DOE/OR/01-1273/V1&D2/A1
Y/ER-182/V1+D2/A1

**Addendum to the Remedial Investigation Report
on Bear Creek Valley Operable Unit 2
(Rust Spoil Area, Spoil Area 1, and SY-200 Yard)
at the Oak Ridge Y-12 Plant,
Oak Ridge, Tennessee
Volume 1. Main Text**

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This addendum to the Remedial Investigation Report on Bear Creek Valley Operable Unit 2 includes revisions to four chapters of information that were a part of the previously issued document entitled *Remedial Investigation Report on Bear Creek Valley Operable Unit 2 (Rust Spoil Area, Spoil Area 1, and SY-200 Yard) at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee* (DOE/OR/01-1273/V1&D2). Specifically, Chaps. 2, 3, 4, and 9 herein include minor changes made to the previously issued D2 version of the document; these changes are noted herein with a WordPerfect redline feature in the margin where the changes have occurred. Volume 1 of this document is not being reissued in its entirety as a D3 version because only the four chapters just mentioned have been affected by requested changes. Volume 2 of this document is not being reissued because there were no changes that needed to be incorporated in Volume 2.

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Y/ER-182/V1&D2/A1

Energy Systems Environmental Restoration Program
Y-12 Environmental Restoration Program

**Addendum to the Remedial Investigation Report
on Bear Creek Valley Operable Unit 2
(Rust Spoil Area, Spoil Area 1, and SY-200 Yard)
at the Oak Ridge Y-12 Plant
Oak Ridge, Tennessee**

Volume 1. Main Text

Date Issued—April 1995

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Environmental Restoration and Waste Management Programs
OAK RIDGE Y-12 PLANT
Oak Ridge, Tennessee 37831-8169
managed by
MARTIN MARIETTA ENERGY SYSTEMS, INC.
for the
U.S. DEPARTMENT OF ENERGY
under contract DE-AC05-84OR21400

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PREFACE

This addendum to the Remedial Investigation (RI) Report on Bear Creek Valley Operable Unit (OU) 2 at the Oak Ridge Y-12 Plant (DOE/OR/01-1273/V1&D2/A1) was prepared in accordance with requirements under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) for reporting the results of a site characterization for public review. This work was performed under Work Breakdown Structure 1.4.12.1.1.02.42.10. This addendum is a supplement to a document that was previously issued in January 1995 and that provided the Environmental Restoration Program with information about the results of the 1993 investigation performed at OU 2. The January 1995 D2 version of the RI Report on Bear Creek Valley OU 2 included information on risk assessments that have evaluated impacts to human health and the environment. Information provided in the document formed the basis for the development of the Feasibility Study Report, DOE/OR/02-1279&D1.

This addendum includes revisions to four chapters of information that were a part of the document issued in January 1995. Specifically, it includes revisions to Chaps. 2, 3, 4, and 9; these changes have been noted herein with the WordPerfect redline feature in the margin where changes have occurred. Volume 1 of this document is not being reissued in its entirety as a D3 version because only the four chapters just mentioned have been affected by requested changes. Note also that Volume 2 of this RI Report on Bear Creek Valley OU 2 is not being reissued in conjunction with Volume 1 of this document because there have been no changes requested or made to the previously issued version of Volume 2 of this document.

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Table 2.9. Threatened and endangered plant and animal species potentially occurring on the Oak Ridge Reservation

