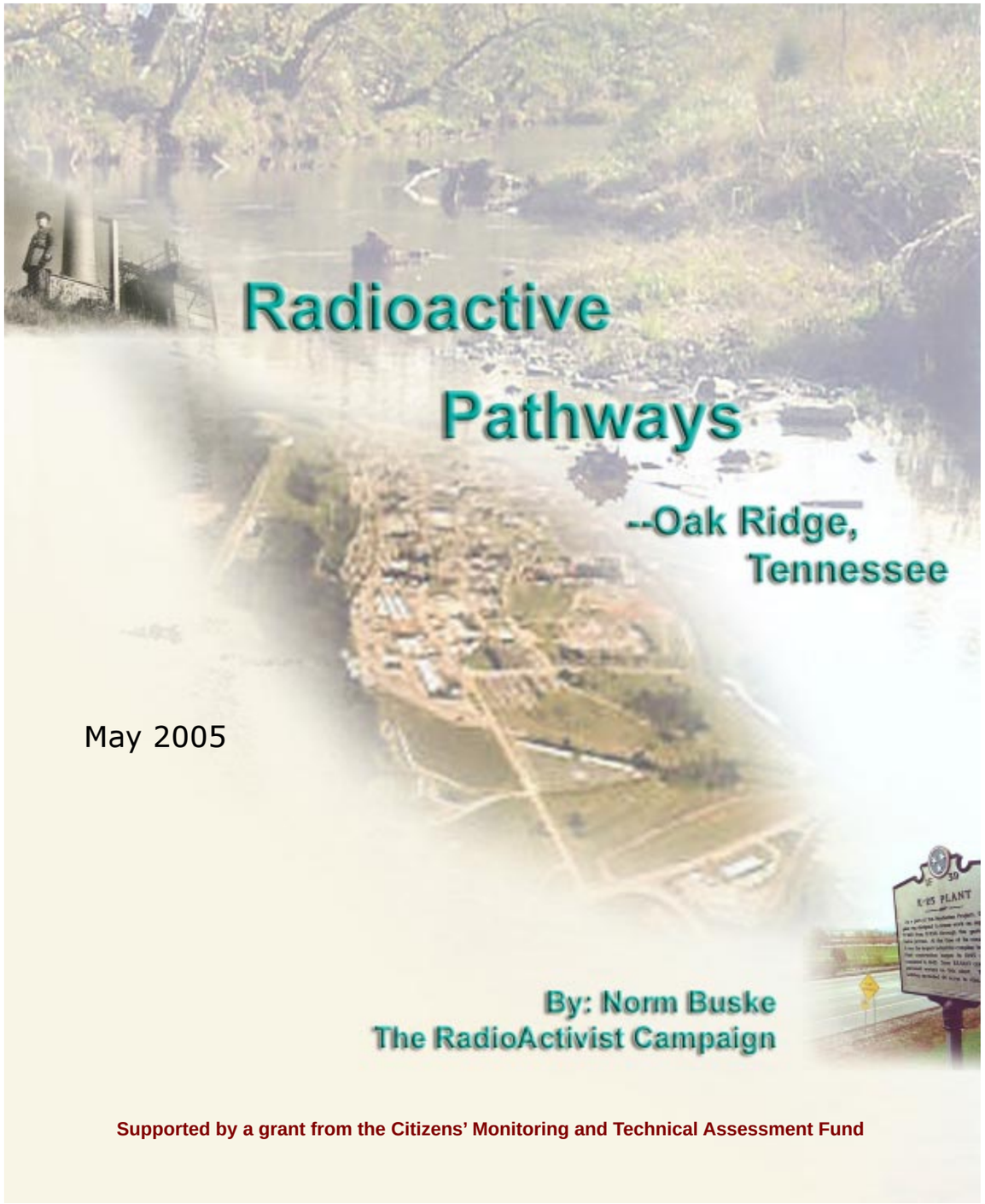

Supported by a grant from the Citizens' Monitoring and Technical Assessment Fund

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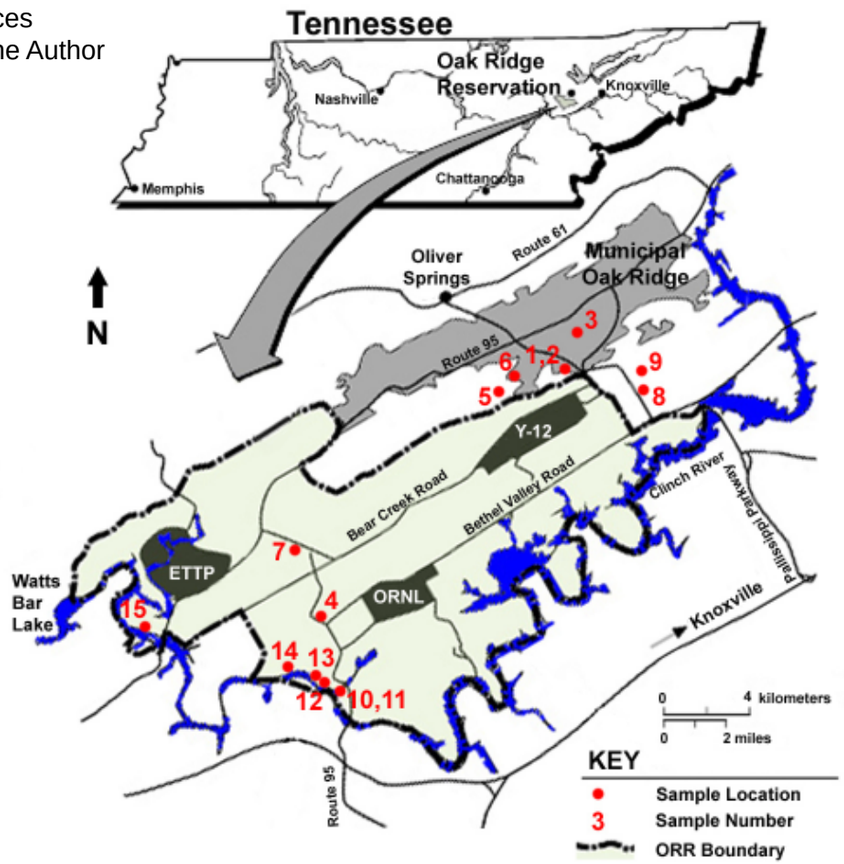


Oak Ridge Reservation (ORR) map and TRAC's sampling locations. The main ORR facilities are the East Tennessee Technology Park (ETTP), Oak Ridge National Laboratory (ORNL), and the Y-12 National Security Complex (Y-12).

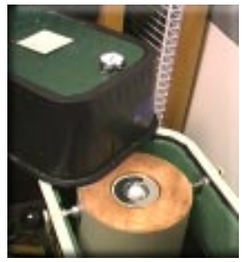
Summary

In November 2004, a non-profit scientific organization, The RadioActivist Campaign (TRAC), conducted a radiological survey around the Oak Ridge Reservation (ORR) in Oak Ridge, Tennessee. TRAC collected 15 environmental samples from 8 candidate, radiological pathways from ORR into the surroundings. TRAC selected samples based on official reports, concerns expressed by citizens, and availability of material.

TRAC analyzed the samples in its own laboratory. TRAC used two radiological indicators (Pb/U and Cs-137) to determine whether the radioactivity of each sample was of *ORR* origin or of *natural* origin. Four radionuclides are reported here:

strontium-90
uranium-238
radium-226
thorium

TRAC's laboratory is sensitive to about a hundred radionuclides that decay with primary or secondary emissions of photons in the 3 - 3,000 KeV range. TRAC's laboratory does not report tritium (H-3), carbon-14, plutonium, and some other radionuclides of interest.



TRAC's spectrometer can detect a hundred radionuclides.

