

Contract No:

This document was prepared in conjunction with work accomplished under Contract No. DE-AC09-08SR22470 with the U.S. Department of Energy (DOE) Office of Environmental Management (EM).

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To: Environmental Monitoring Group Files

June 2, 2016

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SRS Environmental Air Surveillance Program 1954-2015: General Trends

The radiological monitoring program at SRS was established under the DuPont Company in June 1951 and was used as a measurement of the effectiveness of plant controls and as an authoritative record of environmental conditions surrounding the plant. It also served as a method of demonstrating compliance with applicable federal regulations and guidance. This document serves as a general summary of changes made specifically to the environmental air monitoring program since its inception, and a discussion of the general trends seen in the air monitoring program at SRS from 1954 to 2015.

Initially, the environmental air surveillance program focused not only on releases from SRS but also on fallout from various weapons testing performed through the end of 1978. Flypaper was used to measure the amount of fallout in the atmosphere during this period, and was present at each of the 10 monitoring stations. By 1959, all site stacks were included in the air monitoring program to determine their contribution to the airborne radioactivity onsite, and the number of air surveillance samplers rose to 18. This trend of an increased number of sampling locations continued to a peak of 35 sampling locations before shifting to a downward trend in the mid-1990s. In 1962, 4 outer-range samplers were placed in Savannah and Macon, GA, and in Greenville and Columbia, SC. Until 1976, air samplers were simply placed around the perimeter of the various operation locations (after 1959, this included stacks to determine their contribution to the airborne radioactivity), with the intent of creating as representative a distribution as possible of the air surrounding operations.

In June of 1976, the site was split into 30° sectors and the 25 existing samplers were either placed on the perimeter of the site or at various points around a circle at a 25-mile radius from the center of the site.

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This correlated with the 4 existing long-distance sites, all of which were approximately 100 miles away, and in an aim to increase the area covered by the samplers, 6 monitoring stations were placed onsite.

In 1982, SRNL dose models of potential releases were determined to be overly conservative and therefore overestimate the offsite doses. To remedy this, offsite doses were based on newer models developed for assessing effects of the operation of licensed commercial nuclear facilities. The air monitoring stations were spaced to permit continuous monitoring within every 30° sector on the site perimeter, and at a 25-mile radius, in an attempt to increase the probability of detecting a significant release of airborne radiation, regardless of wind direction. No record of technical or mathematical justification for the placement of air monitoring stations could be found prior to 1996, when an evaluation of the air sampler locations was performed using the Waite Method (Waite, 1973), commonly viewed as an adequate method to allow a monitoring program to meet regulatory and site-specific program requirements (Fledderman, 1996). In this estimation, the entire population is assumed to reside at the site boundary (a conservative assumption), and the site boundary is assumed to be a uniform distance of 10 miles from the center of the site. By using information about the fraction of the total population at a given distance, and the fraction of time that a certain 30° sector is downwind of sources, the Waite method produces a weighting factor to determine the ideal number of samplers per given sector, given a specific number of available samplers. The one caveat of this method is that the maximum applicable population distance is limited to 10 miles, an issue for very large nuclear facility sites (such as SRS). At distances greater than 10 miles, the equation loses its ability to associate demographic and meteorological variables to yield useful recommendations when applied to a site on an octant basis.

Using the Waite method, SRS was able to determine that not only was the relocation of sites not required, but that the reduction of monitoring sites would not adversely impact the spatial distribution of the sites. With this in mind, the number of sites was reduced to 17 (13 on-site or at perimeter, 3 25-mile radius sites, and 1 site in Savannah, approximately 100 miles away from the site). In 2003, the air monitoring program was again changed in response of the Six Sigma Reduction Study, an across-the-board budget reduction effort that had the effect of re-evaluating the air sampling system to determine whether the system could still function adequately with fewer samplers, and more time between sampling occasions. It was determined that adequate spatial coverage could be maintained with at least one monitoring site within each of the 8 compass octants. Supplementary sites near local population centers complement this basic coverage, and led to the reduction of air sampling locations from 12 to 10 (Heffner, 2003). Additionally, the sampling frequency was decreased from weekly to bi-weekly at most sites, annually or semiannually at H and F Tank Farms, and quarterly at C-Area, K-Area, and L-Area. A reevaluation of the air monitoring program took place after these changes were implemented, and it was determined that the program was still effective at detecting releases even with the reduced sampling locations (Fledderman, 2003).