Scientific name	Common name	Status	
		Federal ^a	State ^b
Flora			
<i>Aureolaria patula</i>	Spreading false foxglove	C1	E
<i>Carex gravida</i>	Gravid sedge		S
<i>Cimicifuge rubifolia</i>	Appalachian bugbane	C2	T
<i>Cypripedium acuale</i>	Pink lady's slipper		E*
<i>Delphinium exaltatum</i>	Tall larkspur	C2	E
<i>Diervilla lonicera</i>	Northern bush honeysuckle		T
<i>Elodea nuttallii</i>	Nuttall waterweed		S
<i>Fothergilla major</i>	Mountain witch alder		T
<i>Hydrastis canadensis</i>	Golden seal		T
<i>Juglans cinerea</i>	Butternut	C2	T
<i>Lilium canadense</i>	Canada lily		T
<i>Lilium michiganense</i>	Michigan lily		T
<i>Liparis loeselii</i>	Fen orchid		E
<i>Panax quinqifolius</i>	Ginseng	3C	T
<i>Platanthera flava</i> v. <i>herbiola</i>	Tuberculed rein orchid		T
<i>Platanthera peramoena</i>	Purple fringeless orchid	3C	T
<i>Saxifraga careyana</i>	Carey saxifrage	C3	S
<i>Spiranthes ovalis</i>	Lesser ladies tresses		S
<i>Spirata virginiana</i>	Virginia spiraeas	T	E
Mammals			
<i>Lutra canadensis</i>	River otter		T
<i>Myotis grisescens</i>	Gray bat	E	E
<i>Myotis sodalis</i>	Indiana bat	E	E
Birds			
<i>Circus cyaneus</i>	Northern harrier		D
<i>Falco peregrinus</i>	Peregrine falcon	E	E
<i>Haliaeetus leucocephalus</i>	Bald eagle	E	E
<i>Pandion haliaetus</i>	Osprey		
<i>Accipiter striatus</i>	Sharp-shinned hawk		E

Table 2.9 (continued)

Scientific name	Common name	Status	
		Federal ^a	State ^b
<i>Accipiter cooperii</i>	Cooper's hawk		T
<i>Aimophila aestivalis</i>	Bachman's sparrow		E
<i>Ammodramus savannarum</i>	Grasshopper sparrow		T
<i>Nycticorax nycticorax</i>	Black-crowned night heron		D
<i>Coragyps atratus</i>	Black vulture		D
<i>Buteo lineatus</i>	Red-shouldered hawk		D
<i>Tyto alba</i>	Barn owl		D
<i>Picoides borealis</i>	Red-cockaded woodpecker	E	E
<i>Thryomanes bewickii</i>	Bewick's wren		T
Fish			
<i>Hemitremia flammea</i>	Flame chub		D
<i>Phoxinus tennesseensis</i>	Tennessee dace		D
Amphibians			
<i>Aneides aeneus</i>	Green salamander		D
<i>Cryptobranchius alleganiensis</i>	Hellbender	C2	D
<i>Gyrinophilus palleucus</i>	Tennessee cave salamander	C2	T
Reptiles			
<i>Chrysemys scripta troosti</i>	Cumberland turtle		D
<i>Attenuatus longicaudus</i>	Eastern slender glass lizard		D
<i>Pituophis melanoleucus</i>	Northern pine snake	C2	T
<i>Cnemidophorus sexlineatus</i>	Six-lined racerunner		D
Birds			
<i>Melanerpes erythrocephalus</i>	Red-headed woodpecker		D
<i>Buteo lineatus</i>	Red-shouldered hawk		D
<i>Passerherbulus henslowii</i>	Henslow's sparrow	C	
<i>Chondestes grammacus</i>	Lark sparrow		D
<i>Pgoectes gramineus</i>	Vesper sparrow		D
Mammals			
<i>Plecotus rafinesquii</i>	Rafinesque's big-eared bat	C	D
<i>Sorex dispar</i>	Long-tailed shrew	C	D
<i>Sorex cinereus</i>	Masked shrew		D

ARTIN MARIETTA ENERGY SYSTEMS, INC.POST OFFICE BOX 2009
OAK RIDGE, TENNESSEE 37831

April 17, 1995

Ms. Sherry L. Lankford
Department of Energy, Oak Ridge Operations
Post Office Box 2001
Oak Ridge, Tennessee 37830-8501

Dear Ms. Lankford:

Transmittal of Addendum to Remedial Investigation Report on Bear Creek Valley Operable Unit 2 (Rust Spoil Area, Spoil Area 1 and SY-200 Yard) at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee (DOE/OR/01-1273/V1&D2/A1)

