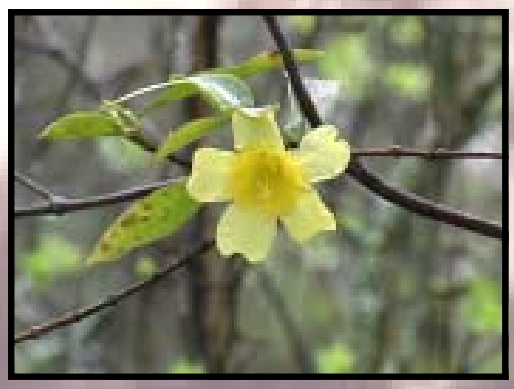
Under a Cloud

- Fallout from the Savannah River Site



By: Norm Buske
The RadioActivist Campaign

October 2003

Contents

Page	
1	Introduction
	Savannah River Site
	Purpose of this study
2	Study Results
Centerfold	This Study at a Glance
6	Discussion
7	Conclusions
8	Glossary
	e-references
9	Questions & Answers
Back cover	Contact Information
	Credits
	About the Author

Extracting Dust from Pine Needles (Sample 3b)

Summary

In April 2003, The RadioActivist Campaign (TRAC) identified a pattern of radioactive cesium-137 outside the northeast boundary of the Savannah River Site (SRS). That cesium-137 is evidence of recent radioactive fallout, from SRS, that contaminates the area downwind of the site. The radioactivity of that cesium-137 was 50 times the normal “background” level.

TRAC believes SRS’s contamination of the area downwind of the site poses a threat to public health and safety and environmental quality. SRS denies that the site contaminates public air and land and states that radioactivity from fallout around SRS is not above background levels.

TRAC also identified levels of cesium-137 at a thousand times background level in Lower Three Runs Creek, which drains SRS. Along with the cesium-137, TRAC found strontium-90 and a trace of cobalt-60 contaminating the creek. The combination of those three radionuclides suggests that the source of that contamination is spent nuclear fuel at SRS. That contamination is entering the Savannah River.

This report brings these contamination problems to the public’s attention so the affected communities can take action to protect their health and their environment.

Introduction

Savannah River Site (SRS)

The Department of Energy (DOE - originally named the Atomic Energy Commission) began constructing the Savannah River Site in South Carolina, in 1951. SRS's mission was to produce weapons materials for national defense. Those materials included plutonium-239 and tritium for nuclear bombs.

SRS Facility - Photo Courtesy DOE

R-Reactor, SRS's first reactor, went "on-line" in 1953. P-, L-, K-, and C-Reactors all followed within the next two years. By the 1980s, SRS's original production mission was complete and the old reactors were shut down. SRS's mission was then diversified, with one focus being on cleanup of the wastes remaining from the Cold War production era.

Westinghouse Savannah River Company now manages SRS's operations for DOE. In 1994, a SRS Citizens Advisory Board was established to help set cleanup priorities. In 2000, the government selected SRS for three new plutonium missions.

Purpose of this Study

The RadioActivist Campaign (TRAC) is a scientific project of the Tides Center of San Francisco. TRAC measures radioactivity around nuclear facilities and reports the results and implications to the public. In 2002, the Citizen's Monitoring and Technical Assessment Fund provided funds for TRAC to measure radioactivity around three DOE sites: Hanford in Eastern Washington, Los Alamos National Laboratory in north central New Mexico, and Savannah River Site, in South Carolina.

SRS Caution Sign

In April 2003, TRAC, in coordination with SRS, collected biological samples, from public lands and waters, at 6 locations outside the SRS boundary.

TRAC analyzed these samples, along with a reference background sample from New Mexico, to assess SRS's radiological impacts downwind and downstream of the site. The results of that study are reported on the next two pages. Their implications are discussed later in this report.

Study Results

TRAC collected 6 samples of biota from outside SRS and analyzed them for artificial radioactivity. TRAC's laboratory reported positive results for the nuclear fission product cesium-137 (Cs-137). Those positive results are presented here, along with two "background" results for comparison.

