

# **Report of Cancer Incidence Rates in North Carolina Counties with Coal Ash Storage Facilities,**

**Prepared by The North Carolina Central Cancer Registry, August 27, 2015**

## **Introduction**

The North Carolina Central Cancer Registry (CCR) conducted a review of cancer cases in 14 North Carolina counties after the Occupational and Environmental Epidemiology Branch contacted the registry regarding a study on the health effects of coal ash sites in these counties, specifically, gastrointestinal tumors and stomach cancers. The counties included in this study are: Buncombe, Caswell, Catawba, Chatham, Cleveland, Gaston, New Hanover, Person, Robeson, Rockingham, Rowan, Rutherford, Stokes and Wayne. These counties were selected based on the information available on the North Carolina Department of Environment and Natural Resources web site on coal ash ponds at [http://portal.ncdenr.org/c/document\\_library/get\\_file?uuid=cd67c1da-b20d-47a4-a2de-034cf47baa54&groupId=14](http://portal.ncdenr.org/c/document_library/get_file?uuid=cd67c1da-b20d-47a4-a2de-034cf47baa54&groupId=14).

## **Methods**

This report is based on cases reported to the North Carolina Central Cancer Registry (CCR) as of July 2015, which were diagnosed during 2009 - 2013 with address at the time of diagnosis in North Carolina and diagnosis codes as reflected in the pathology and medical reports reported from the hospitals and facilities.

For the purpose of this study, the age-adjusted rates for the time period 2009 to 2013 for the top four cancers – lung/bronchus, colorectal, female breast and prostate; Environmental cancers – liver, pancreas, leukemia, brain, bladder, kidney, multiple myeloma and non-Hodgkin lymphoma; and gastrointestinal cancers – stomach, small intestine and colorectal for the 14 counties were calculated along with the corresponding 95% confidence interval. Gastrointestinal cancers were defined by ICD-O-3 site codes: stomach (C160-C169), small intestine (C170-C179) and colon/rectum (C180-C189, C199, and C209).

## **Analysis**

According to Table 1 (Top 4 and Gastrointestinal Cancer), when comparing the 95% confidence intervals for the five year age-adjusted rates (2009 to 2013), incidence rates for lung/bronchus in Gaston, Rockingham and Stokes Counties are significantly higher than the state rate; the incidence rate for prostate cancer in Robeson County is also significantly higher than the state rate. Given the number of rates being compared, this may just reflect the random distribution of the cancer incidence rates. Note that some of these 14 counties had incidence rates significantly lower than the state rate.

According to Table 2 (Cancers Associated with Environmental Factors), when comparing the 95% confidence intervals for the five year age-adjusted rates (2009 to 2013), the incidence rate for liver cancer in Gaston County is significantly higher than the state rate, and the multiple myeloma incidence rate in Wayne County is significantly higher than the state rates. Again, given the number of rates being compared, this may just reflect the random distribution of the cancer incidence rates. Note that some of these 14 counties had incidence rates significantly lower than the state rate.

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**Table 1: 2009-2013 Top 4 and Gastrointestinal Cancer Incidence Rates for 14 Counties in North Carolina.**

County	LUNG/BRONCHUS				FEMALE BREAST			
	Cases	Rate	95 % Lower CI	95 % Upper CI	Cases	Rate	95 % Lower CI	95 % Upper CI
Buncombe	997	63.2	59.3	67.3	1,365	166.9	157.9	176.4
Caswell	107	68.1	55.6	82.8	117	146.8	120.2	177.9
Catawba	620	67.0	61.7	72.6	728	148.4	137.6	159.8
Chatham	234	48.0	41.9	54.7	379	155.4	139.4	172.9
Cleveland	429	69.0	62.6	76.0	460	139.4	126.7	153.2
Gaston	987	81.4	76.3	86.7	935	145.7	136.3	155.5
New Hanover	761	64.2	59.6	69.0	929	150.2	140.4	160.4
Person	202	82.7	71.6	95.3	180	141.2	120.8	164.3
Robeson	466	69.1	62.8	75.9	397	107.3	96.8	118.6
Rockingham	570	90.5	83.1	98.4	489	156.1	142.1	171.2
Rowan	676	79.9	74.0	86.3	636	149.5	137.8	162.0
Rutherford	353	75.0	67.3	83.5	352	149.4	133.6	166.7
Stokes	286	89.2	79.1	100.5	205	127.9	110.5	147.6
Wayne	515	75.8	69.3	82.7	530	144.4	132.2	157.5
<b>NORTH CAROLINA</b>	<b>40,180</b>	<b>75.2</b>	<b>74.5</b>	<b>76.0</b>	<b>47,927</b>	<b>167.7</b>	<b>166.2</b>	<b>169.3</b>