TRAC found radioactivity of ORR origin in five of the 8 pathways tested. Each of those positive results is associated with a deficiency of official monitoring. **The most notable deficiency is the failure to address contaminated groundwater from ORR, which is still largely *out of sight and out of mind*.** This deficiency will become a severe, long lasting, intractable problem in future decades, unless substantial improvements are made.

The pathway of greatest concern expressed by citizens – radioactive fallout from atmospheric releases – tested at no more than a trace of radioactivity from ORR. This is an important and unexpected testament to ORR's improved management practices and to public oversight of those improvements.

In TRAC's survey, **the radionuclides of greatest concern from ORR were strontium-90 (Sr-90) and radium-226 (Ra–226)**. Ra-226 is the base material for intense sources of neutrons. Intense neutron sources can produce *blocked* isotopes for micro-nuclear weapons. Ra-226 of ORR origin thus evidences new pollution already seeping out from a new generation of weapons production.

Introduction to Oak Ridge

Wheat was one of the small communities cleared to develop the Oak Ridge Reservation (ORR).

Before 1942, what is now Oak Ridge, Tennessee, was a rural area of fairly isolated farming communities including Scarboro, East Fork, Bethel, and Wheat, 25 miles west of the city of Knoxville. On September 29, 1942, Henry Stimson, Undersecretary of War, authorized acquisition of 91.5 square miles of Tennessee land as one of three national sites to develop nuclear weapons.

