terrorism activities with other government agencies. Data obtained from the environmental radiological monitoring program will help in determining the extent of radiation contamination and framework for further decision making during an event. The section will continue to use the Global Positioning System technology along with logistical and technical support from the EPA's GIS and RADNET departments to improve its monitoring capability statewide and utilize its knowledge base across the nation. This multi-tiered approach has proven to be an effective way to protect the health and safety of the public moving forward in an ever-changing world.

The Radiation Protection Section also reviews facility sampling plans and results for ionizing radiation facilities in addition to updating the emergency sample location maps around the state's nuclear power plants in coordination with Duke Energy. Emergency exercises with the states utility, other state and local agencies is an important role of the environmental branch as well as radioactive incident investigations, sample confirmation and possible contamination concerns round out the multi-agency role within the state of North Carolina.

Finally, the section reviews and evaluates analysis results for filtration media used by community water systems to remove Naturally Occurring Radioactive Material (NORM) from public water supplies. The State Laboratory of Public Health can test the filtration media before any improperly discarded media makes its way to waste disposal sites that are unqualified to receive low-level radioactive waste. NORM issues continues to be a growing concern with many different pathways, constituents and waste processes effecting human health within the state.

2018 PLAN FOR ENVIRONMENTAL RADIATION SURVEILLANCE

The table below shows a summary of the planned surveillance program, including both nuclear facility and statewide surveillance between January 2018 and December 2018 for samples taken of any particular environmental media in one year.

Note: For budgetary reasons, and years of continued results below detection limits, RPS has discontinued the following facilities in various years leading up to 2011: PCS Phosphate Mine in Aurora, NC; Pulsar Research Reactor at NC State University in Raleigh, NC, and the B- 52 Bomber Crash Site in Faro, NC. Finally, the Catawba (CT) Monitoring sites were discontinued due to loss of access and leases through Mecklenburg County Air Quality Control. The decision to halt these programs were made to allow the Radiation Protection Section to focus on environmental surveillance at fixed nuclear facilities and other ambient monitoring sites across the state where more potential impact to human health would be affected. However, all prior relationships and access agreements with county emergency coordinators and extensions remain in place. In the event of an emergency sample collection and monitoring will be completed through RPS Emergency Preparedness coordinator.