Enclosed are ten copies of the Addendum to *Remedial Investigation Report on Bear Creek Valley Operable Unit 2 (Rust Spoil Area, Spoil Area 1 and SY-200 Yard) at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee (DOE/OR/01-1273/V1&D2/A1)*. This document is issued in response to comments by the Tennessee Department of Environment and Conservation (TDEC) in a letter dated February 15, 1995, from R. Doug McCoy to Nelson Lingle. Also enclosed is a Comment Response Summary Table addressing these comments. Please submit the appropriate number of copies of both the Addendum and the Comment Response Summary Table to the Environmental Protection Agency (EPA) and TDEC for their records.

The EPA approved the D2 version of this document in a March 2, 1995, letter from Fernando Rivera to Nelson Lingle. Issuance of this Addendum finalizes the approval process for this document.

Please sign and return the attached acknowledgment form as documentation of your receipt of this document. You may contact Judy Hodgins at 576-2368 with any questions that you have.

Sincerely,

Dennis G. Cope, Program Manager
Y-12 Environmental Restoration

DGC:JAHodgins:tkb

cc: S. W. Wiley, TOA

cc/enc: File—ER Document Management Center—RC

Ms. Sherry L. Lankford
Page 2
April 17, 1995

Ltr#ER/T-Y-95/0023

I acknowledge receipt of ten copies of the document listed below and will transmit the required number of copies of this document to the Environmental Protection Agency and the Tennessee Department of Environment and Conservation.

Signed: _____ Date of Signature: _____
Sherry L. Lankford

Document: *Addendum to the Remedial Investigation Report on Bear Creek Valley Operable Unit 2 (Rust Spoil Area, Spoil Area 1 and SY-200 Yard) at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee (DOE/OR/01-1273/V1&D2/A1)*

RESPONSE TO COMMENTS Bear Creek OU2 Remedial Investigation Plan					
No.	Page/Section/	Comment	Accept/ Reject	Response	Revision Location
R. Doug McCoy					
1.	Page 2-47, Table 2.9	Animals and plants in this table in the D1 document are omitted in the D2 (e.g. mammals). Please update this table with the attached endangered species list (from <i>An Approach and Strategy for Performing Ecological Risk Assessments for the US Department of Energy's Oak Ridge Reservation: 1994 Edition, ES/ER/TM-33/RI</i>).		Animals and plants omitted from the D2 version of Table 2.9 were added back into the table. The table was updated using the attached endangered species list that was provided.	Table 2.9
2.	Page 2-50, Paragraph 4, Threatened and Endangered Species	Please edit this paragraph to reflect the species listed on Table 2.9, as was requested in comment 6-A in the State's original comment letter on this document.		Agree. Change made to paragraph as requested.	Sect 2.7.2 p. 2-51

RESPONSE TO COMMENTS Bear Creek OU2 Remedial Investigation Plan					
No.	Page/Section/	Comment	Accept/ Reject	Response	Revision Location
3.	Page 3-198, Paragraph 2	The intent of the original comment was for more information concerning dates and circumstances of the one exception of mercury emissions for ambient air to be provided, not specific information on NESHAPS criteria. Please correct.		<p>The exception refers to Ambient Station Number 8 at the west end of the Y-12 Plant. The concentrations of ambient mercury vapor showed an increase in 1989 at Ambient Station Number 8 but decreased from 1990 to 1992 to the lowest annual average. Although Ambient Station Number 8 showed an increase and was an exception, the ambient mercury vapor concentrations were well below the NESHAP guideline of 1 µg/m³ (30-d average). This information was taken from the 1992 Environmental Report Vol. 1.</p> <p>The revision to this paragraph, as indicated by the original response to the comment, was inadvertently omitted from the text. The paragraph was revised using 1992 ORR Environmental Monitoring Report which indicates that results of 1992 monitoring are well below the NESHAP gridlines of 1 µg/m³.</p>	Section 3.2.7 p. 3-198 ¶ 2
4.	Page 4-11, Section 4.5.4	The response to this comment in the Comment Resolution letter is adequate but is not reflected in the text of the D2 version. Please correct.		A portion of the comment response was inadvertently omitted from the text modification. The response to the comment will be added as requested.	Section 4.5.4 p. 4-11

Table 2.9 (continued)

Scientific name	Common name	Status	
		Federal ^a	State ^b
<i>Sorex fumeus</i>	Smokey shrew		D
<i>Sorex longirostris</i>	Southeastern shrew		D
<i>Felis cancolor</i>	Cougar	E	

^aFederal status codes:

E = Endangered.

