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*Oak Ridge Reservation*

# Annual Site Environmental Report **2021**

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Cover Image

Richard G. Schwartz,  
Oak Ridge National Laboratory

Design

Professional Project Services, Inc.

# Oak Ridge Reservation Annual Site Environmental Report 2021

**US Department of Energy  
project manager and Oak Ridge Reservation  
coordinator:**

Katatra Vasquez

**Technical coordinators:**

Y-12 National Security Complex:

Paula Roddy  
Chloe Hutchison

Oak Ridge National Laboratory:

Joan Hughes  
Walt Doty

East Tennessee Technology Park:

Mike Coffey  
Roger Petrie

**Project director:**

James J. Rochelle

**Project coordinator:**

Kimberly L. Davis, PhD

**Integrating editor:**

Teresa J. Thompson

**Technical support:**

Ellen J. Wald

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**DOE contact:** If you have questions or comments about the ASER documents, or wish to provide review comments or suggestions for improvement, please complete the survey at the bottom of the web page at the link above, or contact Katatra Vasquez, DOE/SC, at [katatra.vasquez@science.doe.gov](mailto:katatra.vasquez@science.doe.gov).

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# Acronyms and Abbreviations

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<b>A</b>	ACM	asbestos-containing material
	AFFF	aqueous film-forming foams
	ANSI	American National Standards Institute
	AOEC	Agent Operations Eastern Command
	AROD	amended record of decision
	ASER	<i>Oak Ridge Reservation Annual Site Environmental Report</i>
	AWQC	ambient water quality criterion
<b>B</b>	BCG	biota concentration guide
	BCK	Bear Creek kilometer
	BFK	Brushy Fork kilometer
	BMAP	Biological Monitoring and Abatement Program
<b>C</b>	CAA	Clean Air Act
	CAP-88 PC	Clean Air Act Assessment Package-1988 (software)
	CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
	CFR	<i>Code of Federal Regulations</i>
	CFTF	Carbon Fiber Technology Facility
	CNS	Consolidated Nuclear Security, LLC
	COLEX	column exchange
	COVID-19	Coronavirus Disease 2019
	CRK	Clinch River kilometer
	CROET	Community Reuse Organization of East Tennessee
	CWA	Clean Water Act
	CWTS	ETTP Chromium Water Treatment System
	CY	calendar year
	<b>D</b>	D&D
DCE		dichloroethene/dichloroethylene
DCS		derived concentration standard
DMRQA		Discharge Monitoring Report Quality Assurance Study
DOD-ELAP		US Department of Defense Environmental Laboratory Accreditation Program
DOE		US Department of Energy
DOECAP		DOE Consolidated Audit Program
DU		depleted uranium
<b>E</b>	EA	environmental assessment
	EC&P	environmental compliance and protection
	ECD	Y-12 Environmental Compliance Department

	ED	effective dose
	EESP	Energy Efficiency and Sustainability Program
	EFK	East Fork Poplar Creek kilometer
	EFPC	East Fork Poplar Creek
	EM	DOE Office of Environmental Management
	EMS	environmental management system
	EMWMF	Environmental Management Waste Management Facility
	EO	executive order
	EPA	US Environmental Protection Agency
	EPCRA	Emergency Planning and Community Right-to-Know Act
	EPEAT	Electronic Product Environmental Assessment Tool
	EPSD	UT-Battelle Environmental Protection Services Division
	EPT	ephemeroptera, plecoptera, and trichoptera (taxa)
	e-RICE	emergency reciprocating internal combustion engine
	ES&H	environment, safety, and health
	ESPC	Energy Savings and Performance Contract
	ESS	ORNL Environmental Surveillance System
	ETTP	East Tennessee Technology Park
	EU	exposure unit
<b>F</b>	FCK	First Creek kilometer
	FFK	Fifth Creek kilometer
	FLC	Federal Laboratory Consortium
	FMD	ORNL Facilities Management Division
	FWS	US Fish and Wildlife Service
	FY	fiscal year
<b>G</b>	GHG	greenhouse gas
	GP	guiding principle
	GRID-C	Grid Research Integration and Deployment Center
	GSA	General Services Administration
<b>H</b>	HBCU	Historically Black Colleges and Universities
	HFIR	High Flux Isotope Reactor
	HPSB	high-performance sustainable building
	HQ	hazard quotient
	HVC	ORNL Hardin Valley Campus
<b>I</b>	IC <sub>25</sub>	25-percent inhibition concentration
	ISMS	integrated safety management system
	ISO	International Organization for Standardization
	Isotek	Isotek Systems, LLC
<b>L</b>	LEED	Leadership in Energy and Environmental Design