**SUMMARY OF N. C. ENVIRONMENTAL RADIATION SURVEILLANCE PROGRAM
(January 2018- December 2018)**

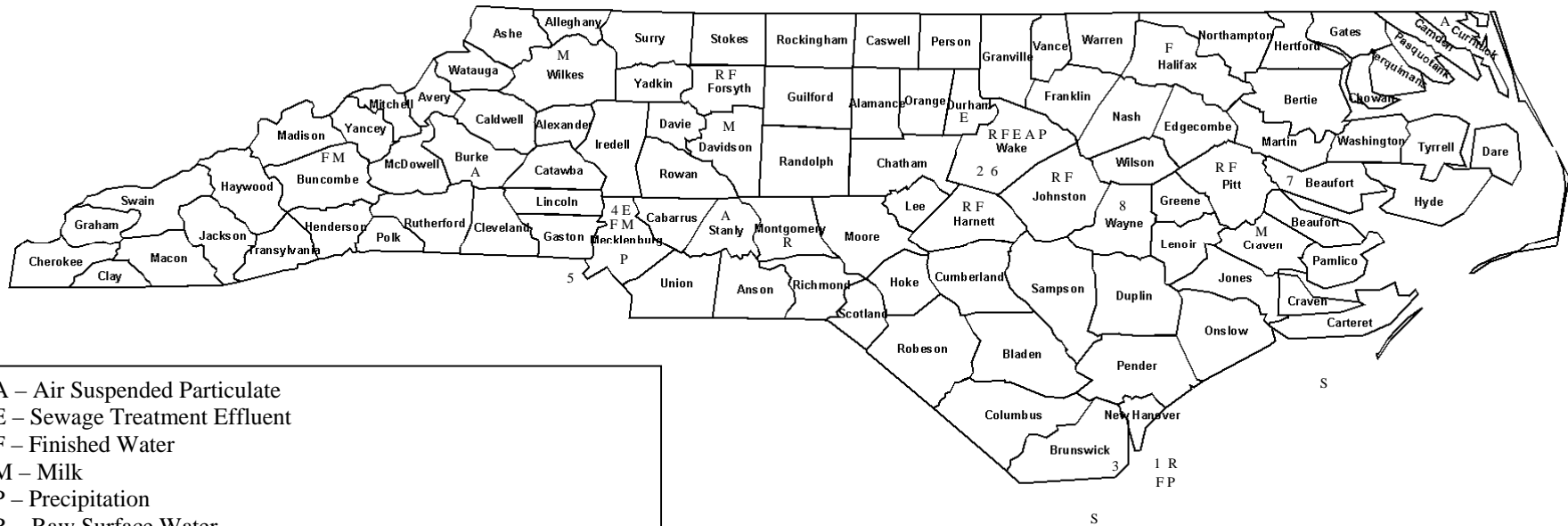
	<u>Routine</u>	<u>BR</u>	<u>GNF</u>	<u>MG</u>	<u>CT</u>	<u>SH</u>	<u>Total Year</u>
Air Particulate	0	260	156	208	0	208	832
Air Iodine	0	104	0	104	0	52	260
Milk	36	0	0	12	0	12	60
Surface Water	36	24	12	24	0	36	132
Groundwater	0	0	8	0	0	12	20
Precipitation	12	0	0	0	0	0	12
Treated Sewage	0	0	0	0	0	0	0
Soil	0	2	0	1	0	0	3
Shellfish or Fish	0	12	0	12	0	12	36
Vegetation or Food	0	1	0	1	0	1	3
TLD	0	36	5	33	0	38	116
Total for Year	84	403	176	362	0	333	323

Abbreviations: BR - Brunswick Steam Electric Plant (Progress Energy)
GNF - Global Nuclear Uranium Fuel Facility
MG - McGuire Nuclear Station (Duke)
CT - Catawba Nuclear Power Plant (Duke)
SH - Shearon Harris Nuclear Power Plant (Progress Energy)

NORTH CAROLINA

ENVIRONMENTAL RADIATION SURVEILLANCE NETWORK

2018



- A – Air Suspended Particulate
 - E – Sewage Treatment Effluent
 - F – Finished Water
 - M – Milk
 - P – Precipitation
 - R – Raw Surface Water
 - S – Shellfish
-
- 1 – Global Nuclear Fuels (formerly GE)
 - 2 – Pulstar (NCSU)*
 - 3 – Brunswick Nuclear Plant (Progress Energy)
 - 4 – McGuire Nuclear Station (Duke Energy)
 - 5 – Catawba Nuclear Station (Duke Energy)
 - 6 – Harris Nuclear Plant (Progress Energy)
 - 7 – PCS Phosphate – Aurora, NC*
 - 8 – B-52 Crash Site – Faro, NC*
- *Discontinued Sites

Statewide Surveillance

Further budgetary concerns has changed our statewide sampling program into a mix of current relationships with NC Department Agriculture and local County Health Departments. The maps and tables within this report represent the ability “to scale up” from our current milk collections, and collect samples at locations where RPS has a previous relationship and collection site. The maps show the approximate location of each sampling possible sample point and the type of sample taken to aid in decision making during an event. Tables identify the planned dates on which samples taken after an emergency or event predicating the ramping up of our statewide network surveillance. Previously, RPS received and analyzed air samples collected at NC Division of Air Quality sites but since has but cut due to budgetary concerns. Should the need ever arise; a startup schedule similar to all other statewide media samples could be collected.

For 2018, some periodic environmental sampling may continue around facilities with the potential for radioactive release. The sampling programs around inactive burial sites at Duke University, North Carolina State University and the University of North Carolina at Chapel Hill continue to be a non-issue due to source removal or treatment and clean-up activities at these sites. However, RPS also maintains the option to perform independent sample collection, as needed all of these facilities in addition to the required monitoring program under their respective Radioactive Materials Licenses. Sample results from these programs are submitted to the environmental branch of RPS for review and may be posted on our website.