T = Threatened.

C1 = Taxa for which the USFWS has on file substantial information on biological vulnerability and threats to support the appropriateness to list them as endangered or threatened species. Included are those taxa whose status in recent past is known, but may have already become extinct.

C2 = Taxa for which information now in possession of the service indicated that proposing to list them as endangered or threatened is appropriate, but for which substantial data on biological vulnerability and threat(s) are not currently known or on file to support a proposed rule.

C3 = Taxa that are no longer being considered for listing as threatened or endangered species.

3C = Taxa that have proven to be more abundant or widespread than was previously believed and/or those that are not subject to any identifiable threat.

^bState status codes:

E = Endangered.

E* = Endangered due to commercial exploitation.

T = Threatened.

S = Special concern.

D = Deemed in need of management.

Sources:

Cunningham et al. 1993. *Resource Management Plan for the Oak Ridge Reservation, Vol. 29: Rare Plants on the Oak Ridge Reservation*, ORNL/NERP-7. Oak Ridge, Tenn., August.

Memorandum from R. Kroodsma, Energy Systems, to R. E. Ambrose, SAIC, July 28, 1994.

Suter et al. 1994. *An Approach and Strategy for Performing Ecological Risk Assessments for the U.S. DOE Oak Ridge Reservation*, ES/ER/TM-33/R1.

General Wildlife Habitats

LEGEND

HARDWOOD/MIXED HARDWOOD HABITAT		AQUATIC HABITAT
PINE PLANTATION HABITAT		CAVE HABITAT
OLD FIELD AND GRASSLAND HABITAT		BUILDING HABITAT

Fig. 2.20. General wildlife habitats on the ORR (Source: DOE 1980).

undergrowth develops and provides habitat for species similar to those found in early- to mid-stage hardwood-mixed and hardwood/conifer forests. Avian species have a low preference for the pure pine areas bordering the transmission line corridors. Pine warblers and white-throated sparrows are common, but few other species are evident. These habitats are little used by reptiles or amphibians (Johnson 1964).

Old-field and grassland habitat. In the grassland/forb stage of vegetation, the principal species of small mammals are the southeastern shrew, least shrew, short-tailed shrew, eastern harvest mouse, hispid cotton rat, pine mouse, and the eastern cottontail rabbit. The eastern mole occurs in areas of loose soil. Closely mowed or grazed areas and dense kudzu growth is good habitat for the groundhog. Also found there are the striped skunk, coyote, red fox, and white-tailed deer. In more brushy vegetation, the white-footed mouse, golden mouse, and opossum may be found. Bird species found in this habitat include bobwhite, red-tailed hawk, field sparrow, towhee, blue grosbeak, meadowlark, and red-winged blackbird. The eastern bluebird population has increased with the establishment of bluebird nesting boxes. The yellow-breasted chat is found in old fields. Numerous frog, toad, lizard, and snake species are found in the old field areas.

Aquatic and riparian habitats. Many reptiles and amphibians occur in the various aquatic and wetland areas, including turtles, queen snakes, water snakes, salamanders, and frogs. The muskrat and beaver are bound closely to aquatic habitats. Rice rats, mink, and raccoons are also found in these areas. Many large mammals come frequently to this habitat to drink, and various small species are present at the water's edge. The American bald eagle occurs occasionally as a transient. Canada geese, great blue herons, and green-backed herons nest on the ORR.