The background activity of Cs-137, both near and far away from SRS, is about one picocurie per kilogram (1 pCi/kg, wet weight, in particular for *sorrel* - a plant that grows in streams). See results for Samples 1 and 2, below. For comparison, the Environmental Protection Agency limit for Cs-137 in drinking water is 200 pCi/Kg.

The U.S. Department of Energy, SRS's owner and operator, claims that the only Cs-137 outside the site boundary is barely detectable and remains from worldwide fallout from American and Russian testing of nuclear weapons in the 1950s and 1960s.

(Text continues below the Table of Results, on the next page.)

Table of Results

Sample Number. *Setting :*	1. *local background*	2. *far upwind background*
Location of Sample :	southeast of SRS	far west of SRS
Place :	**Furse Mill Pond**	**Los Alamos, NM**
Locale :	Hwy 125, N side; at mill	West bank of Rio Grande, mouth of Sanchez Canyon, south of Los Alamos lab
Latitude: North 33° + minutes:	05.863'	North 35° +40.994'
Longitude: West 81° + minutes:	31.501'	West 106° +19.057'
Sample class :	aquatic vegetation	aquatic vegetation
Medium :	sorrel	sorrel
Wet/Dry weight ratio :	12.3	7.2
Sample Identifier* :	340712	350213
Cs-137 [pCi/kg(wet)] :	**1.2** ±1.9	**−0.7** ±1.9

* Sample Identifier is 6 digit sample collection time: YearMonthDayDayHourHour. For example 340712 = 2003, April 07, 12:00 hours.

Sample Number. *Setting* : 3a.* old *downwind*	3b.* recent *downwind*
Location of Sample :	northeast of SRS	northeast of SRS
Place :	**Seven Pines Road**	**Seven Pines Road**
Locale :	tree farm edge, road E side	tree farm edge, road E side
Latitude: North 33° + minutes:	17.534'	17.534'
Longitude: West 81° + minutes:	27.293'	27.293'
Sample class :	detritus on ground	dust
Medium :	pine needles	dust off pine needles
Wet/Dry weight ratio :	2.31	2.31, assumed
Sample Identifier* :	340910p	340910
Cs-137 [pCi/kg(wet)] :	**6.** ±5.	**70.** ±5.

*Sample 3b is dust rinsed off the pine needles of Sample 3a.

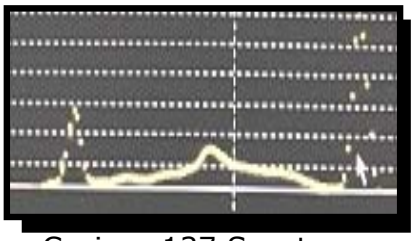
Sample Number.	4.* two sample locations		5.
Setting :	recent *downwind*		*downwind*
Location of Sample :	northeast of SRS		northeast of SRS
Place :	**NNE of SRS**	**ENE of SRS**	**Tinker Creek**
Locale :	Green Pond Rd. at N. Silverton St.	Seven Pines Rd at Pioneer Dr.	Highway 278 bridge, SW side
Latitude: North 33° + minutes:	21.706'	18.207'	22.708'
Longitude: West 81° + minutes:	45.340'	27.898'	30.402'
Sample class :	roadkill		aquatic vegetation
Medium :	2 gray squirrel tails		sorrel
Wet/Dry weight ratio :	2.14		10.6
Sample Identifier :	3409sq		340710
Cs-137 [pCi/kg(wet)] :	**174.** ±20.		**65.** ±2.

*Sample 4 is a composite of two recent roadkills, tails taken from gray squirrels at two locations. Figure 1, at the top of the next page, shows locations where these samples were collected.

Sample Number. *Setting :*	6. *downstream*	7. *swamp reference*
Location of Sample :	southeast of SRS	south of SRS
Place :	**Lower 3 Runs Creek**	**Steel Creek**
Locale :	Hwy 125 bridge, SW side	flooded creek, west side
Latitude: North 33° + minutes:	04.396'	05.820'
Longitude: West 81° + minutes:	26.639'	36.987'
Sample class :	aquatic vegetation	flooded vegetation
Medium :	sorrel	wild grape leaves
Wet/Dry weight ratio :	12.7	7.4
Sample Identifier* :	340816	341014
Cs-137 [pCi/kg(wet)] :	**1254.** ±5.	**10.** ±2.

