OH-23-C
OH-23
11528

ornl

ORNL/RASA-95/15

OAK RIDGE NATIONAL LABORATORY

LOCKHEED MARTIN

Results of the Independent Radiological Verification Survey at the Former Associate Aircraft Tool and Manufacturing Company Site, Fairfield, Ohio (FOH001)

D. E. Rice
M. E. Murray
K. S. Brown

MANAGED BY
LOCKHEED MARTIN ENERGY SYSTEMS, INC.
FOR THE UNITED STATES
DEPARTMENT OF ENERGY

UCN-13673 (38 6-95)

ORNL/RASA-95/15

HEALTH SCIENCES RESEARCH DIVISION
Environmental Restoration and Waste Management Non-Defense Programs
(Activity No. EX 20 20 01 0; ADS1310AA)

Results of the Independent Radiological Verification Survey at the Former Associate Aircraft Tool and Manufacturing Company Site, Fairfield, Ohio (FOH001)

D. E. Rice, M. E. Murray, K. S. Brown

Date Issued - January 1996

Investigation Team
R. D. Foley–Measurement Applications and Development Manager
D. E. Rice – Survey Team Leader

Survey Team Members

J. F. Allred	M. E. Murray
J. P. Abston	V. P. Patania
A. C. Butler[1]	D. A. Rose
G. H. Cofer	W. H. Shinpaugh[1]
R. L. Coleman	P. F. Tiner
R. C. Gosslee	J. Wade
D. L. Jones[1]	M. E. Ward[1]
D. D. McKinney[1]	W. Winton

[1]Midwest Technical, Inc.

Work performed by the
MEASUREMENT APPLICATIONS AND DEVELOPMENT GROUP

Prepared by the
OAK RIDGE NATIONAL LABORATORY
Oak Ridge, Tennessee 37831-6285
managed by
LOCKHEED MARTIN ENERGY RESEARCH CORP.
for the
U. S. DEPARTMENT OF ENERGY
under contract number DE-AC05-96OR22464

CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGMENTS

This project was sponsored by the Office of Environmental Restoration, U.S. Department of Energy, under contract DE-AC05-84OR21400 with Lockheed Martin Energy Systems, Inc. The authors wish to acknowledge the contributions of J. M. Lovegrove, D. A. Rose, D. A. Roberts, D. D. McKinney, and V. P. Patania of the Measurement Applications and Development Group, Oak Ridge National Laboratory, for sample preparation and participation in the analyses, editing, and reporting of data for this survey.

ABSTRACT

At the request of the U.S. Department of Energy (DOE), a team from Oak Ridge National Laboratory (ORNL) conducted an independent radiological verification survey at the former Associate Aircraft Tool and Manufacturing Company site in Fairfield, Ohio. The survey was performed from February to May of 1995. The purpose of the survey was to verify that the site was remediated to levels below DOE guidelines for FUSRAP sites.

Results of the independent radiological verification survey at the former Associate Aircraft Tool and Manufacturing Company confirm that the residual uranium contamination at the site is below DOE FUSRAP guidelines for unrestricted use.

Results of the Independent Radiological Verification Survey at the Former Associate Aircraft Tool and Manufacturing Company Site, Fairfield, Ohio (FOH001)*

INTRODUCTION

The former Associate Aircraft Tool and Manufacturing Company site is located at 3550 Dixie Highway, Fairfield, Ohio. Associate Aircraft Tool and Manufacturing Company produced hollow uranium slugs in a machine shop at the site in 1956. The work was performed for National Lead of Ohio in a contract with the Atomic Energy Commission to augment the capacity of the Feed Materials Production Center at Fernald in the development of nuclear energy for defense-related projects. The current occupant of the building, Force Control, operates a multipurpose machine shop.[1] Figure 1 is a diagram of the site.

At the request of the U.S. Department of Energy (DOE), a team from Oak Ridge National Laboratory conducted an independent radiological verification survey at the former Associate Aircraft Tool and Manufacturing Company Site, Fairfield, Ohio. The survey was performed from February to May of 1995. The purpose of the survey was to verify that radioactivity from residues of ^{238}U was remediated to a level below acceptable DOE guideline levels for FUSRAP sites by Bechtel National, Inc. (BNI).