Within weeks, thousands of workers, scientists, and engineers swarmed to the countryside to build and operate Manhattan Project facilities to supply nuclear materials for the first atomic bombs. The project was named the Clinton Engineer Works.

To accommodate the workers and their families, the government built permanent housing nearby. The housing area was fenced, with guards posted at entrance gates, and access was restricted to workers and residents. Oak Ridge, the "Secret City," was born. For the first seven years, Oak Ridge was not located on any maps, despite a peak population of over 70,000.

Construction of the first Oak Ridge facility, the Graphite Reactor, began in February 1943. Oak Ridge facilities began producing plutonium for nuclear weapons in 1944. Y-12 enriched the uranium for the bomb dropped on Hiroshima, Japan, on August 6, 1945, signaling the end of World War II.

By 1947, Oak Ridge had become the most modern manufacturing complex in the world. In May 1959, a municipal government was established, incorporating 92 square miles into the City of Oak Ridge. This area includes almost all of the present-day 53 square miles of the U.S. Department of Energy's (DOE's) Oak Ridge Reservation (ORR) and 24 square miles zoned residential, commercial, or light industrial.

The main clusters of facilities in the Oak Ridge Reservation are the Y-12 National Security Complex (Y-12), the Oak Ridge National Laboratory (ORNL), and the East Tennessee Technology Park (ETTP).

The Graphite Reactor (right), went critical in November 1943 and began producing plutonium early in 1944.

In addition to nuclear weapons research and development, modern Oak Ridge facilities work on programs ranging from neutron-related science to environmental cleanup.

After the Cold War, the missions of Y-12 and ORNL were expanded and now range from nuclear weapons research and development to environmental cleanup. Y-12 has been designated the National Prototype Center in recognition of its unique capabilities regarding nuclear weapons. ORNL is an international leader in neutron-related science and technology, computing, materials science, and environmental research. ETTP is completing cleanup in transition to becoming a commercially "reindustrialized" area.

Y-12 and ORNL are undergoing major improvements leading to safer operations with better environmental quality. ORR's environmental program focuses on cleaning up old wastes and includes aggressive efforts to properly manage new wastes.

DOE and the Tennessee Department of Environment and Conservation (TDEC) have made Oak Ridge one of the most monitored, sampled, and analyzed areas of the world. As a result, many residents believe that "Oak Ridge is one of the safest cities in which to live [*Oak Ridge, Tennessee*, Oak Ridge Chamber of Commerce (March 2002)]." A number of reports conclude that ORR operations do not threaten the Oak Ridge environment, or the health of residents, where they live, work, study, or play.

Despite those public assurances, some citizens worry that official studies overlook the communities' radiological problems. Some residents are concerned that ORR operations have made Oak Ridge an unhealthy place to live.

Between November 2 and 6, 2004, The RadioActivist Campaign (TRAC) conducted an independent radiological reconnaissance of Oak Ridge, outside fenced and posted areas of ORR. This is the report of that study.

Checking background levels at Bear Creek as part of TRAC's radiological reconnaissance around ORR.

Introduction to This Study

TRAC collected grass from East Fork Poplar Creek to test for artificial radioactivity.

In 2004, The RadioActivist Campaign (TRAC) obtained a grant from the Citizens' Monitoring and Technical Assessment Fund (MTA Fund) to study radioactive pathways from the Oak Ridge Reservation (ORR) into the unfenced, unposted surroundings.

The MTA Fund was established as part of a 1998 court settlement between the U.S. Department of Energy (DOE) and 39 non-profit peace and environmental groups around the country. The MTA Fund has provided money to non-profit, non-governmental organizations for research and monitoring relating to the U.S. nuclear weapons complex (**www.mtafund.org**).

The RadioActivist Campaign is a scientific project of the non-profit Tides Center of San Francisco. TRAC is based in Belfair, WA. TRAC's staff has conducted independent radiological investigations around nuclear facilities, worldwide, since 1983 (**www.radioactivist.org**).

TRAC prepared for this study by reviewing documents by DOE and the Tennessee Department of Environment and Conservation (TDEC) and by soliciting concerns of citizens neighboring ORR. TRAC was denied access to documents at the DOE Information Center. TRAC began field study at Oak Ridge on November 2, 2004.