± values are one sigma counting uncertainty.

That is to say, DOE claims the Cs-137 levels outside the SRS boundary are not much greater than 1 pCi/kg.



Cesium-137 Spectrum

TRAC collected Samples 3b, 4, and 5 from outside of the SRS boundary, in the downwind direction to the northeast. These samples were of three different "media": dust off pine needles, squirrel tails, and sorrel from Tinker Creek. These three samples tested positive for Cs-137 at 70, 174, and 65 pCi/kg, respectively. These three samples were thus at least 50 times the background level of 1 pCi/kg. TRAC attributes these three positive results to radioactive fallout from SRS.

See Page 6 for discussion of these results and their implications and Page 8 for "e-references."

This Study at a Glance

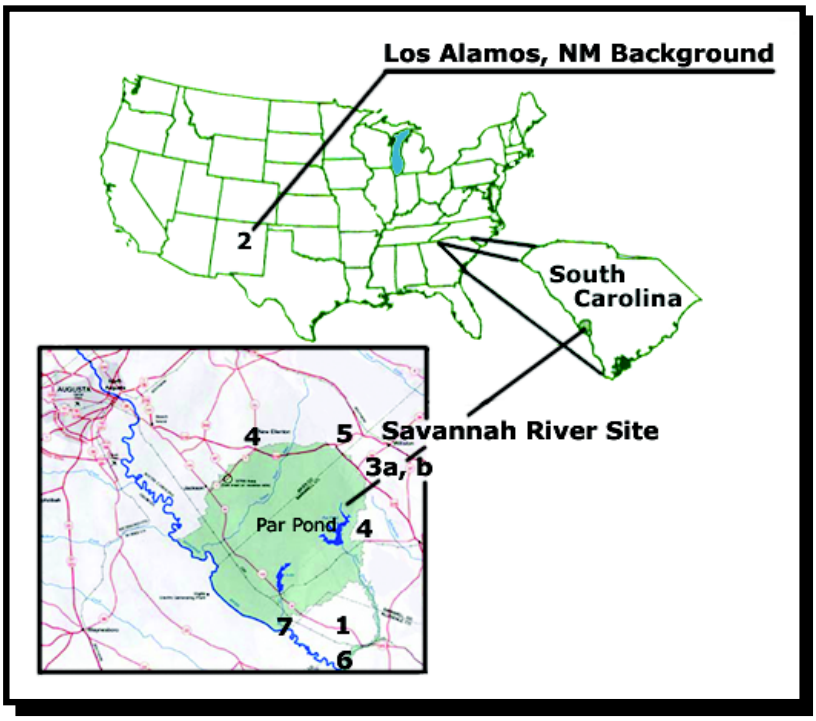


Fig. 1. Sample Collection Locations

The RadioActivist Campaign (TRAC) collected samples from 6 locations around SRS in April 2003. Samples included a local background (Sample 1) and a distant background (Sample 2) from New Mexico. See Fig. 1.

Three samples (3a, b; 4 (combined from two locations); and 5) were collected to the northeast, *downwind* of SRS.

TRAC collected Sample 6 from Lower Three Runs Creek, *downstream* of SRS. Sample 7 was a reference sample from the swamp on the SRS side of the Savannah River. Sample details are on the previous two pages.

TRAC identified high levels of radioactive cesium-137 (Cs-137) in three downwind samples which were of *different media* and from *different pathways*. See Figs. 2 - 4.

TRAC's results from Samples 1 and 2 give the *background* Cs-137 radioactivity at about 1 picocurie/kilogram. That background level of Cs-137 remains from old SRS operations during the Cold War and from Russian and American atmospheric testing of nuclear weapons during the 1950s and 1960s.