AIR PARTICULATE SAMPLING SCHEDULE
(24-hr High Volume Sampling)

<u>Code No.</u>	<u>Location: County/City</u>	<u>Jan.</u>	<u>Feb.</u>	<u>Mar.</u>	<u>Apr.</u>	<u>May</u>	<u>Jun.</u>	<u>Jul.</u>	<u>Aug.</u>	<u>Sept.</u>	<u>Oct.</u>	<u>Nov.</u>	<u>Dec.</u>
12-AP-50	Burke/Morganton												
27-AP-20	Currituck/Currituck												
84-AP-10	Stanly/Albemarle												
92-AP-60	Wake/Raleigh I												
92-AP-61	Wake/Raleigh II												

Continued Low Volume Sampling Weekly (as control station for SHNPP)

PRECIPITATION SAMPLING SCHEDULE

<u>Code No.</u>	<u>Location: County/City</u>	<u>Jan.</u>	<u>Feb.</u>	<u>Mar.</u>	<u>Apr.</u>	<u>May</u>	<u>Jun.</u>	<u>Jul.</u>	<u>Aug.</u>	<u>Sept.</u>	<u>Oct.</u>	<u>Nov.</u>	<u>Dec.</u>
60-PP-20	Mecklenburg/Charlotte												
65-PP-80	New Hanover/Wilmington												
92-PP-60	Wake/Raleigh												

MILK SAMPLING SCHEDULE

<u>Code No.</u>	<u>Processor Location: County/City</u>	<u>2018</u>											
		<u>Jan.</u>	<u>Feb.</u>	<u>Mar.</u>	<u>Apr.</u>	<u>May</u>	<u>Jun.</u>	<u>Jul.</u>	<u>Aug.</u>	<u>Sept.</u>	<u>Oct.</u>	<u>Nov.</u>	<u>Dec.</u>
11-MS-10	Buncombe/Asheville	1	5	5	2	7	4	2	6	3	2	1	3
25-MS-50	Craven/New Bern	8	12	12	9	14	11	9	13	10	9	8	10
29-MS-40	Davidson/Highpoint	15	19	19	16	21	18	16	20	17	16	15	17
92-MS-60	Wake/Raleigh	22	26	26	23	28	25	23	27	24	23	22	24
57-MS-60	Macon/Otto	8	12	12	9	14	11	9	13	10	9	8	10
68-MS-40	Orange/Hillsborough	8	12	12	9	14	11	9	13	10	9	8	10
82-MS-70	Sampson/Spiveys Corner	8	12	12	9	14	11	9	13	10	9	8	10

SEWAGE TREATMENT SAMPLING SCHEDULE

<u>Code No.</u>	<u>Location: County/City</u>	<u>Jan.</u>	<u>Feb.</u>	<u>Mar.</u>	<u>Apr.</u>	<u>May</u>	<u>Jun.</u>	<u>Jul.</u>	<u>Aug.</u>	<u>Sept.</u>	<u>Oct.</u>	<u>Nov.</u>	<u>Dec.</u>
32-SE-20	Durham/Durham												
60-SE-20	Mecklenburg/Charlotte												
92-SE-60	Wake/Raleigh												

RAW SURFACE WATER SAMPLING SCHEDULE

<u>Code No.</u>	<u>Location: County/City</u>	<u>Jan. Feb. Mar. Apr. May Jun. Jul. Aug. Sept. Oct. Nov. Dec.</u>													
34-SW-80	Forsyth/Winston-Salem														
43-SW-50	Harnett/Lillington														
51-SW-70	Johnston/Smithfield														
62-SW-50	Montgomery/Mt. Gilead														
65-SW-80	New Hanover/Wilmington														
74-SW-30	Pitt/Greenville														
92-SW-60	Wake/Raleigh														