TRAC checked its reference information against the Oak Ridge setting. TRAC held a public meeting and listened to the concerns of citizens and public-interest groups for comparison to TRAC's study plan. TRAC also met with the City of Oak Ridge's Environmental Quality Advisory Board. TRAC updated ORR Operations daily, to assure compatibility of activities. However, after TRAC sampled aquatic moss from an unposted, unfenced stretch of Bear Creek, next to Route 95, DOE banned TRAC from access to ORR, including all unposted, unfenced areas. TRAC then revised its plan to collect some samples, from creeks draining ORR, by boat on the Clinch River.

Bear Creek, one of the main contaminant pathways from ORR, had high levels of radioactivity and lacked adequate warning signs.

TRAC completed sampling on November 6, 2004. TRAC prepared the 15 environmental samples and analyzed them in an in-house, single-pass, photon spectrometer.

Approach

Sample Selection: TRAC identified potential pathways of radioactive contaminants from ORR into the surroundings; based on DOE and TDEC reports, on community concerns, and on TRAC's experience and observations. TRAC's sampling was restricted by fences, signs, and finally by a DOE ban on any access to ORR. TRAC was thereby restricted from scientific sampling in areas accessible to members of the public, such as scouts and hunters. DOE's ban on independent sampling in ORR's unposted and unfenced areas diminishes overall public confidence in official assurances of environmental quality and public safety in Oak Ridge.

TRAC sampled airborne (fallout) and waterborne (ground- and surface water) pathways. TRAC focused on sampling vegetation, due to its *bioaccumulation* of contaminants. Bioaccumulation **concentrates** contaminants of biological concern.

Sample Collection: TRAC clipped green grass blades (Samples 2, 3, and 4), sorrel leaves (Sample 11), and privet fruit (Samples 12 through 15) high enough above ground that dust was not of concern. These samples were bagged directly. TRAC collected water Sample 10 directly into a 20 liter plastic cubitainer.

The other 6 samples —mosses, liverwort, and clam shells— contained evident dust or sediments and were carefully washed in ambient creek or spring water. The moss and liverwort samples were scrubbed in a sieve and flushed in a mesh bag, breaking attached material free. The detached material was then eliminated by flotation or sedimentation.

Sample Preparation and Analysis: TRAC recorded each sample "wet" and "dry" (oven dried to <100°C) weight. The "wet/dry" values in the results (Pages 6 - 7) are the ratios of "wet" weight to "dry" weight. TRAC filtered water Sample 10 to 8µm to remove debris and then quiescently evaporated it in a special microwave oven, to a paste residue on plastic film. TRAC then placed each prepared sample into a *standard counting geometry* of 52 grams gross weight (about 35 grams net weight) in a 130mL counting bottle.

Each of the 15 samples was analyzed in TRAC's in-house, wide-band, photon spectrometer for one or more counting times of 23 hours each. This highly stabilized spectrometer is relatively sensitive to electromagnetic energy between 3 and 3,000 KeV. Tritium (H-3), carbon-14, and plutonium are not ordinarily reportable by TRAC's method. See "TRAC's Field and Laboratory Methods" posted at **www.radioactivist.org/methods.html**, for more information.

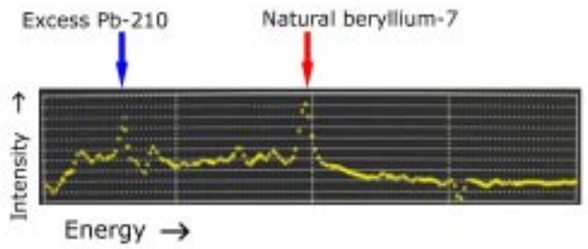
All data passed validation with the exception of Sample 8 which TRAC judged to have inconsistent indicators of contaminant origin.