Radioactive cesium-137 is an artificial *isotope* of the element cesium. Cs-137 has a half-life of 30 years. When a Cs-137 atom decays, its nucleus releases an energetic electron (called a *beta* particle) and a gamma ray (a *photon* having energy between an x-ray and a cosmic ray). TRAC measured Cs-137 in samples collected from around SRS by counting their gamma rays in TRAC's in-house spectrometer.

The three environmental samples that TRAC collected from downwind and to the

Fig. 2. Collecting Pine Needles from the Roadside Northeast of SRS (Sample 3)

northeast of SRS were each about 50 times the background level of Cs-137. That elevated radioactivity was found in the dust on pine needles (Sample 3b), but not in the pine needles themselves (Sample 3a). The finding of elevated Cs-137 in dust on pine needles, but not in the needles suggests the Cs-137 is superficial: it has not yet been absorbed by older vegetation.

Fig. 3. Collecting a Squirrel Tail from Roadkill Found on the Road Northeast of SRS (Sample 4)

That the origin of the Cs-137 is recent was underscored by even higher radioactivity measured in squirrel tails collected Northeast of SRS: 174 picocuries/kilogram in Sample 4. The implication is that the measured Cs-137 was in dust on the squirrel tails. The squirrel tails may have accumulated the contaminated dust before it was washed away by the spring rains of 2003. Elevated cesium-137 in superficial dust indicates a recent, radioactive fallout event.

Within the year before April 2003, SRS spread radioactive fallout that has contaminated the downwind area with Cs-137 at levels 50 times background.

TRAC's finding of Cs-137, at levels similar to those in the squirrel tails, in vegetation collected from Tinker Creek, northeast of SRS, showed that the Cs-137 was already washing into the streams and being accumulated into new springtime growth. Together, these findings of Cs-137 in different sample media, and **only** in samples collected to the northeast of SRS, are evidence of a radioactive fallout event, of SRS origin, sometime during the year before April 2003.

Downstream of SRS, TRAC measured Cs-137, at more than one thousand times background radioactivity, in Lower Tree Runs Creek. Strontium-90 and trace cobalt-60 in that sample suggest that SRS is discharging radioactive waste into the creek.

The U.S. Department of Energy denies that SRS airborne radioactivity, outside the site boundary, exceeds background levels.

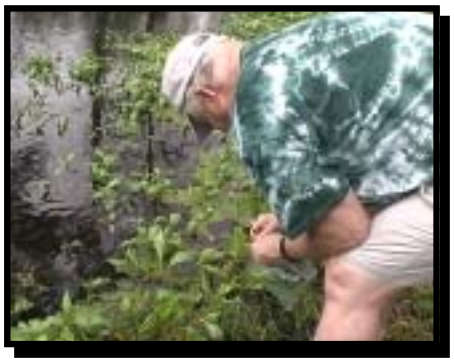


Fig. 4. Collecting Aquatic Vegetation from Tinker Creek (Sample 6)

Discussion

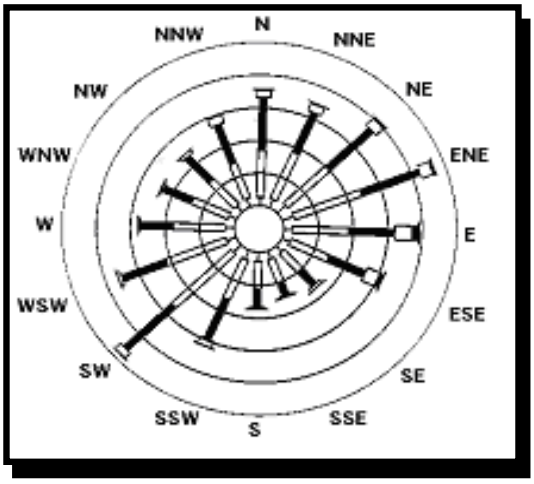


Fig. 5. SRS Weathervane: Directions to Which the Wind Blows

The wind pattern around SRS most often blows across the site to the northeast. See the weathervane in Fig. 5. (The length of each arm indicates the prevalence of wind blowing in that direction. Wider ends indicate greater wind speed.) For this reason, TRAC collected biological samples from around the northeastern boundary of SRS to check for possible radiological fallout from the site.

