

PCS PHOSPHATE

PCS PHOSPHATE AURORA, BEAUFORT COUNTY

It has long been recognized that mining operations can redistribute natural radionuclides found in ore bodies. In the case of phosphate ore, this process can bring uranium and radium into contact with man and his environment. For this reason, the Radiation Protection Section conducts a monitoring program around the PCS Phosphate mining facility in Aurora, North Carolina.

In 1995, Potash Corporation of Saskatchewan (PCS) purchased the Aurora phosphate operations. This was part of the purchase of Texasgulf—a Texas based sulfur-mining company which had operated the site up to that point. This purchase included land previously owned by the North Carolina Phosphate Corporation (NCPC).

The PCS Phosphate site is located in Beaufort County near Aurora, North Carolina. Operations include the phosphate mine, up-grading facilities and several fertilizing materials plants. Mining of Phosphate ore is accomplished by removing approximately 40 feet of overburden using bucket wheel excavators. The ore is then removed from the mine area by dredge or dragline. To keep the mine area dewatered, groundwater is continuously withdrawn from the Castle Hayne aquifer. This water is then used in the phosphoric acid plant and plant cooling systems.

The milling process begins by transporting a slurry of sandy ore and water to the mill by use of a conveyor belt. The material is then washed and screened. Quartz sand is separated from the phosphate rich material by means of floatation, and the phosphate materials are then dried or calcined. Calcined phosphate rock can be shipped to customers as is, or it can be processed further onsite.

Fertilizer is made by reacting phosphate rock with sulfuric acid, forming a weak phosphoric acid with gypsum as a by-product. The weak phosphoric acid is further processed to make feed grade phosphoric acid (56-62% P_2O_5), superphosphoric acid (68-71% P_2O_5), and merchant grade phosphoric acid (52-54% and 56-58% P_2O_5). Other products such as ammonium polyphosphate solution, dry phosphate rock and diammonium phosphate are made from the ore material after

processing. Some of the gypsum can be used for agricultural purposes by peanut farmers. Products are shipped from the site by truck, rail and barge for distribution.

A comprehensive special study of radioactivity in the environment was done around the site and on land owned by the NCPC in 1980. Periodic monitoring has still been maintained since then. In 2008, air particulate samples were collected monthly around the site. There does not appear to be any elevation in the levels found.

None of the air particulate results exceeded the 0.01 pCi/m³ investigation level and were less than the limit of 0.06 pCi/m³ (of gross alpha activity from uranium in ore) for on-site workers found in Appendix B to 10 CFR 20.1001-20.2401.

Air Particulate - Gross Alpha, Gross Beta, and Cesium-137, pCi/m³

<u>Date</u>	<u>TG-APLV-01</u>					
	<u>Alpha (pCi/m³)</u>		<u>Beta (pCi/m³)</u>		<u>Cs-137 (pCi/m³)</u>	
	<u>Meas.</u>	<u>Error</u>	<u>Meas.</u>	<u>Error</u>	<u>Meas.</u>	<u>Error</u>
1/11/08	1.70E-03	1.00E-04	8.80E-03	3.00E-04		
2/15/08	2.20E-03	1.00E-04	1.42E-02	5.00E-04		
3/14/08	3.40E-03	2.00E-04	1.74E-02	6.00E-04		
4/7/08	1.60E-03	1.00E-04	6.60E-03	3.00E-04		
5/5/08	4.70E-03	3.00E-04	7.50E-03	4.00E-04		
6/2/08	3.69E-03	1.80E-04	8.09E-03	3.20E-04		
7/14/08	4.10E-03	2.20E-04	1.25E-02	4.90E-04		
8/14/09	2.43E-03	1.30E-04	1.46E-02	5.30E-04		
9/10/09	2.15E-03	1.30E-04	1.37E-02	5.00E-04		
10/13/09	1.26E-03	9.00E-05	8.96E-03	3.40E-04		
11/3/09	2.69E-03	1.60E-03	1.51E-02	5.60E-03		
12/8/09	2.70E-03	1.40E-04	1.20E-02	4.30E-04		

Surface Water - Gross Alpha, Gross Beta, and Radium-226, pCi/l^a

<u>Date</u>	<u>Site</u>	<u>Alpha (pCi/l)</u>		<u>Beta (pCi/l)</u>		<u>Ra-226 (pCi/l)</u>	
		<u>Meas.</u>	<u>Error</u>	<u>Meas.</u>	<u>Error</u>	<u>Meas.</u>	<u>Error</u>

Groundwater Sites - Gross Alpha, Gross Beta, and Radium-226, pCi/l^a

<u>Date</u>	<u>Site</u>	<u>Alpha (pCi/l)</u>		<u>Beta (pCi/l)</u>		<u>Ra-226 (pCi/l)</u>	
		<u>Meas.</u>	<u>Error</u>	<u>Meas.</u>	<u>Error</u>	<u>Meas.</u>	<u>Error</u>

Surface Soil - Gross Alpha, Gross Beta, and Radium-226, pCi/g^a

<u>Date</u>	<u>Site</u>	<u>Alpha (pCi/g-drv)</u>		<u>Beta (pCi/g-drv)</u>		<u>Ra-226 (pCi/g-drv)</u>	
		<u>Meas.</u>	<u>Error</u>	<u>Meas.</u>	<u>Error</u>	<u>Meas.</u>	<u>Error</u>

Sediment - Gross Alpha, Gross Beta, and Radium-226, pCi/g^a

<u>Date</u>	<u>Site</u>	<u>Alpha (pCi/g-drv)</u>		<u>Beta (pCi/g-drv)</u>		<u>Ra-226 (pCi/g-drv)</u>	
		<u>Meas.</u>	<u>Error</u>	<u>Meas.</u>	<u>Error</u>	<u>Meas.</u>	<u>Error</u>

Terrestrial Vegetation - Gross Alpha, Gross Beta, and Radium-226, pCi/g^a

<u>Date</u>	<u>Site</u>	<u>Alpha (pCi/g-drv)</u>		<u>Beta (pCi/g-drv)</u>		<u>Ra-226 (pCi/g-drv)</u>	
		<u>Meas.</u>	<u>Error</u>	<u>Meas.</u>	<u>Error</u>	<u>Meas.</u>	<u>Error</u>

^a Other than air particulate, no other sample media were collected at PCS Phosphate in 2008.