Results of Independent Radiological Monitoring Around Oak Ridge

Sample No.	Latitude N. degrees	Longitude W. degrees	LOCATION DESCRIPTION		Sample Medium	wet/dry	INDICATORS Pb/U	RADIONUCLIDES OF CONCERN pCi/kg(wet) Cs-137	Sr-90	U-238	Ra-226	Thorium	Sample No.
BKG	47.40310	122.94957	Hood Canal, WA	high background reference from composition roof	terrestrial moss	6.98	>30.				198.	83.	BKG
1.	36.00168	84.24924	East Poplar Creek	Scarboro, beyond end and N. of Woodbury Ln.	clam shell	1.17	<0.		840.				1.
2.	36.00168	84.24924	East Poplar Creek	Scarboro, beyond end and N. of Woodbury Ln.	green grass	5.06	0.2			54.		93.	2.
3.	36.00760	84.24916	Woodland	creek-side, W of Manhattan and Northwestern intersect	green grass	5.90	>30.				25.		3.
4.	35.91759	84.33585	Rt. 95, Bethel V. Rd.	east shoulder of Rt. 95, N. of Bethel Valley Road	green grass	5.41	>30.	1. ± 4.			29.		4.
5.	35.99381	84.26739	Scarboro, Oak Valley	old rd., W. of Hampton Rd., N. of Baptist Church	terrestrial moss	5.93	50.			8.	107.		5.
6.	35.99815	84.26574	Scarboro, Trib. Creek	N. side of Tuskegee Dr., opposite South Fisk Ave.	aquatic moss	7.07	0.7	8. ± 3.		28.	511.	214.	6.
7.	35.94374	84.34515	Bear Creek (Rt. 95)	W. side of Rt. 95, 1/4 mile N. of Bear Creek Rd.	aquatic moss	7.72	0.1	17. ± 3.	403.	469.	903.	505.	7.
8.	35.99760	84.22353	U. Tenn. Arboretum	on boulder, E. of creek, 1/4 mile NW of visitor center	terrestrial moss	5.04	38.	39. ± 4.		18.	159.	17.	8.
9.	36.00066	84.22262	Cattail Spring	S. of Union Rd. and residence, E. of driving range	liverwort	23.0	>30.				86.	33.	9.
10.	35.89667	84.33305	White Oak Creek	on Clinch River side of discharge, from main flow	surface water	—*	0.1	35. ± 0.	47. ± 8.	0.4		0.9	10.
11.	35.89667	84.33305	White Oak Creek	as above, from both sides of mouth of creek	sorrel	13.2	0.1	1270. ± 10.	2550.	19.		55.	11.
12.	35.90151	84.34170	Creek (between 11 & 13)	at creek mouth, N. side of Clinch River	privet fruit	4.11	0.1		856.	7.			12.
13.	35.90248	84.34366	Melton Creek	at creek mouth, N. side of Clinch River	privet fruit	4.09	0.9	18. ± 4.	~81.	7.			13.
14.	35.89795	84.33575	Jones Island Creek	at creek mouth, N. side of Clinch River	privet fruit	3.47	>30.						14.
15.	35.91638	84.41463	Clinch River at ETTP	north shore, by old power house	privet fruit	3.52	<0.	12. ± 5.		8.		62.	15.
REF				**EPA primary standards, as reference only**	**drinking water**			**200.**	**8.**	**21.**	**3.**	**5.****	**REF**

- Latitudes and Longitudes are Global Positioning System on datum WGS 84.
- Sample collection times are in the Data Report at **www.radioactivist.org/ORRreports.html**.
- See map on inside front cover for sampling locations.

Results are reported in units of picocuries/kilogram(wet weight) [= pCi/kg(wet)]. These units allow direct comparisons of radioactivities of samples of different materials (media). Noting that one liter of water has a mass of one kilogram, results are directly comparable to Drinking Water Standards for radionuclides. Furthermore, bioaccumulation factors are simple ratios of radioactivities in biota to radioactivities in their water substrate, without any unit conversions.



Sample 5 spectrum at completion of analysis. TRAC used excess Pb-210 divided by previously analyzed uranium as one indicator of whether the radioactivity was of ORR origin.

One pCi/kg(wet) is equivalent to one nuclear decay per minute, in a pound of wet sample (for example, a pint of water).

To convert pCi/kg(wet) to pCi/g(dry), multiply by 0.001 x wet/dry ratio. To convert pCi to Becquerels (Bq), multiply by 0.037.

* 21.79 kg (= 21.79 liters) surface water sample from mouth of White Oak Creek, coarse filtered (8 µm, Whatman 2V paper) to remove debris.

** As equilibrium with decay product Ra-228.

± values are one standard deviation, counting uncertainty.

Blank spaces in table mean No Detection.

Pb/U	Ratio of disequilibrium (excess) decay product lead-210 (Pb-210) to parent uranium-238. Pb/U is an indicator of the source of U-238 in some environmental samples. If the source is natural, Pb/U often has a high value (>30) in vegetation and other samples. Values listed as ">30" and "<0" have No Detection of U-238. If the source is uranium separated from other elements, Pb/U often has a low value (<1) in vegetation and other samples. See the Discussion.
Cs-137	Cesium-137 (half-life = 30 years) is a product of nuclear fission —a beta particle emitter that mimics potassium.
Sr-90	Strontium-90 (half-life = 29 years) is a product of nuclear fission —a beta particle-emitting bone-seeker.
U-238	Uranium-238, the abundant (99.3%) isotope of natural uranium (half-life = 4.5 billion years) —an alpha particle-emitting bone-seeker.
Ra-226	Radium-226 (half-life = 1599 years) is an intermediate decay product of U-238 —an alpha particle-emitting bone-seeker.
Thorium	Natural thorium and decay progeny (half-life = 14 billion years) —an alpha particle-emitting bone-seeker.