FINISHED WATER SAMPLING SCHEDULE

<u>Code No.</u>	<u>Location: County/City</u>	<u>Jan. Feb. Mar. Apr. May Jun. Jul. Aug. Sept. Oct. Nov. Dec.</u>													
11-FW-80	Buncombe/Asheville														
34-FW-50	Forsyth/Winston-Salem														
42-FW-70	Halifax/Roanoke Rapids														
43-FW-50	Harnett/Lillington														
51-FW-80	Johnston/Smithfield														
60-FW-30	Mecklenburg/Charlotte														
65-FW-60	New Hanover/Wilmington														
74-FW-30	Pitt/Greenville														
92-FW-60	Wake/Raleigh														

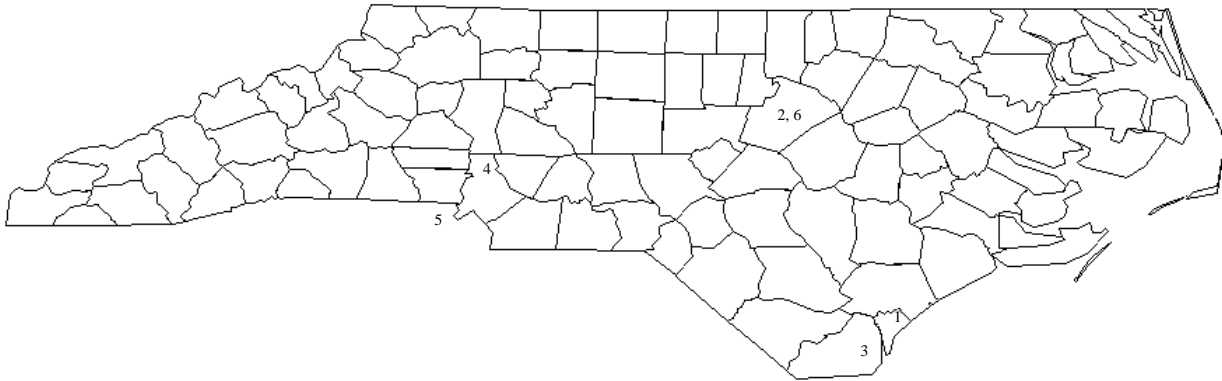
SHELLEFISH SAMPLING SCHEDULE

<u>Code No.</u>	<u>Location: County/City</u>	<u>Jan. Feb. Mar. Apr. May Jun. Jul. Aug. Sept. Oct. Nov. Dec.</u>													
16-SL-50	Carteret/Morehead City														

Nuclear Facility Surveillance

This year, operational surveillance will continue around Brunswick Nuclear Power Plant, William B. McGuire Nuclear Station, Shearon Harris Nuclear Power Plant, and Global Nuclear Fuels Uranium Fuel Fabrication Plant. As of January 1, 2017, RPS changed site location numbers for some of the sample locations in the split sample program at Shearon Harris Nuclear Plant and Brunswick Nuclear Plant. Wherever possible, split sampling locations for air, water, milk, food crops and fish will have identical site numbers for state and utility locations, as is the case at the McGuire Nuclear Station.

The Table on page 9 shows the types of samples, number of locations for each type, collection frequency and the nature of analysis performed upon each type sample. Maps supplied designate which locations samples are taken and the type of sample at each location.



- | |
|--|
| <ul style="list-style-type: none">1 – Global Nuclear Fuels (formerly GE)2 – Pulstar (NCSU) DISCONTINUED3 – Brunswick Nuclear Plant (Duke Energy)4 – McGuire Nuclear Station (Duke Energy)5 – Catawba Nuclear Station air site DISCO6 – Harris Nuclear Plant (Duke Energy) |
|--|

ENVIRONMENTAL RADIATION SURVEILLANCE OF NUCLEAR FACILITIES IN NORTH CAROLINA
(Sample Locations, Collection Frequency and Types of Analysis)