VERIFICATION PROCEDURES

A description of the typical survey methods and instrumentation providing guidance for the verification survey may be found in *Measurement Applications and Development Group Guidelines*, ORNL-6782 (January 1995).[2]

Gamma radiation levels were determined using portable NaI gamma scintillation meters; beta/gamma measurements were made with GM "pancake" probes; alpha measurements were made with ZnS "beer mug" detectors. Large-area proportional detectors were used to scan floors.

The indoor verification survey of the Force Control building included the following:

- Measurement of alpha and beta-gamma radiation levels in all accessible areas of the building and wherever areas of elevated radiation levels were indicated during

---

*The survey was performed by members of the Measurement Applications and Development Group of the Health Sciences Research Division at Oak Ridge National Laboratory under DOE contract DE-AC05-84OR21400.

previous surveying activities and other post-remediation surveys. Contaminated areas of the building were remediated in zones I–VIII by BNI (see Figs. 2 and 3). Contaminated drainpipes in Zones II and III and drainpipes exiting the building at the south wall of Zone II were removed by BNI, then the excavated trench areas were remediated. Sections 1–6 of the building are arbitrary divisions defined in the complete ORNL radiological survey report of 1993.[1]

- Smears of floors, walls, and overhead surfaces in remediated areas inside the Force Control building for measurement of transferable alpha and beta-gamma radioactivity levels. Smear locations are shown on Fig. 2. Overhead smears were obtained from beams in Sections 3, 4, and 5 of the building, as shown on Fig. 2.
- Sampling and radionuclide analysis of verification systematic and biased soil samples taken beneath the concrete floor in the building (Fig. 2).

The outdoor survey of the area adjacent to the Force Control building in remediated areas included the following:

- A walkover scan of alpha and beta-gamma radiation levels.
- Sampling and radionuclide analysis of verification systematic and biased soil samples. Sample locations are shown on Fig. 3.

In addition to conducting independent radiological surveys, ORNL staff reviewed the radiological survey data resulting from BNI post-remedial action work.

VERIFICATION SURVEY RESULTS

DOE guidelines are summarized in Table 1. Typical background radiation levels for the Fairfield, Ohio area are presented in Table 2. These data are provided for comparison with survey results presented in this section. Background concentrations have not been subtracted from radionuclide concentrations measured in soil samples.

Results of laboratory analyses of systematic and biased verification samples for ^{238}U are listed in Table 3. Field analyses of these samples using a NaI gamma spectroscopy system revealed values within ±20% of those determined in the gamma spectroscopy laboratory. Results of laboratory analysis of smear samples taken on surfaces throughout the building are listed in Table 4.

All floor, wall, subfloor, and overhead surfaces previously known to be or suspected of being contaminated were confirmed to be within DOE guidelines at the end of the verification survey,[3] except for an area of contamination of 167 m^2 located under the concrete floor immediately east of the eastern wall rollup door in Section 1 of the building (see Fig. 2). The subfloor contamination was also assessed by a hazard assessment, and DOE subsequently approved supplemental standards for the area of contamination.[4]

CONCLUSIONS

Review of BNI survey results by ORNL, and the independent radiological verification survey by ORNL at the former Associate Aircraft Tool and Manufacturing Company site confirm that the site meets the DOE radiological guidelines for unrestricted use.

REFERENCES

1. M. E. Murray, R. F. Carrier, and R. A. Mathis, *Results of the Radiological Survey at the Former Associate Aircraft Tool and Manufacturing Company Site, Fairfield, Ohio,* ORNL/RASA-93/2, Martin Marietta Energy Systems, Inc., Oak Ridge Natl. Lab., March, 1993.

2. *Measurement Applications and Development Group Guidelines,* ORNL-6782, Martin Marietta Energy Systems, Inc., Oak Ridge Natl. Lab., January 1995.

3. Memo, J. W. Wagoner II, Director, Off-Site/Savannah River Program Division, Office of Eastern Area Programs, Office of Environmental Restoration, U.S. DOE, to L. K. Price, Director, Former Sites Restoration Division, Oak Ridge Field Office, U.S. DOE, February 10, 1995.