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In 2005, the number of air monitoring sites was increased to 15. By this point, it was that the network existed largely to monitor the release of tritium from the site, as other specific radionuclides are not routinely detectable at the site perimeter. As various facilities and operations wind down or start up (for example, the Saltstone facility), monitoring on a temporary or more permanent basis may be introduced in that area; changes to the program are laid out in SRS Environmental Reports, issued yearly. In 2011, there was a change from splitting the site into 30° sectors to 45° sectors, however the number of samplers remained constant at 15 (11 onsite or at the perimeter, 3 at a 25-mile radius, and 1 at a 100-mile radius in Savannah) until 2014. At that point, it was determined that only a small percentage (<15%) of samples taken showed detectable levels at the 25-mile perimeter. A review of historical tritium data (the radionuclide of greatest concern at SRS) showed that 25-mile perimeter samples provided adequate background control levels and monitoring in population centers, and also provided similar results when compared with the Savannah location. For that reason, in 2014 the Savannah, GA monitoring site was removed, leaving only the perimeter sampling stations and the 25-mile radius sites to monitor potential releases from the site (14 sites in all).

Overall, trends include an increase in the number of air monitoring stations to a peak of 35 monitoring stations before moving in a reduction phase in the mid-1990s, partially due to budget concerns. No record was made of any technical or mathematical rationale behind the placement of the air monitoring stations onsite or at the perimeter prior to 1996, when the Waite method was used to determine the optimum placement of samplers within 30° sectors. Upon performance of this method, it was determined that the network would function adequately with fewer samplers. This, coupled with the completion of a number of operations onsite, led to the reduction in air sampling locations. Dose models were adapted from use in commercial nuclear power operations for the site, as they more accurately represented potential doses to the surrounding population centers. While sampling locations are temporarily added at various operations, the general trend of reducing the number of sampling locations, in addition to reducing the frequency of sampling (initially from weekly to bi-weekly, and in some areas, to semi-annually) continues to the present day. As of 2015, there are 14 sampling locations (11 onsite or at the perimeter, and 3 at the 25-mile radius) to monitor the radiological hazards potentially released from SRS. The maps in Figures 1 to 4 give an idea of how the program has changed in regards to sampling location and number of samplers (taken from the respective Annual Site Environmental Reports).

Next steps in the air surveillance program include determining and applying a modernized rationale for the location of the existing air monitoring locations that will maximize the efficiency of the system at large and the individual samplers to accurately detect a release anywhere on site, and modeling onsite dispersion of various release products to determine how they could spread to the surrounding population centers.

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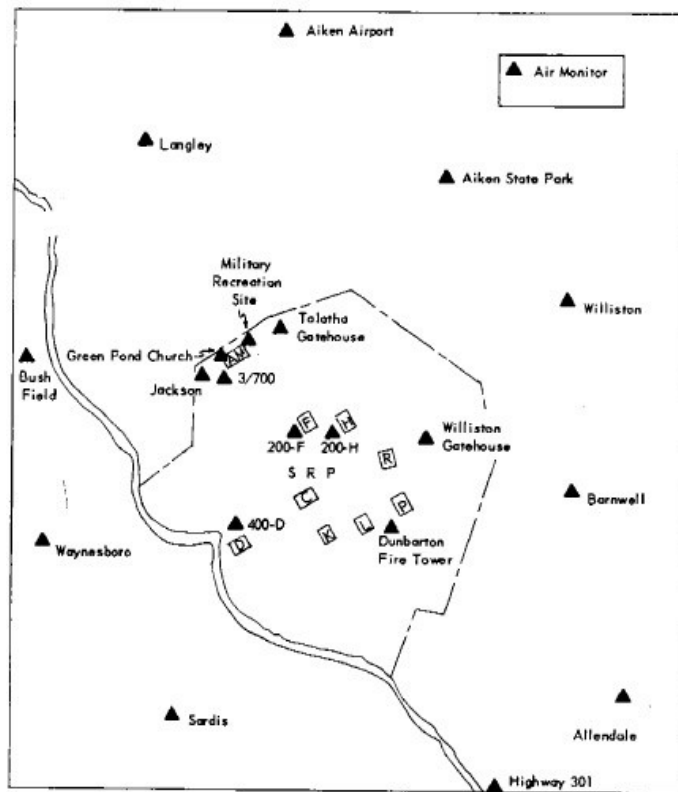