Discussion

TRAC sampled vegetation from potential contaminant pathways.

This discussion of the radiological results is arranged by pathways of concern for migration of radioactivity from ORR into its surroundings. This focus on pathways accords with interests expressed by Oak Ridge residents.

For each of the 8 pathways TRAC sampled, this discussion includes the concern and rationale for sampling, a description of the relevant samples collected, the results, and some implications.

There is also a somewhat different interest in identifying *radionuclides of concern* around ORR. That interest is suggested by the arrangement of the columns in the radiological results. The first two columns, "Pb/U" and "Cs-137," are indicators of contamination origin. Pb/U <1 and Cs-137 >0 indicate contamination primarily of ORR origin. Appropriate concern for the other radionuclides in the table can then be assessed in terms of their levels in comparison to natural background and reference levels, the importance of pathways they contaminate, and their implications in context. The Data Report at **www.radioactivist.org/ORRreports.html** discusses each radionuclide reported in the present study and implications of their presence.

Radium-226 of ORR origin is of particular concern because Ra-226 is the base material for intense sources of neutrons (PbBiPo-214 α into BeT_2 → ~1 Ci/µg). Such intense neutron sources can be used to produce *blocked* isotopes, such as curium-250, on an industrial scale, for micro-nuclear weapons. Ra-226 of ORR origin thus evidences pollution from a new generation of weapons production already contaminating surrounding waters.

Atmospheric pathway: radioactive fallout downwind of ORR: ORR's neighbors expressed most concerns for radioactive fallout, downwind of Y–12 and ORNL. At one extreme were concerns that fallout from ORR was, and still might be, a serious health threat to the community. At the other extreme, air monitoring was viewed as a waste of resources resulting from false allegations intended to detract from a sense of community well being and to lower property values.

Moss collected from the Scarboro community tested negative for fallout from ORR.

TRAC discussed fallout scenarios with residents, exploring anecdotes and wind patterns. TRAC collected

Moss from the arboretum had only a "trace" of fallout attributable to ORR.

grass Sample 3 and terrestrial moss Samples 5 and 8 from downwind of ORR to directly assess fallout. Samples BKG, 4, and 9 provided context.

Results were negative. The only indication of fallout was 39 pCi/kg(wet) of Cs-137 in Sample 8. Considering the propensity of terrestrial mosses to bioaccumulate Cs-137 from fallout, this positive result amounts to a "trace" of fallout. The uranium content of Sample 8 was not attributable to ORR.

Whatever the history of fallout from ORR, with modernized operations and increased public oversight, the area downwind of ORR is now evidently practically free of radioactive fallout.

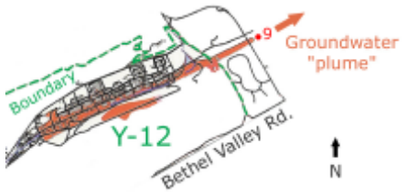
Ground/surface water pathway: contaminated stream in Scarboro: Scarboro residents expressed frustration that their concerns for contaminated water seeping from ORR into Scarboro had not been addressed. TRAC compared maps of DOE, TDEC, and Environmental Protection Agency [SESD Proj. 01-1222, September 2002] sampling locations with the locations of community concerns. Residents pointed to a stream emerging from the north side of Y-12, flowing north along the east side of South Fisk Avenue, and joining East Fork Poplar Creek west of the intersection of Tusculum Drive and East Tulsa Road. That stream is shown on the "Oak Ridge & Anderson County, TN Street Map [Superior Mapping Company, Knoxville, TN (2004)]." TRAC collected Sample 6 from the stream to address this specific concern.

Results were positive. Both Pb/U <1 and Cs-137 >0 indicated contamination of ORR origin. Ra-226 and thorium tested far above natural background, at 511 and 214 pCi/kg(wet), respectively. Radioactive contamination of this moss was almost half the contaminant levels of comparable moss from highly contaminated Bear Creek.

These positive results demand priority follow-up, with radionuclide-specific and toxicant analyses of water and biota. This stream should be posted to warn against human contact. Underlying groundwater contamination should be investigated.

The suggestion that government agencies side-stepped a clearly stated community concern warrants procedural investigation.