	LLW	low-level radioactive waste
	LPF	Lithium Processing Facility
<b>M</b>	M&E	material and equipment
	MAPEP	Mixed Analyte Performance Evaluation Program
	MARSAME	<i>Multi-Agency Radiation Survey and Assessment of Materials and Equipment Manual</i>
	MARSSIM	<i>Multi-Agency Radiation Survey and Site Investigation Manual</i>
	MBK	Mill Branch kilometer
	MCK	McCoy Branch kilometer
	MCL	maximum contaminant level
	MEI	maximally exposed individual
	MEK	Melton Branch kilometer
	MIK	Mitchell Branch kilometer
	MOA	memorandum of agreement
	MSRE	Molten Salt Reactor Experiment
	MT	meteorological tower
<b>N</b>	NAAQS	National Ambient Air Quality Standards
	NELAP	National Environmental Laboratory Accreditation Program
	NEPA	National Environmental Policy Act
	NESHAPs	National Emission Standards for Hazardous Air Pollutants
	NNSA	National Nuclear Security Administration
	NPDES	National Pollutant Discharge Elimination System
	NPO	NNSA Production Office
	NRC	US Nuclear Regulatory Commission
	NRHP	National Register of Historic Places
	NTRC	National Transportation Research Center
	NWSol	North Wind Solutions, LLC
<b>O</b>	ODS	ozone-depleting substance
	OLCF	Oak Ridge Leadership Computing Facility
	OREM	DOE Oak Ridge Office of Environmental Management
	ORETTC	Oak Ridge Enhanced Technology and Training Center
	ORGDP	Oak Ridge Gaseous Diffusion Plant
	ORISE	Oak Ridge Institute for Science and Education
	ORNL	Oak Ridge National Laboratory
	ORO	DOE Oak Ridge Office
	ORR	Oak Ridge Reservation
	ORSSAB	Oak Ridge Site Specific Advisory Board
	OST	Office of Secure Transportation
<b>P</b>	P2	pollution prevention
	PCB	polychlorinated biphenyl

	PCBADL	Polychlorinated Biphenyl Annual Document Log
	PCCR	phased construction completion report
	PCE	tetrachloroethene
	PFAS	per- and polyfluoroalkyl substances
	PFOA	perfluorooctanoic acid
	PFOS	perfluorooctane sulfonate
	PM <sub>10</sub>	particulate matter with an aerodynamic diameter ≤ 10 μm
	PM <sub>2.5</sub>	fine particulate matter with an aerodynamic diameter ≤ 2.5 μm
	PWTC	Process Waste Treatment Complex
<b>Q</b>	QA	quality assurance
	QC	quality control
	QMS	quality management system
<b>R</b>	R&D	research and development
	RA	remedial action
	Rad-NESHAPs	National Emission Standards for Hazardous Air Pollutants for Radionuclides
	RCRA	Resource Conservation and Recovery Act
	RMAL	Radiochemical Materials Analytical Laboratory
	ROD	record of decision
	RSI	Restoration Services, Inc.
	RTR	real-time radiography
<b>S</b>	SA	supplement analysis
	SARA	Superfund Amendments and Reauthorization Act
	SBMS	UT-Battelle Standards-Based Management System
	SC	DOE Office of Science
	SD	storm water outfall/storm drain
	SNS	Spallation Neutron Source
	SODAR	sonic detection and ranging
	SOF	sum of fractions
	SOP	state operating permit
	SPCC	spill prevention, control, and countermeasures
	SSP	site sustainability plan
	STP	sewage treatment plant
	SWEIS	sitewide environmental impact statement
	SWPP	storm water pollution prevention
	SWPPP	storm water pollution prevention plan
	SWSA	solid waste storage area
<b>T</b>	TCE	trichloroethene/trichloroethylene
	TDEC	Tennessee Department of Environment and Conservation
	TEMA	Tennessee Emergency Management Agency