4. Memo, J. W. Wagoner II, Director, Off-Site/Savannah River Program Division, Office of Eastern Area Programs, Office of Environmental Restoration, U.S. DOE, to L. K. Price, Director, Former Sites Restoration Division, Oak Ridge Field Office, U.S. DOE, June 5, 1995.

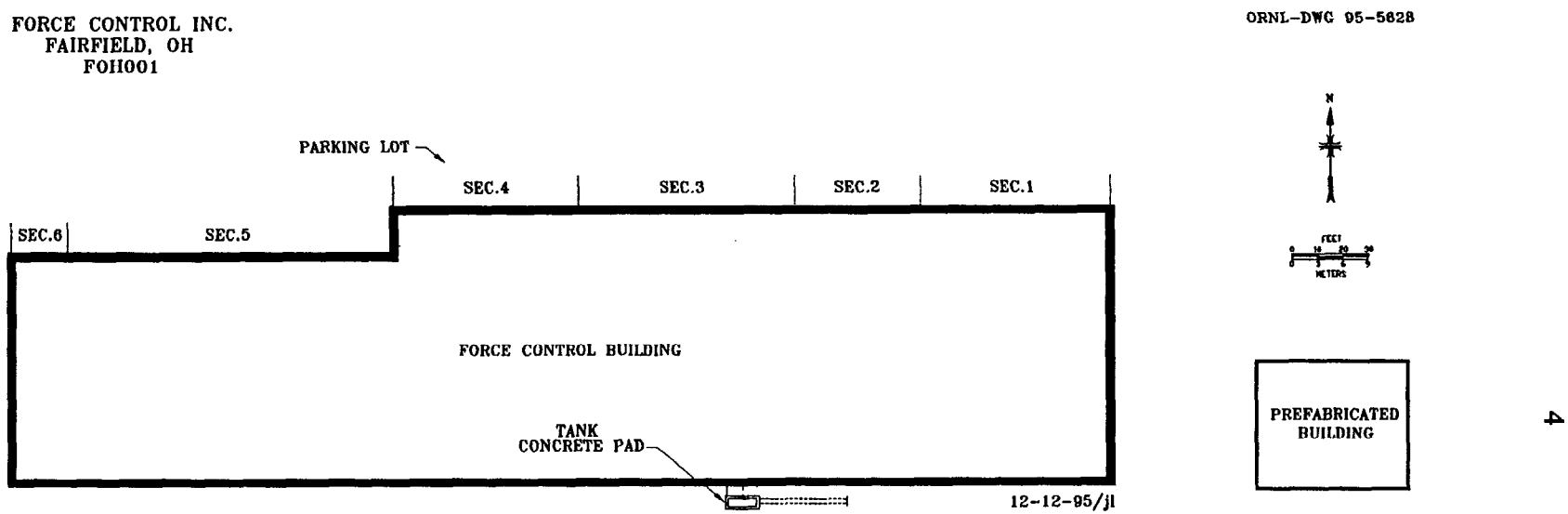

Fig. 1. Diagram of the former Associate Aircraft Tool and Manufacturing Company Site.