TYPES OF ANALYSIS

Facility and Description	Type of Sample	Number of Split Sample Locations	Number of Independent Sample Locations	Collection Frequency	γ	α	β	Sr	H-3	γ	U	I
<u>Brunswick Nuclear Power Plant</u> Located in Brunswick County. Two 821 MW reactors (GE's BWR).	Air Particulate	3	1	W	a		X	f				
	Air Radioiodine	2	0	W	X							
	SW	2	0	M	h	X	X	b	X			X
	SW	2	0	S-A	h	X	X	b	X			
	GW	0	0	S-A	c	X	X		X			
	Sediment	0	0	S-A	X	X	X					
	Fish	2	0	S-A	X	X	X					
	Vegetation	1	1	S-A	X	X	X					
	TLD	0	37	Y						X		
<u>William B. McGuire Nuclear Station</u> Located in Mecklenburg County. Two 1,180 MW reactors (Westinghouse PWR).	Air Particulate	2	2	W	a		X	f				
	Air Radioiodine	2	0	W	X							
	Milk	1	0	M	g			b				X
	SW	2	0	M	h	X	X	b	X			X
	SW	0	2	Q	h	X	X	b	X			
	Sediment	1	0	A;S-A	j	X	X					
	Fish	1	0	S-A	j	X	X	d				
	Vegetation	0	0	S-A	j	X	X					
	Veg(Food Crop)	1	0	S-A	j	X	X					
	TLD	0	40	Y						X		
	GW	0	0	S-A	j				X			
<u>Global Nuclear Fuels Uranium Fuel Fabrication Plant</u> Located in New Hanover County.	Air Particulate	2	1	W	a	X	X					X
	SW	1	0	M,Q		X	X					k
	GW	3	0	Q,S-A		X	X					k
	Soil	0	0	S-A		X	X					m
	Vegetation	0	0	S-A		X	X					n
	Sediment	0	0	S-A		X	X					m
	TLD	0	5	Y						X		
<u>Shearon Harris Nuclear Power Plant</u> Located in Wake County. One 900 MW reactor (Westinghouse PWR).	Air Particulate	2	1	W	a		X					
	Air Radioiodine	1	1	W	X							
	Milk	1	0	M	g							X
	SW	3	0	B-W,M	h	X	X		X			X
	SW	0	0	Q	h	X	X		X			
	GW	5	0	Q	c	X	X		X			
	Sediment	1	0	S-A	j	X	X					
	Fish	2	0	S-A	j	X	X					
	Vegetation	1	0	S-A	j	X	X					
	TLD	0	41	Y						X		
<u>Catawba Nuclear Power Plant</u> Located in Lake Wylie, S.C.. Two 1,153 MW reactors (Westinghouse PWR).	Air Particulate	0	0	W	a		X	f				
	TLD	0	0	Y						X		

**Includes stabilization pond site monitoring projects monitored semiannually.

KEY TO SAMPLE CHART

- a = analysis performed on composite of all sites monthly using detectors as note "e".
- b = Sr-89 and Sr-90 analysis performed if Cs-137 > 10 pCi/l
- c = Gamma isotopic if gross beta > 5 pCi/l
- d = If beta > 20 pCi/g (dry)
- e = Gamma analysis of 47 mm filter composites using the intrinsic HPGe detector; Iodine charcoal cartridges are gamma analyzed using the HpGe detector also.
- f = Sr-90 performed if Cs-137 > 0.2 pCi/m³
- g = Milk isotopes: More than 70 isotopes in the Ge(Li) library
- h = Water isotopes: More than 70 isotopes including K-40, Cr-51, Mn-54, Co-60, Zn-65, Zr-95, Ru-106, I-131, Cs-134, Cs-137, Ba/La-140, Ce-144, Ra-226
- i = Total uranium if gross alpha > 15 pCi/l
- j = Soil and Sediment isotopes: More than 70 isotopes including K-40, Mn-54, Co-60, Zn-65, Zr-95, Ru-106, I-131, Cs-134, Ba-140, Ce-144, Ra-226, Th-232
- k = Alpha spectroscopy uranium if gross alpha > 5 pCi/l
- m = Alpha spectroscopy uranium if gross alpha > 15 pci/g (dry)
- n = Alpha spectroscopy uranium if gross alpha > 0.3 pCi/g (wet)
- X = Indicated analysis will be performed

