Oak Ridge Reservation

Annual Site Environmental Report 2020

Cover Image

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Oak Ridge Reservation
Annual Site Environmental Report
2020

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Acronyms and Abbreviations

A	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	*Oak Ridge Reservation Annual Site Environmental Report*
	AWQC	ambient water quality criterion
B	BCG	biota concentration guide
	BCK	Bear Creek kilometer
	BFK	Brushy Fork kilometer
	BMAP	Biological Monitoring and Abatement Program
C	CAA	Clean Air Act
	CAP-88	Clean Air Act Assessment Package (software)
	CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
	CFR	*Code of Federal Regulations*
	CFTF	Carbon Fiber Technology Facility
	CNS	Consolidated Nuclear Security, LLC
	COLEX	column exchange
	CRK	Clinch River kilometer
	CROET	Community Reuse Organization of East Tennessee
	CWA	Clean Water Act
	CWTS	ETTP Chromium Water Treatment System
	CY	calendar year
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
E	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
F	FCK	First Creek kilometer
	FFK	Fifth Creek kilometer
	FMD	ORNL Facilities Management Division
	FWS	US Fish and Wildlife Service
	FY	fiscal year
G	GHG	greenhouse gas
H	HFIR	High Flux Isotope Reactor
	HPSB	high-performance sustainable building
	HQ	hazard quotient
	HVC	ORNL Hardin Valley Campus
I	IC_{25}	25-percent inhibition concentration
	ISMS	integrated safety management system
	ISO	International Organization for Standardization
	Isotek	Isotek Systems, LLC
L	LEED	Leadership in Energy and Environmental Design
	LLW	low-level radioactive waste
	LPF	Lithium Processing Facility
M	M&E	material and equipment
	MAPEP	Mixed Analyte Performance Evaluation Program
	MARSAME	*Multi-Agency Radiation Survey and Assessment of Materials and Equipment Manual*

	MARSSIM	*Multi-Agency Radiation Survey and Site Investigation Manual*
	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
N	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
O	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
P	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_{10}	particulate matter with an aerodynamic diameter ≤ 10 µm

	$PM_{2.5}$	fine particulate matter with an aerodynamic diameter ≤ 2.5 µm
	PWTC	Process Waste Treatment Complex
Q	QA	quality assurance
	QC	quality control
	QMS	quality management system
R	R&D	research and development
	RA	remedial action
	Rad-NESHAPs	National Emission Standards for Hazardous Air Pollutants for
	RCRA	Resource Conservation and Recovery Act
	RMAL	Radiochemical Materials Analytical Laboratory
	ROD	record of decision
	RSI	Restoration Services, Inc.
S	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
T	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
	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
U	UPF	Uranium Processing Facility
	USDA	US Department of Agriculture
	UST	underground storage tank
	UT	University of Tennessee
	UT-Battelle	UT-Battelle, LLC
V	VOC	volatile organic compound
W	WBK	Walker Branch kilometer
	WCK	White Oak Creek kilometer
	WEPAR	West End Protected Area Reduction
	WOC	White Oak Creek
	WOD	White Oak Dam
	WQC	water quality criterion
	WQPP	water quality protection plan
	WRRP	Water Resources Restoration Program
Y	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	gal/min	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	$\times 10^{18}$	atto	$\times 10^{-18}$
peta	$\times 10^{15}$	femto	$\times 10^{-15}$
tera	$\times 10^{12}$	pico	$\times 10^{-12}$
giga	$\times 10^{9}$	nano	$\times 10^{-9}$
mega	$\times 10^{6}$	micro	$\times 10^{-6}$
kilo	$\times 10^{3}$	milli	$\times 10^{-3}$
hecto	$\times 10^{2}$	center	$\times 10^{-2}$
deka	$\times 10^{1}$	decic	$\times 10^{-1}$