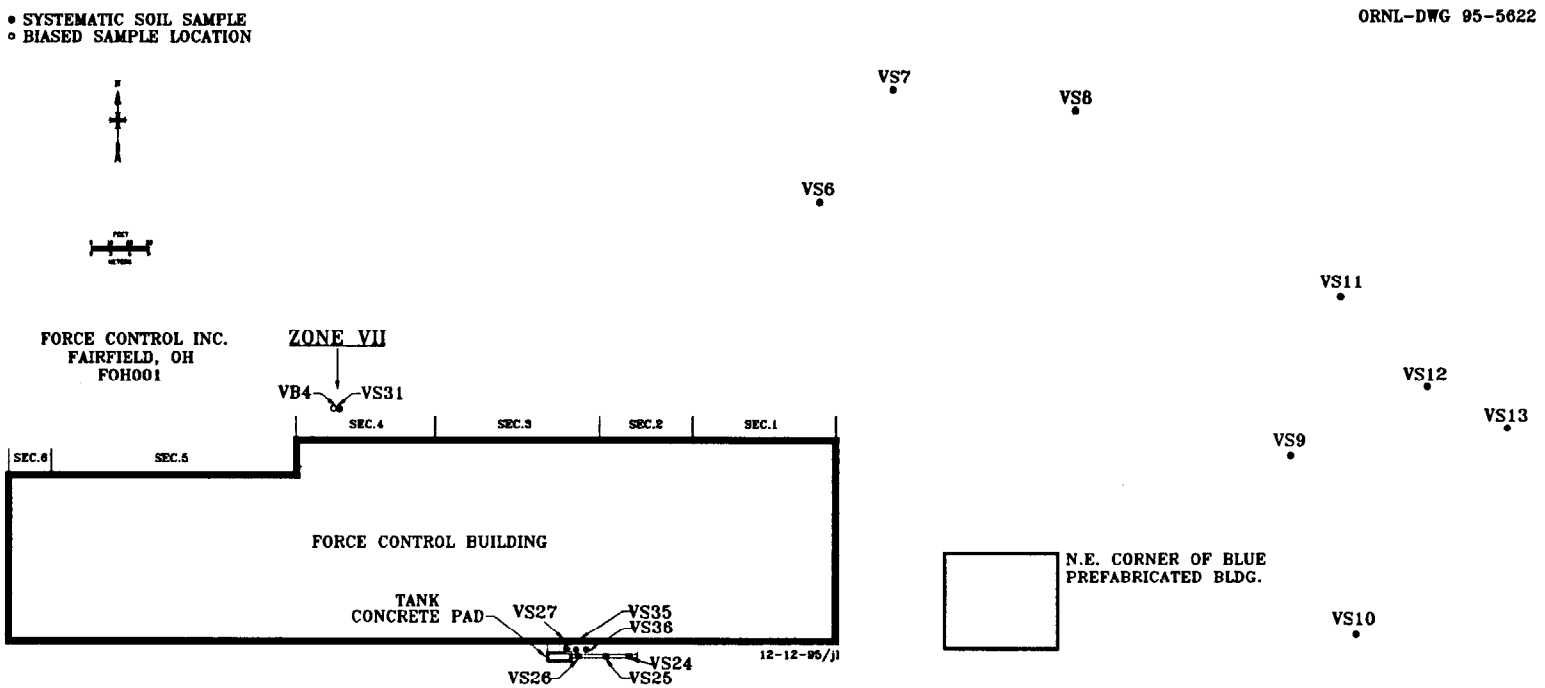

Fig. 3. Locations of verification systematic and biased soil samples outside the Force Control building.

Table 1. Applicable guidelines for protection against radiation (Limits for uncontrolled areas)

Mode of exposure	Exposure conditions	Guideline value
Total residual surface contamination[a]	^{238}U, ^{235}U, U-natural (alpha emitters)	
	Maximum	15,000 dpm/100 cm^2
	Average	5,000 dpm/100 cm^2
	Removable	1,000 dpm/100 cm^2
Derived concentrations	Total uranium	35 pCi/g[b, c]
Guideline for non-homogeneous contamination (used in addition to the 100-m^2 guideline)[d]	Applicable to locations with an area ≤25 m^2, with significantly elevated concentrations of radionuclides ("hot spots")	$G_A = G_i(100/A)^{1/2}$, where G_A = guideline for "hot spot" of area (A) G_i = guideline averaged over a 100-m^2 area

[a]DOE surface contamination guidelines are consistent with *NRC Guidelines for Decontamination at Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for By-Product, Source, or Special Nuclear Material*, May 1987.

[b]Memo, J. W. Wagoner II, Director, Off-Site/Savannah River Program Division, Office of Eastern Area Programs, Office of Environmental Restoration, U.S. DOE, to L. K. Price, Director, Former Sites Restoration Division, Oak Ridge Field Office, U.S. DOE, February 10, 1995.

[c]Since the contaminant was normal uranium, the guideline value for ^{238}U was 17.5 pCi/g.

[d]DOE guidelines specify that every reasonable effort shall be made to identify and to remove any source that has a concentration exceeding 30 times the guideline value, irrespective of area (adapted from *Revised Guidelines for Residual Radioactive Material at FUSRAP and Remote SFMP Sites*, April 1987).

Sources: Adapted from U.S. Department of Energy, DOE Order 5400.5, April 1990, and U.S. Department of Energy, *Guidelines for Residual Radioactive Material at Formerly Utilized Sites Remedial Action Program and Remote Surplus Facilities Management Program Sites*, Rev. 2, March 1987; and U. S. Department of Energy Radiological Control Manual, DOE N 5480.6 (DOE/EH-256T), June 1992.