Figure 1. Air Monitoring Stations in 1963

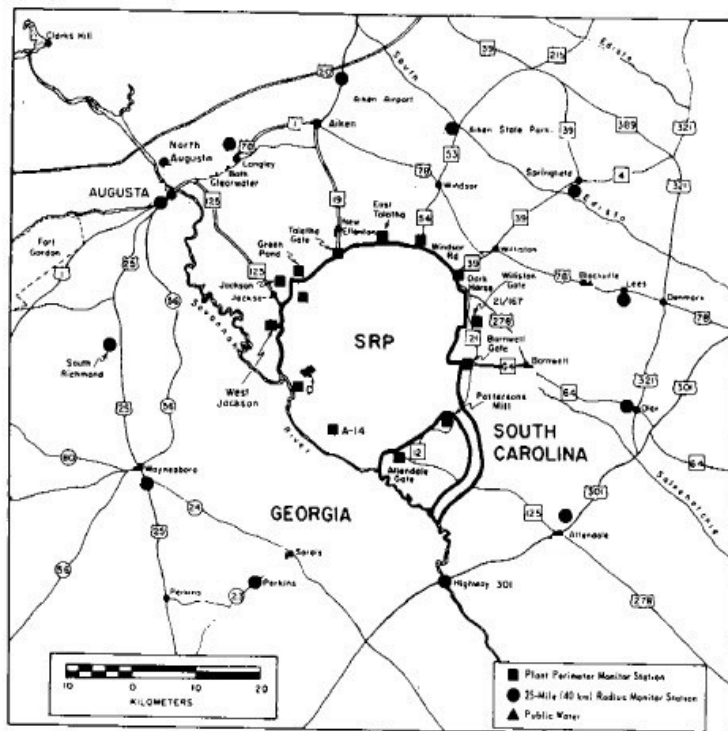


Figure 2. Air Monitoring Stations in 1976

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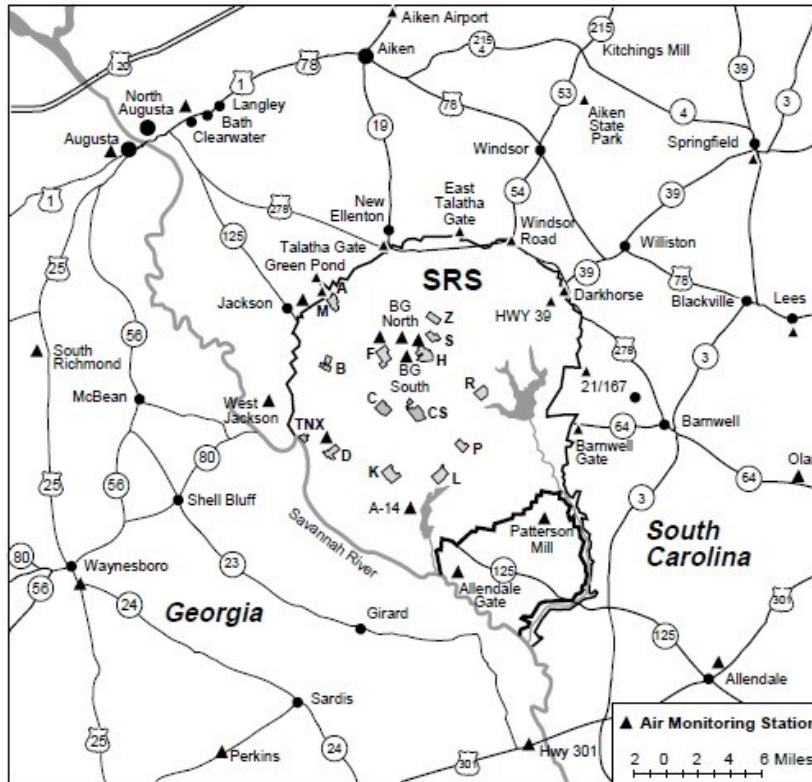


Figure 3. Air Monitoring Stations in 1993

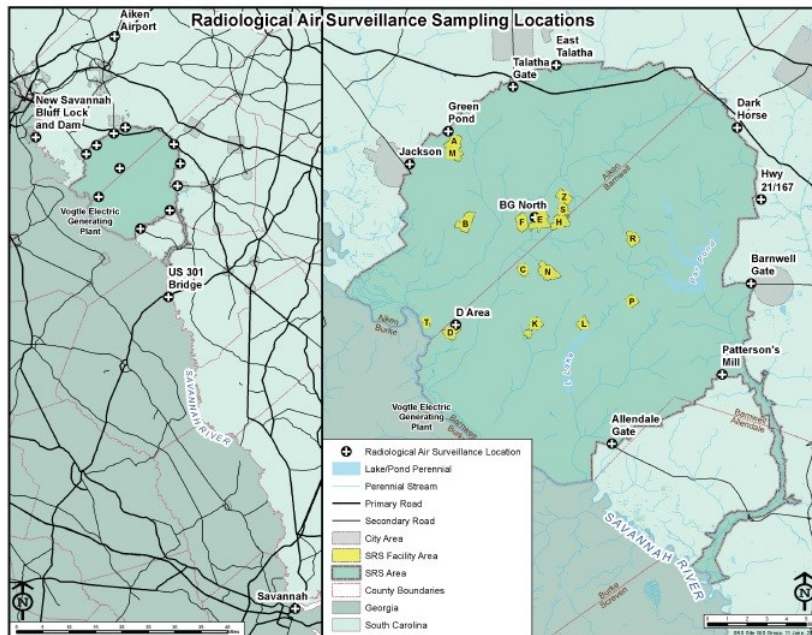


Figure 4. Air Monitoring Stations in 2013

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