**Table 1 Continued:**

County	PROSTATE				STOMACH			
	Cases	Rate	95 % Lower CI	95 % Upper CI	Cases	Rate	95 % Lower CI	95 % Upper CI
Buncombe	953	129.1	120.9	137.8	90	6.0	4.8	7.4
Caswell	113	147.4	120.3	179.3	12	8.0	4.1	14.4
Catawba	491	107.3	97.7	117.5	47	5.0	3.6	6.7
Chatham	217	94.5	82.2	108.4	22	4.6	2.8	7.2
Cleveland	430	144.1	130.5	158.9	44	7.3	5.3	9.8
Gaston	616	110.2	101.4	119.6	78	6.5	5.1	8.2
New Hanover	557	97.1	89.0	105.7	62	5.3	4.1	6.9
Person	150	130.2	109.6	153.7	26	10.2	6.6	15.2
Robeson	498	152.0	138.2	166.8	48	6.8	5.0	9.1
Rockingham	418	142.7	129.0	157.6	36	5.9	4.1	8.2
Rowan	495	123.5	112.6	135.2	41	5.0	3.5	6.8
Rutherford	206	90.1	77.9	103.9	31	6.7	4.5	9.6
Stokes	184	121.0	103.7	140.6	17	5.3	3.0	8.8
Wayne	404	132.2	119.2	146.2	39	5.8	4.1	8.0
<b>NORTH CAROLINA</b>	<b>34,606</b>	<b>136.2</b>	<b>134.8</b>	<b>137.7</b>	<b>3,727</b>	<b>7.1</b>	<b>6.8</b>	<b>7.3</b>

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**Table 1 Continued:**

County	COLON/RECTUM				SMALL INTESTINE			
	Cases	Rate	95 % Lower CI	95 % Upper CI	Cases	Rate	95 % Lower CI	95 % Upper CI
Buncombe	507	33.7	30.7	36.8	41	2.8	2.0	3.9
Caswell	68	44.8	34.4	57.4	*	*	*	*
Catawba	349	38.4	34.4	42.7	19	2.2	1.3	3.4
Chatham	159	36.3	30.6	42.7	7	1.7	0.6	3.7
Cleveland	270	45.1	39.8	50.9	12	2.1	1.1	3.8
Gaston	526	44.9	41.1	49.0	49	4.2	3.1	5.6
New Hanover	364	31.3	28.1	34.8	39	3.2	2.3	4.5
Person	102	42.9	34.9	52.4	5	2.0	0.6	4.9
Robeson	243	36.6	32.0	41.6	19	2.8	1.6	4.4
Rockingham	283	46.4	41.0	52.3	18	2.7	1.6	4.4
Rowan	352	42.6	38.2	47.4	17	2.1	1.2	3.4
Rutherford	176	39.4	33.6	45.9	13	2.9	1.5	5.2
Stokes	107	35.2	28.7	42.8	6	2.0	0.7	4.7
Wayne	289	43.9	38.9	49.3	18	2.5	1.5	4.0
<b>NORTH CAROLINA</b>	<b>21,754</b>	<b>41.3</b>	<b>40.8</b>	<b>41.9</b>	<b>1,824</b>	<b>3.4</b>	<b>3.3</b>	<b>3.6</b>

**Table 1 Continued:**

County	ALL CANCERS			
	Cases	Rate	95 % Lower CI	95 % Upper CI
Buncombe	7,257	472.3	461.2	483.5
Caswell	736	468.5	434.3	504.9
Catawba	4,155	453.2	439.2	467.4
Chatham	1,920	413.7	394.7	433.4
Cleveland	2,867	472.5	455.1	490.6
Gaston	5,770	485.3	472.7	498.2
New Hanover	5,242	450.4	438.1	463.0
Person	1,197	494.4	466.2	524.0
Robeson	2,773	405.7	390.4	421.5
Rockingham	3,251	536.0	517.3	555.3
Rowan	4,067	492.2	477.0	507.9
Rutherford	2,028	450.0	430.1	470.7
Stokes	1,457	472.0	447.5	497.6
Wayne	3,236	483.1	466.4	500.3
<b>NORTH CAROLINA</b>	<b>276,867</b>	<b>520.6</b>	<b>518.6</b>	<b>522.6</b>