**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.*

Unit conversions

Unit	Conversion	Equivalent	Unit	Conversion	Equivalent
Length					
in.	× 2.54	cm	cm	× 0.394	in.
ft	× 0.305	m	m	× 3.28	ft
mile	× 1.61	km	km	× 0.621	mile
Area					
acre	× 0.405	ha	ha	× 2.47	acre
ft^2	× 0.093	m^2	m^2	× 10.764	ft^2
$mile^2$	× 2.59	km^2	km^2	× 0.386	$mile^2$
Volume					
ft^3	× 0.028	m^3	m^3	× 35.31	ft^3
qt (US liquid)	× 0.946	L	L	× 1.057	qt (US liquid)
gal	× 3.7854118	L	L	× 0.264172051	gal
Concentration					
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
Weight					
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
Temperature					
°C	°F = (9/5)°C + 32	°F	°F	°C = (5/9) (F–32)	°C
Activity					
Bq	× 2.7×10^{-11}	Ci	Ci	× 3.7×10^{10}	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^2	× 1	nCi/m^2	nCi/m^2	× 1	mCi/km^2
dpm/L	× 0.45×10^9	$\mu Ci/cm^3$	$\mu Ci/cm^3$	× 2.22×10^9	dpm/L
pCi/L	× 10^{-9}	µCi/mL	µCi/mL	× 10^9	pCi/L
pCi/m^3	× 10^{12}	$\mu Ci/cm^3$	$\mu Ci/cm^3$	× 10^{12}	pCi/m^3

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In Memoriam

Photo courtesy of DOE

Lynn Freeny
1958 – 2021

Lynn Freeny grew up in East Tennessee, and was hired in 1992 as the third official DOE photographer for Oak Ridge. A familiar sight with his oversized camera bag slung over his shoulder, he documented newsworthy events such as visits from presidents and other dignitaries, groundbreaking and ribbon-cutting ceremonies, and important DOE milestones. He also captured tranquil scenes of wildlife and native plants, beautiful sunrises, and other everyday views of nature on the Oak Ridge Reservation; many have been included in the Oak Ridge Reservation Annual Site Environmental Reports over the years. Lynn used his passion for photography to tell the story of Oak Ridge through his expertly composed images. He not only chronicled events at Oak Ridge during his tenure, he was the acknowledged authority on the extensive collection of Manhattan Project photos taken by DOE's first Oak Ridge photographer, Ed Westcott. Lynn posted many of Westcott's images online, and often produced just the right photograph for an article, display, or document about Oak Ridge's impressive and unique history. As Ken Tarcza, manager of DOE's Office of Science Consolidated Service Center in Oak Ridge stated, "He was an artist as much as a photographer and captured so much more than an image when he pushed the shutter on a camera. Lynn's role in documenting both current and historic Oak Ridge activity cannot be understated. His passion for photography drove him to memorialize the broad, ongoing initiatives being undertaken by DOE in Oak Ridge, and his legacy will live on for years to come."

Photo courtesy of Suzy Peterson

Mark Peterson
1961 – 2020

Mark Peterson was born and raised in a small town near Chicago, and his lifelong love of all things aquatic began with the fishing trips he took with his dad on the great northern lakes. Early on, Mark decided to make understanding and protecting these ecosystems his life's work. After earning his Master's degree in Aquatic Ecology he moved to Oak Ridge and began his career with ORNL's Environmental Sciences Division, where he would remain for the rest of his life. He helped develop the Aquatic Ecology Laboratory into the world-class facility that it is today and helped guide its missions, both in research and in compliance and conservation. Although Mark was involved in DOE projects across the country, he is best known for his work here in Oak Ridge. Active in the field and in the lab, Mark mapped and documented aquatic resources such as wetlands all across the Oak Ridge Reservation. He was instrumental in the major upgrade of the Aquatic Ecology Lab. He worked with DOE and regulators such as TDEC and EPA to develop and manage the biological monitoring and abatement programs at the three main ORR sites, and he pioneered innovative remediation techniques to protect the environment while maximizing the return on the investment of resources. And, of course, when there were fish to be collected, Mark made every effort to be in on the action. Mark's love of nature and the great outdoors was evident throughout his career, and he was proud to devote his life to protecting and restoring natural resources for the use and enjoyment of all.