Threatened and endangered species. Several mammal species on the federal and state list as threatened and/or endangered may occur on the ORR but have not been verified. These are listed in Table 2.9. There have been reported sightings of cougar on or in the area of the ORR, but this species probably does not occur on a regular basis. Also, the river otter has not yet been sighted on the ORR but was introduced to area streams and suitable habitats that exist on the ORR. Only two of the mammal species listed in Table 2.9 have been documented on the ORR: the Southeastern shrew and Indiana bat (Kroodsma 1987 and 1994). The pine snake is listed as threatened by the TWRA, and its presence in the Bear Creek watershed has been verified. The Cooper's hawk occurs in forests throughout the ORR as does the bald eagle. The Cooper's hawk is listed by the state as threatened while the bald eagle is listed as both a state and federal threatened species (Kroodsma 1994). Other birds recently documented on the ORR and listed by the state as endangered or in need of management include the grasshopper sparrow, black-crowned night heron, black vulture, red-shouldered hawk, and barn owl. The Tennessee dace, a major constituent of the fish population above the weir at BCK 4.55, is listed as a species in need of management. Its habitat is protected by the state of Tennessee (Starnes and Etnier 1980). Rare plants occurring on the Y-12 Plant site have been characterized by Hardy, Pounds, and Cook (1992). Table 2.9 lists all threatened and endangered plants and animal species potentially occurring on the ORR and the federal and/or state status of each.

2.7.3 Aquatic Fauna

There have been 19 species of fish found in Bear Creek in recent quantitative monitoring efforts conducted at 7 sites along virtually the entire length of the creek (Southworth *et al.*

1992). Minnows [blacknose dace (*Rhinichthys atratulus*) and Tennessee dace (*Phoxinus tennesseensis*)], stoneroller (*Campostoma anomalum*), and creek chub (*Semotilus atromaculatus*) were the predominant fish species found upstream from the weir at BCK 4.55. Below the weir, larger species (northern hogsucker (*Hypentelium nigricans*), white sucker (*Catostomus commersoni*), and rockbass (*Ambloplites rupestris*) were more common; the diversity of minnow species increased; and darters were found. Conclusions of the recent fish-monitoring studies were that much of Bear Creek had limited fish fauna (low species richness) characterized by robust population parameters (high densities and biomass). The uppermost site (BCK 12.36) had no stable, resident fish population. Water from this site was commonly toxic to fathead minnow larvae in toxicity testing and contained high levels of dissolved salts as a result of input of contaminated groundwater from the S-3 Site. The next two monitoring sites downstream, BCK 11.83 and BCK 11.09, had low fish density and biomass in 1984 and 1985 but showed recovery in later sampling. No impacts on the fish of Bear Creek were evident in the vicinity of inputs from the Burial Grounds (BCK 9.91 and BCK 9.40) despite the fact that qualitative surveys found no fish in the tributaries (NT-6-8) draining that site.

The yellowfin madtom (*Noturus flavipinnis*), listed by the state as endangered, has been found in Bear Creek. The Tennessee dace, a major constituent of the fish population above the weir at BCK 4.55, is listed as a species in need of management. Its habitat is protected by the state of Tennessee (Starnes and Etnier 1980). In Bear Creek, it occurs at every site above the weir and in at least four tributaries (NT-13, NT-14, NT-18, and ST-7).

Quantitative sampling of benthic invertebrates was conducted monthly at nine sites from BCK 12.36 to BCK 3.25 during June 1984–May 1985 as part of Phase 1 of the ecological monitoring program for Bear Creek and at quarterly intervals thereafter (Southworth *et al.* 1992). A total of 126 distinguishable taxa were collected in Bear Creek, including crustaceans (Isopoda, Amphipoda, and Decapoda); aquatic worms (Oligochaeta); snails (Gastropoda); mussels (Pelecypoda); and insects (Insecta). There were 11 orders of insects collected in Bear Creek, including springtails (Collembola), mayflies (Ephemeroptera), dragonflies and damselflies (Odonata), crickets and grasshoppers (Orthoptera), stoneflies (Plecoptera), true bugs (Hemiptera), alderflies and fishflies (Megaloptera), caddisflies (Trichoptera), butterflies and moths (Lepidoptera), beetles (Coleoptera), and true flies (Diptera).