TRAC collected a local background sample from Furse Mill Pond, SSE of the site. See Fig. 6, below. Winds seldom blow from SRS toward the SSE direction.

In the three samples collected from downwind of SRS, TRAC detected only radioactive Cs-137. Based on: 1) the absence of other radionuclides in those samples and 2) the limited direction of contamination, TRAC identifies the source of that Cs-137 as an airborne fallout event from SRS; possibly from processing old radioactive waste.

Fig. 6. Furse Mill Pond: Local Background Collection Location (Sample 1)

Vegetation collected from Lower Three Runs Creek, downstream of SRS, contained 275 pCi/kg of strontium-90 and a trace of cobalt-60 in addition to the 1254 pCi/kg of Cs-137 reported in the results. See page 7. Based on this radiological “fingerprint,” TRAC tentatively identified the source material as spent nuclear fuel somewhere in the Par Pond drainage. See Fig. 7.

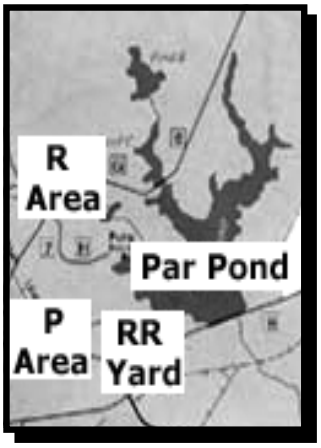


Fig. 7. Map of Par Pond in SRS

About 8000 spent nuclear fuel assemblies are located at SRS. Major SRS facilities that drain into Par Pond are the closed R- and P-Reactor Areas and a railroad yard.

TRAC notified DOE of the results presented in this report. DOE attributed the reported cesium-137 to worldwide fallout from atmospheric testing in the 1950s and 1960s. See e-references.

Conclusions

Checking Radioactivity of Sample from Tinker Creek (Sample 5)

1. TRAC found radioactive cesium-137, recently deposited to the northeast of Savannah River Site, at 50 times background levels. This radioactive fallout probably came from a single accident at SRS, within the year before April 2003. This fallout event is a public health concern.

2. SRS denies off-site airborne contamination exceeds background levels that remain from worldwide fallout from atmospheric nuclear weapons testing during the 1950s and 1960s. That denial indicates the problems around SRS include a lack of government accountability to the neighboring communities.

3. TRAC identified one thousand times the background level of radioactive cesium-137 in vegetation in Lower Three Runs Creek, which drains SRS into the Savannah River. That radioactivity was accompanied by strontium-90 and traces of cobalt-60. The combination of those three radionuclides is a fingerprint that suggests *spent nuclear fuel* is the source material.

4. About 8000 spent nuclear fuel assemblies are held at SRS. None of SRS's spent nuclear fuel facilities drain into Lower Three Runs Creek. Thus, the source of the radioactive waste TRAC discovered in Lower Three Runs Creek has not been made public by SRS.

No Fishing Sign Near Lower Three Runs Creek, within SRS Perimeter

5. The government agency that is responsible for SRS seems to ignore off-site radiological impacts of its operations. Therefore, the responsibility for protecting public health, safety, and environmental quality reverts to the affected communities. The discovery of cesium-137 around SRS, reported here, is a wake-up call for the public to secure true site accountability and the protection of public and environmental health.

Glossary

cesium-137 – radioactive product of uranium or plutonium fission ; half-life = 30 years
cobalt-60 – radioactive product of neutron irradiation of steel in a reactor; half-life = 5 years
fallout – settling to the ground of radioactive particles that had been ejected into the air
isotope – the number of neutrons added to the protons in an atom of some element, like iron or cesium
pCi/kg(wet) – one picocurie/kilogram = one nuclear disintegration per minute, in a liquid pound, which is one pint
strontium-90 – radioactive product of the fission of uranium or plutonium; half-life = 29 years

e -references

—1——> Date: Fri, 18 Jul 2003 12:55:14 -0400
From: bill-doe.taylor@srs.gov
Subject: Re: sent again: results of radiological study around SRS
To: Norm Buske <search@igc.org>
Cc: arthurb.gould@srs.gov

Pete Fledderman took the initiative to print out recent Cs-137 results form a variety of air stations. The on-site (Burial Ground-North), site perimeter, and offsite location (High-way 310 bridge) all look about alike; it's not obvious that any one station is consistently higher or lower than any other.