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**Table 2: 2009-2013 Incidence Rates of Cancers Associated with Environmental Factors for 14 Counties in North Carolina**

County	LIVER				PANCREAS			
	Cases	Rate	95 % Lower CI	95 % Upper CI	Cases	Rate	95 % Lower CI	95 % Upper CI
Buncombe	141	9.0	7.5	10.6	142	8.9	7.4	10.5
Caswell	13	8.0	4.2	14.2	25	15.2	9.8	23.0
Catawba	55	5.8	4.3	7.5	94	10.2	8.2	12.5
Chatham	25	5.3	3.4	8.0	51	10.8	8.0	14.4
Cleveland	41	6.7	4.7	9.1	76	12.4	9.7	15.6
Gaston	126	10.1	8.4	12.1	145	12.1	10.2	14.3
New Hanover	98	8.2	6.6	10.0	115	9.7	8.0	11.6
Person	25	10.3	6.6	15.5	20	7.5	4.6	11.9
Robeson	41	5.6	4.0	7.7	67	10.2	7.8	13.0
Rockingham	50	8.2	6.1	11.0	77	12.2	9.6	15.4
Rowan	60	6.8	5.2	8.8	82	9.7	7.7	12.1
Rutherford	22	4.7	2.9	7.4	58	12.9	9.7	16.8
Stokes	18	6.3	3.7	10.3	34	10.3	7.1	14.6
Wayne	46	6.5	4.7	8.7	86	12.7	10.1	15.8
<b>NORTH CAROLINA</b>	<b>4,399</b>	<b>7.9</b>	<b>7.7</b>	<b>8.2</b>	<b>7,064</b>	<b>13.3</b>	<b>13.0</b>	<b>13.6</b>

**Table 2 Continued:**

County	BLADDER				KIDNEY			
	Cases	Rate	95 % Lower CI	95 % Upper CI	Cases	Rate	95 % Lower CI	95 % Upper CI
Buncombe	345	21.5	19.3	23.9	206	13.6	11.8	15.7
Caswell	20	11.5	7.0	18.4	39	24.2	17.1	33.7
Catawba	166	18.3	15.6	21.4	175	18.9	16.2	22.0
Chatham	81	16.0	12.7	20.1	63	14.5	11.0	18.9
Cleveland	124	20.4	16.9	24.4	105	17.9	14.6	21.8
Gaston	237	20.1	17.6	22.9	222	18.6	16.2	21.2
New Hanover	284	24.1	21.4	27.2	170	14.8	12.6	17.3
Person	50	19.8	14.6	26.4	44	18.0	12.9	24.4
Robeson	78	12.0	9.4	15.0	109	15.8	12.9	19.1
Rockingham	147	23.5	19.8	27.7	126	21.5	17.8	25.8
Rowan	183	21.7	18.6	25.2	134	16.2	13.5	19.2
Rutherford	91	19.7	15.8	24.3	80	18.3	14.4	23.0
Stokes	77	24.4	19.2	30.8	57	18.1	13.6	23.7
Wayne	102	15.6	12.7	19.0	118	17.1	14.1	20.6
<b>NORTH CAROLINA</b>	<b>11,356</b>	<b>21.7</b>	<b>21.3</b>	<b>22.1</b>	<b>9,738</b>	<b>18.2</b>	<b>17.9</b>	<b>18.6</b>

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**Table 2 Continued:**

County	MULTIPLE MYELOMA				LEUKEMIA			
	Cases	Rate	95 % Lower CI	95 % Upper CI	Cases	Rate	95 % Lower CI	95 % Upper CI
Buncombe	104	6.7	5.5	8.2	162	10.9	9.3	12.8
Caswell	11	6.8	3.3	12.6	13	8.4	4.4	15.1
Catawba	64	6.8	5.2	8.8	108	12.4	10.1	15.0
Chatham	27	5.2	3.4	7.8	54	11.6	8.6	15.4
Cleveland	38	6.1	4.3	8.4	60	10.4	7.9	13.5
Gaston	81	6.9	5.4	8.6	128	11.1	9.2	13.3
New Hanover	58	4.9	3.7	6.4	135	12.0	10.0	14.2
Person	11	4.7	2.3	8.5	24	10.9	6.9	16.3
Robeson	33	5.2	3.5	7.3	57	8.3	6.3	10.8
Rockingham	50	8.1	6.0	10.7	63	11.1	8.5	14.4
Rowan	64	8.0	6.1	10.2	99	12.3	10.0	15.0
Rutherford	38	8.7	6.1	12.0	47	10.3	7.5	13.8
Stokes	14	4.5	2.5	7.8	27	9.7	6.3	14.3
Wayne	69	10.3	8.0	13.1	93	14.7	11.8	18.0
<b>NORTH CAROLINA</b>	<b>4,083</b>	<b>7.7</b>	<b>7.4</b>	<b>7.9</b>	<b>6,929</b>	<b>13.5</b>	<b>13.1</b>	<b>13.8</b>