The invertebrate fauna of Bear Creek showed a pattern of increasing density, biomass, and taxonomic diversity and richness with increasing distance downstream from the uppermost sampling site (BCK 12.36) (Southworth *et al.* 1992). The paucity of benthic invertebrates in the upper reaches of Bear Creek contrasted sharply with reference sites (unimpacted streams of similar size), which had relatively diverse and abundant assemblages of macroinvertebrates.

In toxicity tests run in March 1988, water from BCK 12.36 and BCK 11.83 was toxic to *Ceriodaphnia*, an invertebrate test species, but not to fathead minnow larvae. At the time of these tests, stream flow in Bear Creek was higher than normal, and contaminants from the S-3 Ponds groundwater plume were diluted more than would be the case under baseflow conditions. Under low-flow conditions, it is likely that Bear Creek water would be toxic to *Ceriodaphnia* as far downstream as BCK 9.4. While evidence of adverse effects on the fish communities of Bear Creek was not noted at sites downstream from BCK 11.83, the benthic fauna appeared to be more sensitive, with clear differences in faunal composition from unimpacted reference sites at all sites except BCK 3.25, where complete recovery appears to have occurred.

Species intolerant of pollution (mayflies, stoneflies, and caddisflies) were absent in the upper reaches and became more common downstream. Mayflies, which are particularly sensitive to toxic metals, were virtually absent at all sites except BCK 3.25. Unlike the fish data, which provide evidence of ecological recovery in Bear Creek since 1984, the benthic macroinvertebrate fauna do not appear to have changed in a manner indicative of either improving or degrading water quality since 1984 (Southworth *et al.* 1992).

No threatened or endangered species of aquatic macroinvertebrates have been collected in Bear Creek.

A limited amount of data have been collected on the bioaccumulation of contaminants by aquatic biota in Bear Creek. Fish collected from lower Bear Creek contained elevated levels of mercury (0.2 to 0.5 $\mu\text{g/g}$, wet weight) in 1982 (Van Winkle *et al.* 1984) and in 1984 (TVA 1986). While well below the U.S. Food and Drug Administration (FDA) action level, these data do indicate the presence of biologically available mercury in the Bear Creek system. Fish from lower Bear Creek were also analyzed for Cd, Cr, Ag, As, and Ni in 1984 (TVA 1986), and levels were found to be typical of fish from uncontaminated environments.

Polychlorinated biphenyl (PCB) contamination in fish from Bear Creek was evident in 1982, when rockbass collected from the lower reaches of the creek were found to contain 0.65 $\pm$ 0.29 ppm (wet weight) PCBs (Turner *et al.* 1988). TVA analyzed fish from lower Bear Creek for organic priority pollutants, including PCBs in 1984; levels of all substances were below detection limits. Fish were collected from lower Bear Creek in 1987 as part of an effort to evaluate the importance (relative to other sources) of the upper EFPC discharge at New Hope Pond as a source of PCB contamination to lower Poplar Creek and the Clinch River. In this collection, PCBs in rockbass averaged 0.28 ± 0.12 ppm ($n=8$), a value comparable to the level of contamination found in sunfish in the lower third of EFPC and well above the level typical of fish from uncontaminated sites (0.02 ± 0.01 ppm). Clams held in Bear Creek (BCK 4.55) for 1 month as part of the same study accumulated 1.01 ppm PCBs (versus 0.05 ppm in controls), indicating that Bear Creek now contains a source of biologically available PCBs.

PCB contamination has been observed in fish in EFPC, Poplar Creek, and the Clinch River/Watts Bar Reservoir downstream from Bear Creek (TVA 1986). It is unlikely that a substantial fraction of this contamination is attributable to Bear Creek because sources of PCBs and similar body burdens are found in EFPC far upstream from the mouth of Bear Creek (TVA 1986). A similar situation exists for mercury (TVA 1986).