—2——> Date: Fri, 18 Jul 2003 12:46:13 -0400
From: bill-doe.taylor@srs.gov
Subject: Re: sent again: results of radiological study around SRS
To: Norm Buske <search@igc.org>
Cc: arthurb.gould@srs.gov, james.heffner@srs.gov, dianne.saylor@srs.gov

This response was provided to Ben Gould, Director, DOE SRS Environmental Quality Management Division, by Dr. Jim Heffner, of Westinghouse Savannah River Company at 803-952-6931.

I would expect a proper and thorough evaluation would show patterns that look just like world-wide fallout from any air pathway...upwind and downwind, near to and far from nuclear facilities. We do have cesium in several stream beds. The implication of "a waste source" is valid for stream beds, but not for air-pathways media like vegetation northeast of the site. ...

A better way to evaluate data is to look at geographic data patterns to see if up-close vegetation has higher concentrations than far-away vegetation. Only if this pattern appears can we conclude that there's an SRS source observed in the samples. Our data have not shown that kind of pattern for air pathways (except for tritium). Strontium, plutonium, uranium, and cesium are generally below detection limits, and the few sporadic positive results are scattered rather than concentrated near the site. ...

Questions & Answers

What is the problem?

1. A radiological study outside the Savannah River Site perimeter revealed a pattern of radioactivity downwind, to the northeast of the site. Recently deposited cesium-137 is 50 times background level. The source is probably a single, recent accident at SRS that produced unreported radioactive fallout.

2. There is also a thousand times the background level of cesium-137 in Lower Three Runs Creek, which drains SRS into the Savannah River. The source of this contamination is probably an operational problem involving spent nuclear fuel at SRS.

3. The Department of Energy, owner and operator of SRS, denies these problems and continues to spread radioactivity.

Far Upwind, Background Sample Near Los Alamos, New Mexico (Sample 2)

Why should I care?

1. These three problems threaten public health and safety, and environmental quality.

2. It's your health and your environment.

What should I do?

1. Get informed! Watch for relevant news items. Contact organizations working on these issues. (Some contacts are provided on the back cover of this report.)

2. Get involved! Help raise public awareness by talking about SRS with your family, friends, or co-workers.

3. Speak up! Get the word out. Write letters to your newspaper or your congressperson and demand that the Department of Energy become a good neighbor that protects your health and your environment.

Contacts

Blue Ridge Environmental Defense League
P.O. Box 88
Glendale Springs, NC 28629
(336) 982-2691
fax: (336) 982-2954
www.bredl.org

Site Owner and Operator
United States Department of Energy
Savannah River Operations Office
Public Affairs Division
Aiken, SC 29808
(803) 725-0195
www.srs.gov

Site Contractor
Westinghouse Savannah River Company
Savannah River Site
Public Affairs Division
Aiken, SC 29808
(803) 725-0195

Credits

Produced by:
Moon Callison
The RadioActivist Campaign
7312 NE North Shore Road
Belfair, WA 98528
(360) 275-1351
www.radioactivist.org

Supported by:
A Grant from the Citizens' Monitoring and Technical Assessment Fund

About the Author

Norm Buske directs The RadioActivist Campaign (TRAC). He has masters degrees in physics from the University of Connecticut and in oceanography from the Johns Hopkins University. He has conducted non-governmental, in-field, radiological investigations around nuclear weapons facilities since 1983. Norm does TRAC's sampling, sample processing, and he operates TRAC's in-house radiological laboratory. He has received a certificate of honor for his scientific and technical investigations of the environmental consequences of nuclear weapons production in the United States and Russia.