	TMDL	total maximum daily load
	TMI	Tennessee Macroinvertebrate Index
	TRI	toxic chemical release inventory
	TRN	Technical Resilience Navigator
	TRO	total residue oxidant
	TRU	transuranic
	TSCA	Toxic Substances Control Act
	TSS	total suspended solids
	TVA	Tennessee Valley Authority
	TWPC	Transuranic Waste Processing Center
	TWRA	Tennessee Wildlife Resources Agency
<b>U</b>	UPF	Uranium Processing Facility
	USDA	US Department of Agriculture
	UST	underground storage tank
	UT	University of Tennessee
	UT-Battelle	UT-Battelle, LLC
<b>V</b>	VARP	Vulnerability Assessment and Resilience Planning
	VOC	volatile organic compound
<b>W</b>	WBK	Walker Branch kilometer
	WCK	White Oak Creek kilometer
	WEPAR	West End Protected Area Reduction
	WFMP	<i>Oak Ridge Reservation Wildland Fire Management Plan</i>
	WM/WRM	weapon material/weapon-related material
	WOC	White Oak Creek
	WOD	White Oak Dam
	WQC	water quality criterion
	WQPP	water quality protection plan
	WRRP	Water Resources Restoration Program
<b>Y</b>	Y-12 or Y-12 Complex	Y-12 National Security Complex

# Units of Measure and Conversion Factors\*

## Units of measure and their abbreviations

acre	acre	micrometer	µm
becquerel	Bq	millicurie	mCi
British thermal unit	Btu	milligram	mg
centimeter	cm	milliliter	mL
curie	Ci	millimeter	mm
day	d	million	M
degrees Celsius	°C	million gallons per day	MGD
degrees Fahrenheit	°F	millirad	mrad
disintegrations per minute	dpm	millirem	mrem
foot	ft	milliroentgen	mR
gallon	gal	millisievert	mSv
gallons per minute	gpm	minute	min
gram	g	nanogram	ng
gray	Gy	nephelometric turbidity unit	NTU
gross square feet	gsf	parts per billion	ppb
hectare	ha	parts per million	ppm
hour	h	parts per trillion	ppt
inch	in.	picocurie	pCi
joule	J	pound	lb
kilocurie	kCi	pound mass	lbm
kilogram	kg	pounds per square inch	psi
kilometer	km	pounds per square inch gauge	psig
kilowatt	kW	quart	qt
linear feet	LF	rad	rad
liter	L	roentgen	R
megajoule	MJ	roentgen equivalent man	rem
megawatt	MW	second	S
megawatt-hour	MWh	sievert	Sv
meter	m	standard unit (pH)	SU
metric tons	MT	ton, short (2,000 lb)	ton
microcurie	µCi	yard	yd
microgram	µg	year	yr

## Quantitative prefixes

exa	× 10 <sup>18</sup>	atto	× 10 <sup>-18</sup>
peta	× 10 <sup>15</sup>	femto	× 10 <sup>-15</sup>
tera	× 10 <sup>12</sup>	pico	× 10 <sup>-12</sup>
giga	× 10 <sup>9</sup>	nano	× 10 <sup>-9</sup>
mega	× 10 <sup>6</sup>	micro	× 10 <sup>-6</sup>
kilo	× 10 <sup>3</sup>	milli	× 10 <sup>-3</sup>
hecto	× 10 <sup>2</sup>	center	× 10 <sup>-2</sup>
deka	× 10 <sup>1</sup>	decic	× 10 <sup>-1</sup>

\*Due to differing permit reporting requirements and instrument capabilities, various units of measurement are used in this report. This list of units of measure and conversion factors is intended to help readers make approximate conversions to other units as needed for specific calculations and comparisons.