Note: Only pages 3-197, 3-198, and 3-199 are included here for Chap. 3 because these are the only pages of text from document DOE/OR/01-1273/V1&D2 that were affected by requested changes to Chap. 3.

Fig. 3.57. Ambient air monitoring stations at the Y-12 Plant.

Also monitored were ambient fluoride concentration, TSPs, and mercury concentrations. Ambient air concentrations of fluorides measured during 1992 at each of the Y-12 Plant perimeter air-monitoring fluoride stations were well below TDEC standards. TSP samples collected at the Y-12 Plant were not in excess of state primary or secondary standards in 1992 (Energy Systems 1993a).

Data for mercury in ambient air at five monitoring stations at the Y-12 Plant suggest that the environment and human health are not impacted by releases of mercury to the atmosphere. The results of 1992 monitoring indicate that on-site concentrations of mercury vapor are well below the National Emission Standards for Hazardous Air Pollutants (NESHAPs) guideline of $1 \mu\text{g}/\text{m}^3$ (a 30-d average) and the American Conference of Governmental Industrial Hygienist's threshold limit value of $50 \mu\text{g}/\text{m}^3$ (a time weighted average for an 8-h work day and 40-h work week). The data do show that ambient air mercury concentrations in the Y-12 Plant area are, in general, slightly elevated above natural background and may reach significantly elevated concentrations for short periods in localized areas. Disturbances, such as excavation of soil in contaminated areas, appear to elevate ambient air concentrations of mercury. Ambient air concentrations exhibited a seasonal pattern, with the highest values typically occurring in the warmer months.

3.2.8 Radiation Survey Data

The distribution of radiological contamination over the ORR and surrounding area has been assessed by airborne radiation surveys. These surveys have been flown since 1959, and a review of the aerial monitoring program is presented in Sect. 3.2.8.1.

3.2.8.1 Historical data

Historically, most of the radiation survey information on the ORR and surrounding area has been provided by the Aerial Measuring System (AMS), an aerial radiological surveillance capability maintained by DOE. The AMS is presently operated and maintained by EG&G Energy Measurements, Inc. (EG&G/EM) under contract to DOE.

The first aerial radiological survey of the ORR and surrounding area was conducted during the spring of 1959 by the USGS using a fixed-wing aircraft flying at a 152-m (500-ft) altitude and 1.6-km (1-mile) line spacing. Its primary purpose was to characterize the radiogeology of the area. In 1973, EG&G/EM conducted a survey using a fixed-wing aircraft flying at an altitude of 152 m (500 ft) and speed of 170 knots. Sites identified as having anomalous radiation levels were re-surveyed with a helicopter-mounted AMS flying at an altitude of 76 m (250 ft) and speed of 70 knots. The increased sensitivity provided detailed coverage of radiological activity at the anomalous radiation sites.

In 1980, an aerial radiological survey of the entire ORR and nearby surrounding area, encompassing 440 km^2 (170 m^2), was conducted. The survey consisted of parallel flight lines 152 m (500 ft) apart at an altitude of 91 m (300 ft). During September 12-29, 1989, an aerial radiological survey of the ORR, city of Oak Ridge, and the surrounding area was conducted using parameters identical to those used during the 1980 survey (Maurer 1992).

Most recently, an aerial radiological survey of the ORR and surrounding area in Oak Ridge, which encompasses BCV, was conducted during the period March 30 to April 14, 1992 (Maurer 1993). The survey consisted of a series of parallel flight lines 76 m (250 ft) apart at

an altitude of 46 m (150 ft). The survey was conducted by a helicopter flying at a speed of 70 knots. In support of aerial measurements, ground-based exposure rates and soil samples were obtained from seven "benchmark" sites located within the survey area. The ground-based measurements were used to verify the integrity of the aerial measurements. Radionuclide assays of representative soil samples were also performed to determine corresponding radioisotopic concentrations. In addition, high-altitude aerial photographs were obtained for use as base maps for the aerial contour data, and oblique aerial photographs were obtained for site documentation.