**Table 2 Continued:**

County	BRAIN/OTHER CNS				NON-HODGKINS LYMPHOMA			
	Cases	Rate	95 % Lower CI	95 % Upper CI	Cases	Rate	95 % Lower CI	95 % Upper CI
Buncombe	93	6.7	5.4	8.3	301	20.1	17.8	22.6
Caswell	13	9.2	4.8	16.2	19	12.6	7.3	20.4
Catawba	50	5.7	4.2	7.6	154	17.1	14.5	20.1
Chatham	36	8.1	5.6	11.5	80	16.7	13.1	21.0
Cleveland	38	7.0	4.9	9.7	100	17.1	13.9	20.9
Gaston	65	5.8	4.4	7.4	190	16.4	14.1	18.9
New Hanover	69	6.2	4.8	7.9	176	15.2	13.0	17.7
Person	14	6.4	3.4	10.9	36	15.2	10.6	21.3
Robeson	46	6.7	4.9	9.0	79	11.9	9.4	14.9
Rockingham	35	6.5	4.5	9.2	127	21.0	17.4	25.1
Rowan	49	6.3	4.6	8.4	144	18.0	15.1	21.2
Rutherford	25	6.1	3.8	9.1	67	14.9	11.5	19.1
Stokes	20	7.4	4.5	11.7	58	18.9	14.3	24.8
Wayne	50	7.8	5.8	10.3	110	16.6	13.6	20.1
<b>NORTH CAROLINA</b>	<b>5,201</b>	<b>10.1</b>	<b>9.8</b>	<b>10.3</b>	<b>10,031</b>	<b>19.3</b>	<b>18.9</b>	<b>19.7</b>

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## Notes on Tables 1 and 2:

- \* Counts fewer than 5 are suppressed.
- Cases may not sum to totals due to unknown or other values.
- Numbers are subject to change as files are updated.
- Rates based on counts fewer than 16 are unstable. Use with caution.
- Cancers of the urinary bladder and female breast include in situ cases.
- Age-Adjusted to the US 2000 Census

Age-Adjusted Rates = per 100,000 population. Age-adjusted incidence rates are used to account for differences in the underlying age distribution of a state's population that often influences a crude rate (incidence of disease/population at risk of developing the disease within a specific year). Because the incidence of cancer typically increases with age and the age distribution of a population (number of people in each age category) can change over time and vary by geographic area. An age-adjusted incidence rate accounts for those differences within the population allowing the comparison of the incidence of disease from year to year and one geographic area to another irrespective of the age distribution within the populations.

Vintage 2013 bridged-race postcensal population estimates were obtained from the National Center for Health Statistics ([www.cdc.gov/nchs/nvss/bridged\\_race/data\\_documentation.htm#vintage2013](http://www.cdc.gov/nchs/nvss/bridged_race/data_documentation.htm#vintage2013)).

Confidence intervals (CI) should be framed in the following statement:

The probability that the age-adjusted rate for a given population is between the Lower CI and Upper CI is 95 percent.

A modified gamma interval is used to calculate the confidence intervals (Tiwari RC, Clegg LX, Zou Z. Efficient interval estimation for age-adjusted cancer rates. *Statistical Methods in Medical Research*. 2006;15(6):547-69.).

**Note on the data:** Cases diagnosed out of the state and country but receiving treatment in facilities in North Carolina are not included as they are not required to be reported. The CCR does not have real time data because it takes hospitals at least six months after the diagnosis of a malignancy to submit cancer diagnosis reports. The reason for this is that, per General Statute 130A-209, CCR requires facilities to report complete first course of treatment data and many cases have an extended period of first course treatment. The patient may have surgery, followed by multiple courses of chemotherapy, followed by radiation therapy. In order to obtain complete and accurate data from the facilities there is a lag time of at least six months. For some cases, CCR receives multiple reports from different facilities, which are reviewed and consolidated on an ongoing basis. The CCR continues to receive reports from the hospitals for cases diagnosed in 2013 and prior years. Therefore, all cases diagnosed in 2013 may not be included in this report.