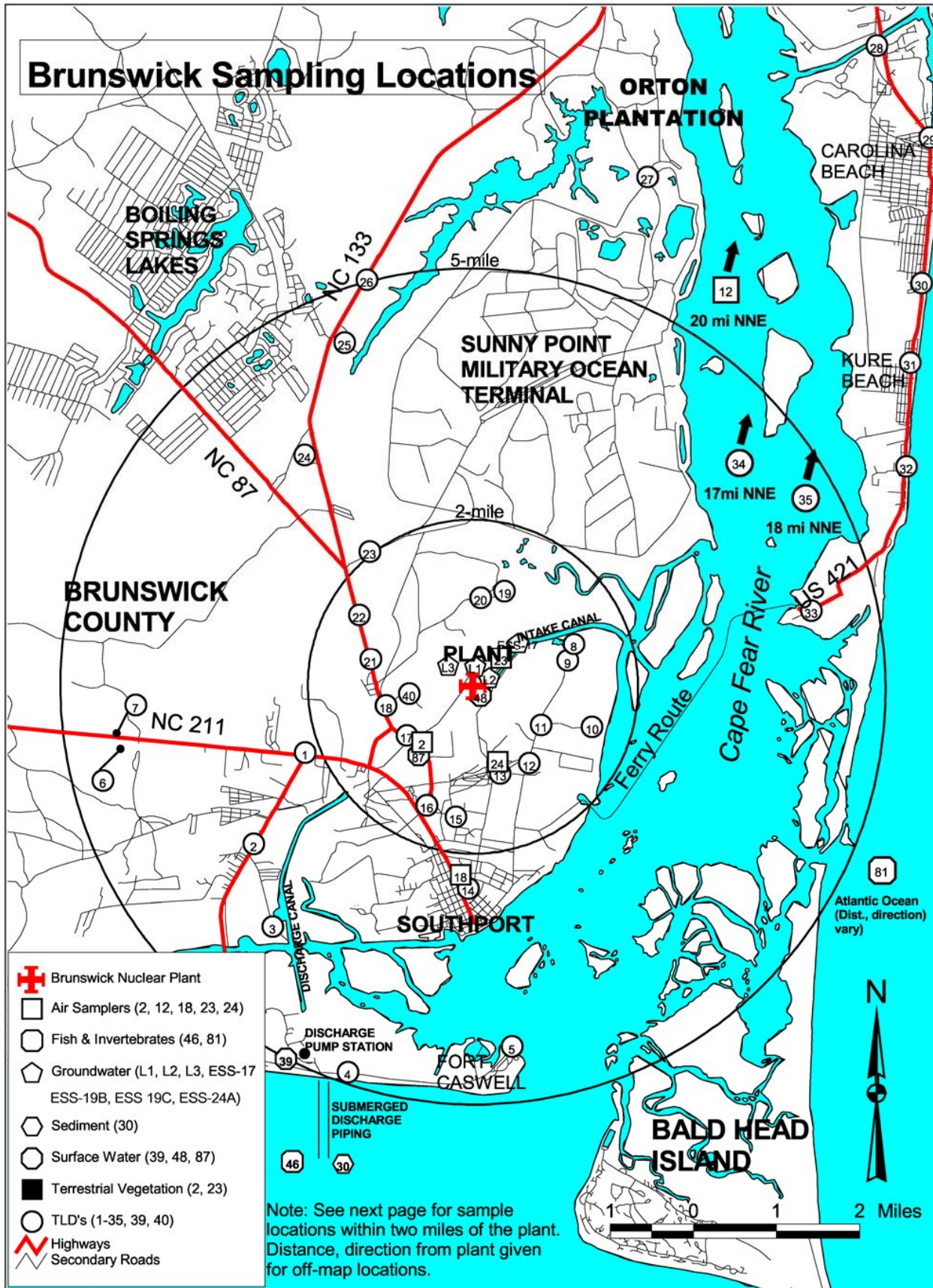
Abbreviations:

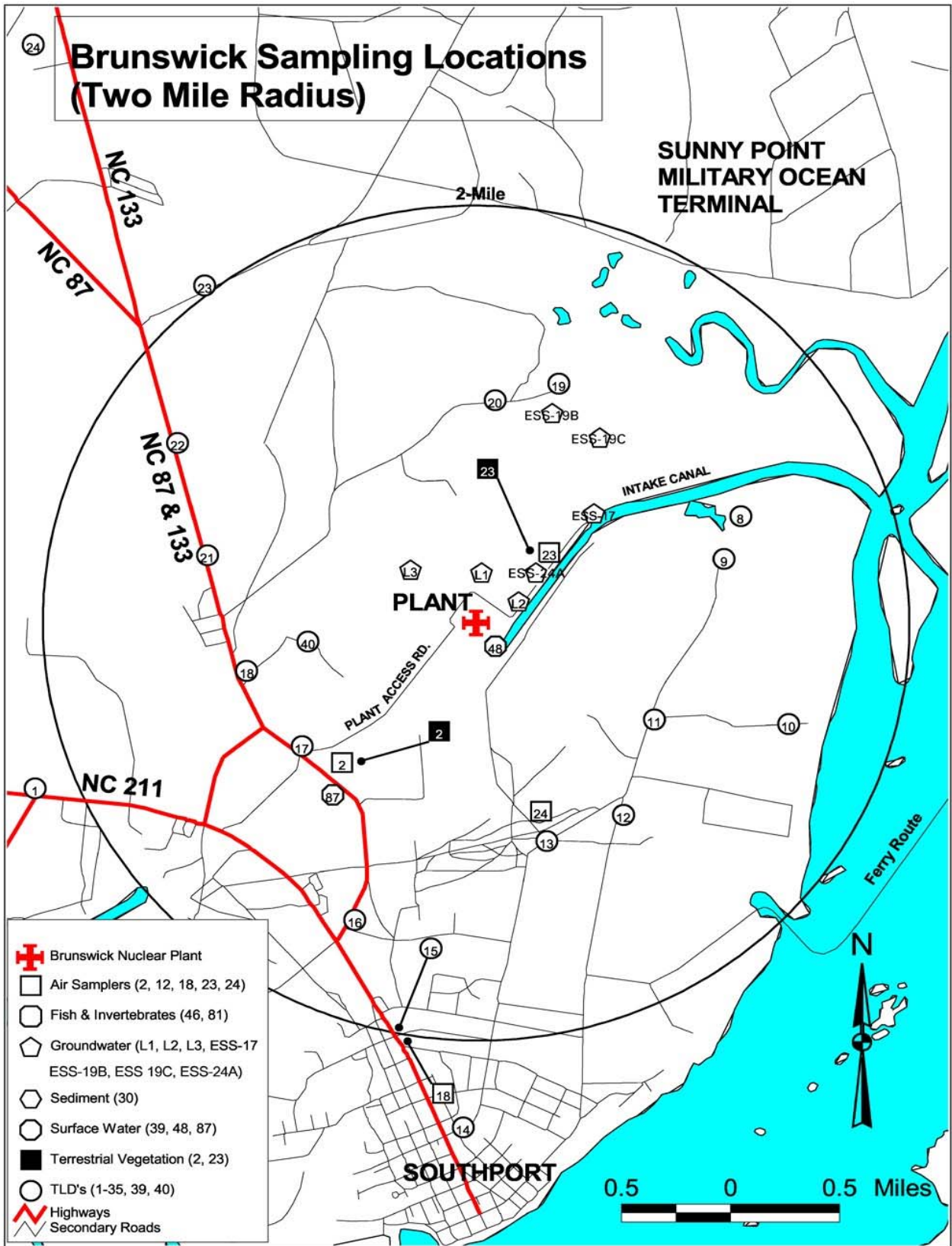
M = Monthly
A = Annually
GW = Groundwater
SW = Surface Water