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Unit conversions

Unit	Conversion	Equivalent	Unit	Conversion	Equivalent
<b>Length</b>					
in.	× 2.54	cm	cm	× 0.394	in.
ft	× 0.305	m	m	× 3.28	ft
mile	× 1.61	km	km	× 0.621	mile
<b>Area</b>					
acre	× 0.405	ha	ha	× 2.47	acre
ft <sup>2</sup>	× 0.093	m <sup>2</sup>	m <sup>2</sup>	× 10.764	ft <sup>2</sup>
mile <sup>2</sup>	× 2.59	km <sup>2</sup>	km <sup>2</sup>	× 0.386	mile <sup>2</sup>
<b>Volume</b>					
ft <sup>3</sup>	× 0.028	m <sup>3</sup>	m <sup>3</sup>	× 35.31	ft <sup>3</sup>
qt	× 0.946	L	L	× 1.057	qt
gal	× 3.7854118	L	L	× 0.264172051	gal
<b>Concentration</b>					
ppb	× 1	µg/kg	µg/kg	× 1	ppb
ppm	× 1	mg/kg	mg/kg	× 1	ppm
ppb	× 1	µg/L	µg/L	× 1	ppb
ppm	× 1	mg/L	mg/L	× 1	ppm
<b>Weight</b>					
lb	× 0.4536	kg	kg	× 2.205	lb
lbm	× 0.45356	kg	kg	× 2.2046226	lbm
ton, short	× 907.1847	kg	kg	× 0.00110231131	ton, short
<b>Temperature</b>					
°C	°F = (9/5)°C + 32	°F	°F	°C = (5/9) (F-32)	°C
<b>Activity</b>					
Bq	× 2.7 × 10 <sup>-11</sup>	Ci	Ci	× 3.7 × 10 <sup>10</sup>	Bq
Bq	× 27	pCi	pCi	× 0.037	Bq
mSv	× 100	mrem	mrem	× 0.01	mSv
Sv	× 100	rem	rem	× 0.01	Sv
nCi	× 1,000	pCi	pCi	× 0.001	nCi
mCi/km <sup>2</sup>	× 1	nCi/m <sup>2</sup>	nCi/m <sup>2</sup>	× 1	mCi/km <sup>2</sup>
dpm/L	× 0.45 × 10 <sup>9</sup>	µCi/cm <sup>3</sup>	µCi/cm <sup>3</sup>	× 2.22 × 10 <sup>9</sup>	dpm/L
pCi/L	× 10 <sup>-9</sup>	µCi/mL	µCi/mL	× 10 <sup>9</sup>	pCi/L
pCi/m <sup>3</sup>	× 10 <sup>12</sup>	µCi/cm <sup>3</sup>	µCi/cm <sup>3</sup>	× 10 <sup>12</sup>	pCi/m <sup>3</sup>

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Justin Frazer  
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Sherry Gibson  
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Richard Ketelle  
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Tony Poole  
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Gill Sallade  
Cheryl Saylor  
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Wesley White

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Kevin Birdwell  
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Kathy Davidson  
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Jamie Evans  
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Taylor Frye  
Neil Giffen  
Wes Goddard  
Mark Goines  
Scott Gregory  
Natalie Griffiths  
Julie Hancock  
Amber Harshman  
Jamie Herold  
Hurtis Hodges  
Joan Hughes  
Trent Jett  
Kathy Jones  
Nikki Jones  
Richard Ketelle  
Walter Koncinski, Jr.  
Jessica Langstaff  
Jeff Maddox  
Michael Masters  
Teresa Mathews  
Paul Matson  
William McCarter  
Kitty McCracken  
Susan Michaud  
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Jesse Morris  
Lori Muhs  
Todd North  
David Pillard  
Karen Sabo  
Denise Saunders  
David Skipper  
George Stephens  
Searia Stephenson  
Louise Stevenson  
Patrick Garcia Strickland  
Terri Torres  
Erin Trent  
Steve Trotter  
Charlie Valentine

## **Y-12 COMPLEX**

Brandy Belicek  
Scott Brooks  
Vicki Brumback  
Mark Burdette  
Sara Cornwell  
Laura Cunningham  
Alexandra Detweiler  
Stan Duke  
Matthew Frost  
Paisley Gunter  
Kim Hanzelka  
Abigail Harmon  
Amber Harshman  
William C. Hurst  
Chloe Hutchison  
Steve Jones  
Kris Kinder  
Jennifer Linton  
Stacey Loveless  
Kenneth Lowe  
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Jane Nations  
Scott Nelson  
Terry Nore  
Elizabeth Owens  
Aprell Patterson  
Melanie Peterson  
Sandra Reagan  
Paula Roddy  
Beth Schultz  
Eugene Sievers  
Brad Skaggs  
Johnny Skinner  
Terri Slack  
Adam Smith  
Rae Spencer  
James Stinnett  
Larissa Welch  
Christian Wenzel  
Eve Whittenburg  
Jeannette Widman  
Rebekah Young