TRAC collected samples from this tributary in Scarboro, which tested positive for thorium and radium-226.



Union Valley groundwater plume (orange). Red dot is TRAC's Sample 9 location.

Groundwater pathway: Union Valley plume: The most widely known pathway of contaminated groundwater emerging from ORR is the Union Valley groundwater plume; see figure. This groundwater plume is routinely sampled at Cattail Spring, at the east end of the plume. Government agencies have reported volatile organics (acetone, trichloroethene, and carbon tetrachloride) and a fission product (technetium-99) in the spring water. TRAC decided to check Cattail Spring by sampling the dominant vegetation on the cracked pavement over the spring. TRAC collected liverwort as Sample 9.

Results were negative. TRAC found no evidence of artificial radioactivity in Cattail Spring, seeping from the east end of the Union Valley groundwater plume.

Groundwater pathway: seepage from ETTP into the Clinch River: Concerned citizens suggested that TRAC sample ETTP. TDEC's 2003 "Environmental Monitoring Report [Page 4-3]" cast doubts on the effectiveness of DOE's program of monitoring contaminated springs: "Nearly every year the division [TDEC] discovers a contaminated and unmonitored new spring i.e. a spring not in any of the DOE surveillance programs." For example, in 2003, TDEC discovered another contaminated spring, dubbed the J.A. Jones Spring, at ETTP. DOE banned TRAC from access to ETTP to collect environmental samples. Unfortunately, heavy rain raised Watts Bar Lake enough to preclude TRAC from sampling shoreline springs by boat. TRAC collected Sample 15 to check on general seepage from ETTP into the Clinch River.

Results were marginal. Both indicators suggested contamination of ORR origin, but values were minimal. Considering the limitations of this study, these findings suggest that investigation of contaminated groundwater seepage from ETTP into the Clinch River should be a priority. Biological indicators (such as TDEC's *BIOINDs*), should be used much more extensively to discover and monitor contaminated groundwater from ORR facilities.

Berries collected near ETTP had low levels of artificial radioactivity.

Surface water pathway: East Fork Poplar Creek: TRAC was advised not to collect samples from East Fork Poplar Creek, because it had already been remediated and TRAC would waste resources sampling there. TRAC collected empty clam shells, Sample 1, to check for Sr-90, and green grass, Sample 2 to check for other radionuclides. There were no signs along the south side of East Fork Poplar Creek warning against water uses.

Clams collected from East Fork Poplar Creek had strontium-90 at 100 times the EPA reference level.

Results were positive. The clam shells contained Sr-90 = 840 pCi/kg(wet), attributable to Y-12. This Sr-90 in clam shells could not be reconciled with the minuscule levels of Sr-90 reportedly discharged from Y-12 outfalls that are monitored. The grass contained 54 pCi/kg(wet) of U-238 attributable to Y-12. Thorium at 93 pCi/kg(wet) was probably attributable to Y–12.

The source of Sr-90 contamination should be identified by sampling clam shells farther upstream in East Fork Poplar Creek.

A lesson to be learned: Monitoring should not stop just because some problems are fixed. Monitoring of East Fork Poplar Creek should be increased and remediation continued to reduce radiological contamination.

Surface water pathway: Bear Creek: Bear Creek Valley has several old disposal areas that have been or are being remediated. DOE and TDEC monitor Bear Creek for contaminants and report the results annually. Uranium is reported in creek water. TDEC collects aquatic vegetation in the creek valley at BIOINDs -03, -17, -18, and -19. TDEC's radiological results for 2003 were nominal. TRAC collected Sample 7 as a comparison with government documentation.

BIOIND = biological indicator sampling location

Results were positive. Both indicators (Pb/U <1, Cs-137 >0) showed contamination of ORR origin. U–238, Ra–226, and thorium were the highest levels of these contaminants found in the present study.

Monitoring of Bear Creek should be expanded to include more BIOINDs, and additional toxicant analyses. Bear Creek should have signs warning against human contact, wherever the creek is accessible from public roads.

This inadequacy of monitoring and reporting should be addressed as a shortcoming of ORR management and public oversight.

Moss collected from Bear Creek had high levels of radium-226, strontium-90, and thorium, as well as uranium that had been previously reported.

ORR wastes discharged from White Oak Creek into the Clinch River influence the environment over a half mile downstream.

Surface water pathway: White Oak Creek discharge into the Clinch River: Residents advised TRAC not to sample the White Oak Creek discharge into the Clinch River, because it has been more than thoroughly sampled, analyzed, and reported. Despite that sampling, the closest TDEC BIOIND location is at Jones Island Creek, over a mile downstream of the discharge. TDEC's BIOIND-23 sample of green algae yielded Cs–137 = 416 pCi/kg(wet). TRAC collected samples 10 through 14 to check reported radioactivities.