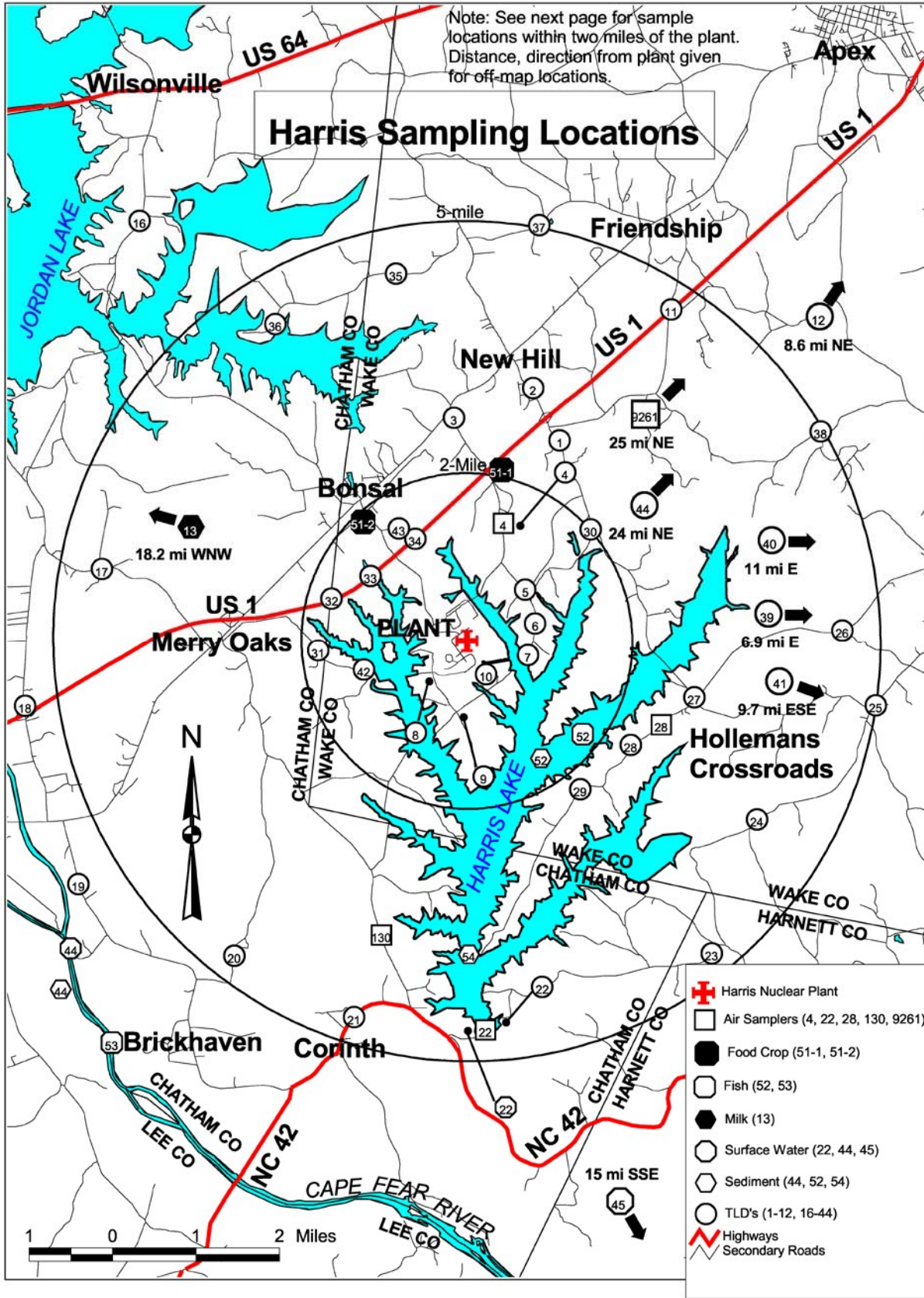
Q = Quarterly
W = Weekly
S-A = Semi-Annually
B-M = Bi-Monthly
(every two weeks)

Site Maps for North Carolina Facilities/

Brunswick Sampling Locations







Harris Sampling Locations (Two Mile Radius)