Two methods were used to analyze the aerial radiation data. The first was the gross count rate method, used to determine the ground level exposure rates. The second was the spectral window method, used to determine the man-made radioactivity and the photopeak count rates for specific man-made radionuclides (Maurer 1993). Radionuclides without gamma or strong X-rays, such as transuranics, will not be detected by the aerial survey; however, radiochemical analyses performed during the recent RI of EFPC indicate these radionuclides are not a problem for ingestion pathways. Typical background exposure rates varied from 7 to 11 $\mu\text{R/h}$ (including the estimated cosmic ray contribution of 3.8 $\mu\text{R/h}$). The results of the aerial and ground-based measurements were found to vary by as much as $\pm 30\%$.

Terrestrial exposure rates at 1 m above ground level were deduced from aerial measurements, integrated with the corresponding aircraft position coordinates, and compiled to produce a contour map (Fig. 3.58). These contours were superimposed on the high-altitude aerial photographs. The data for BCV are presented in Maurer (1992b). Total terrestrial gamma exposure rates for BCV at 1 m range from <8 to 60 $\mu\text{R/h}$, with the overwhelming majority of readings being <13 $\mu\text{R/h}$. One site within BCV was identified with rates between 20 and 60 $\mu\text{R/h}$. This site corresponds to the Bear Creek Burial Ground, a shallow disposal area for uranium metal tailings. Readings in the vicinity of BCV OU 2 show exposure rates between 8 and 13 $\mu\text{R/h}$, but these readings are not statistically significant, as exposure rates <10 $\mu\text{R/h}$ above background rates (7 to 11 $\mu\text{R/h}$ within the Oak Ridge area including the cosmic ray contribution of 3.8 $\mu\text{R/h}$) are considered of no concern, and the correlations between aerial and ground-based measurements vary by as much as $\pm 30\%$.

The man-made gross count (MMGC) rate for the BCV sites is shown in Maurer (1992b). There is a slightly elevated (1000-3200 counts per second) area in the vicinity of SL-1 and the HCDA. A Region of Interest (ROI 25) was identified at the above mentioned Burial Ground, with MMGC between 1000 and 100,000 counts per second (Fig. 3.59). The gamma spectrum for ROI 25 showed photopeaks for $^{234\text{m}}\text{Pa}$ (Fig. 3.60), which indicate the presence of ^{238}U . This is not unexpected due to the nature of the material (uranium tailings) deposited in this area. The SL-1, HCDA, and Burial Ground areas will be investigated further in the RI for BCV OU 1. There is no evidence of radioactivity produced by man-made radionuclides in the BCV OU 2 areas.

3.3 DATA QUALITY REPORT

3.3.1 Purpose

The purpose of this section is to provide an assessment of the QA/QC results from the BCV OU 2 RI to confirm that the data used in this report meet the data objectives established for this investigation. This will be accomplished through an evaluation of the

Historic Preservation to ensure that there will be no adverse impacts to cultural resources. Should adverse impacts be anticipated, the three agencies will negotiate a Memorandum of Agreement before the remediation action proceeds.

4.5.4 Rare, Threatened, or Endangered Species

Although there are a number of state- and federally listed plant and animal species present or potentially present on the ORR, currently there are none present at the BCV OU 2 site that would be impacted by any potential remedial activities. Table 2.9 in Chap. 2 of this document has been extensively updated using 1993 and 1994 references to reflect those plant and animal species potentially occurring on the ORR. The table also indicates, for each plant and animal species potentially occurring on the ORR, the federal and/or state listed status of the plant or animal species.

4.6 ACTION-SPECIFIC ARARs

Performance, design, or other action-specific requirements set controls or restrictions on particular kinds of activities related to the management of hazardous waste (52 FR 32496). Selecting a particular remedial action at a site will invoke the appropriate action-specific ARARs that may specify particular performance standards or technologies, as well as specific environmental levels for discharged or residual chemicals. Action-specific ARARs for BCV OU 2 will be developed during selection of remedial alternatives in the FS.

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