Results were positive, from the White Oak Creek discharge halfway downstream to Jones Island Creek. Surface water Sample 10, collected below the White Oak Creek discharge, contained Cs-137, Sr-90, and uranium at levels in the range reported by DOE. Bioaccumulation factors for sorrel at that location are the ratio of levels in Sample 11, divided by the levels in Sample 10:

radionuclide	bioaccumulation factor		
Cs-137	**1270 / 35**	**=**	**36**
Sr-90	**2550 / 47**	**=**	**54**
U-238	**19 / 0.4**	**=**	**48**
Thorium	**55 / 0.9**	**=**	**61**

The bioaccumulation of uranium and thorium in sorrel is as great as the bioaccumulation of cesium and strontium. This peculiarity invites a check of the chemical states of uranium and thorium discharged from ORR.

These positive results extended downstream 0.7 miles (Sample 13).

The ORR shoreline of the Clinch River should be signed warning against human contact for at least 0.7 miles downstream from the White Oak Creek discharge. Bioaccumulation of radionuclides and toxics in various BIOINDs should be investigated in this area.

Transportation accident pathway: Route 95 Spill: On May 14, 2004, a waste truck carrying Sr-90 leaked onto Route 95, northbound from Bethel Valley Road. The roadway was repaved. TRAC collected Sample 4 to check whether a radiological problem remained six month later.

Results were negative. According to this check, DOE's remediation succeeded.

Grass sampled at Bethel Valley Road tested negative for strontium-90 from a May 2004 waste truck spill.

Conclusions

1. There probably has not been any large-scale, radioactive fallout at Oak Ridge over the last decade. This is a tribute to consistently improved operations at ORR.
2. Contaminated surface water pathways from ORR are substantially under-studied, under-reported, and are not remediated as claimed. Contaminated streams are inadequately signed warning against human contact.
3. Contaminated groundwater pathways from ORR are largely unidentified and unexplored. Despite clear evidence of rapidly flowing underground streams emerging at pathway exit springs, DOE and regulators cling to outdated concepts of slow-moving groundwater migration along diffuse *plumes*. This misconception will prove costly in the future, because extensively contaminated groundwater is expensive or impossible to remediate.
4. TRAC identified high levels of contamination in a seepage/stream from Y-12 flowing into Scarboro. This identification points to serious failure by government agencies to address a specific, long-standing, clearly articulated concern of residents. This pathway evidences pollution from new nuclear weapons production already contaminating ORR's surroundings.

Recommendations

1. The management and oversight that have led to consistent improvements in air quality in Oak Ridge should be continued.
2. These same arrangements should be extended to include surface and groundwater quality, throughout the City of Oak Ridge, including ORR. This will require a more discerning outlook, because contaminated surface water and groundwater are not in every backyard.
3. The accomplishments of the many people and organizations who have worked so hard to make Oak Ridge a good place to live should serve as a solid foundation for more progress, not as a crowning achievement. More focus on problems and their solutions and less focus on public relations will better serve Oak Ridge over decades to come.
4. The problems described in Conclusions 2 through 4 should be solved.
5. More attention should be directed to radioactive contaminants other than uranium [for example, strontium-90, radium-226, and thorium (with decay products)].

Resources

Save Our Cumberland Mountains
865.426.9455
www.socm.org

Blue Ridge Environmental Defense League
P.O. Box 88
Glendale Springs, NC 28629
336.982.2691
www.bredl.org

Scarboro Community Environmental Justice Council, Inc. (501(c)(3) Nonprofit)
C/o James B. Hill, Jr., Chairman & CEO
233 Tusculum Drive
Oak Ridge, TN 37830
865.481.0027
Email: **jbhilljr@juno.com**

Department of Energy
Oak Ridge Operations
P.O. Box 2001
Oak Ridge, TN 37831
865.576.0885
www.oro.doe.gov/

Tennessee Departartment of Environment and Conservation
DOE Oversight Division
761 Emory Valley Road
Oak Ridge, TN 37830
865.481.0995
www.state.tn.us/environment/doeo/

About the Author

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

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 2003 - 2004, TRAC measured radioactivity around five DOE sites: Hanford, Washington; Los Alamos National Laboratory, New Mexico; Savannah River Site, South Carolina; Lawrence Livermore National Laboratory, California; and the Oak Ridge Reservation, Tennessee.

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