Table 2. Background radiation levels and concentrations of selected radionuclides in soil in the Fairfield, Ohio area

Type of radiation measurement or sample	Radiation level or radionuclide concentration
Gamma exposure rate at 1 m above ground surface (μR/h)[a]	
Average	7
Range	3-11
Concentration of radionuclides in soil (pCi/g)[a]	
^{232}Th	0.9
^{226}Ra	1.5
^{238}U	1.3

[a]Values obtained from three locations between Columbus and Cincinnati.

Source: T. E. Myrick, B. A. Berven, and F. F. Haywood, *State Background Radiation Levels: Results of Measurements Taken During 1975–1979*, ORNL/TM–7343, Martin Marietta Energy Systems, Inc., Oak Ridge Natl. Lab., November 1981.

Table 3. Concentrations of ^{238}U in verification samples from the former Associate Aircraft Site, Fairfield, Ohio

Sample ID[a]	Depth (cm)	Uranium-238 concentration (pCi/g)[b]
	Verification systematic samples[c]	
VS1	0-15	0.96 ± 0.2
VS2	0-15	0.65 ± 0.3
VS3	0-15	0.33 ± 0.3
VS4	0-15	2.6 ± 0.6
VS5	0-15	1.7 ± 0.4
VS6A	0-15	1.4 ± 0.4
VS6B	15-30	2.0 ± 0.4
VS6C	30-45	1.3 ± 0.4
VS7A	0-15	0.54 ± 0.4
VS7B	15-30	1.3 ± 0.5
VS7C	30-45	0.87 ± 0.5
VS8A	0-15	0.66 ± 0.4
VS8B	15-30	0.69 ± 0.3
VS8C	30-45	0.93 ± 0.4
VS9A	0-15	1.4 ± 0.5
VS9B	15-30	0.63 ± 0.3
VS9C	30-45	0.64 ± 0.2
VS10A	0-15	0.88 ± 0.4
VS10B	15-30	1.0 ± 0.5
VS10C	30-45	1.6 ± 0.5
VS11A	0-15	0.66 ± 0.3
VS11B	15-30	0.72 ± 0.2
VS11C	30-45	0.72 ± 0.3
VS12A	0-15	0.71 ± 0.1
VS12B	15-30	1.1 ± 0.3
VS12C	30-45	1.5 ± 0.5
VS13A	0-15	0.69 ± 0.4
VS13B	15-30	0.94 ± 0.4
VS13C	30-45	0.72 ± 0.4
VS14	0-15	0.66 ± 0.3

Table 3 (continued)

Sample ID[a]	Depth (cm)	Uranium-238 concentration (pCi/g)[b]
VS15	0-15	<0.50
VS16	0-15	<0.50
VS17	0-15	1.0 ± 0.2
VS18	0-15	0.84 ± 0.3
VS19	0-15	0.37 ± 0.3
VS20	0-15	0.84 ± 0.2
VS21	0-15	1.2 ± 0.3
VS22	0-15	1.0 ± 0.4
VS23	0-15	1.4 ± 0.4
VS24	0-15	1.1 ± 0.3
VS25	0-15	0.89 ± 0.3
VS26	0-15	1.3 ± 0.4
VS27	split sample	6.6 ± 0.7
VS28	0-15	11 ± 0.6
VS29	0-15	0.42 ± 0.2
VS30	0-15	11 ± 0.9
VS31	0-15	2.2 ± 0.4
VS32	0-15	1.1 ± 0.4
VS33	0-15	3.1 ± 0.5
VS34	0-15	1.2 ± 0.3
VS35	0-15	10 ± 0.7
VS36	0-15	1.9 ± 0.2
VS37	0-15	0.55 ± 0.2
VS38	0-15	0.6 ± 0.2
VS39	0-15	1.1 ± 0.4

Table 3 (continued)

Sample ID[a]	Depth (cm)	Uranium-238 concentration (pCi/g)[b]
VS40	0-15	1.6 ± 0.4
VS41	0-15	1.5 ± 0.3
VS42	0-15	1.6 ± 0.3
VS43	0-15	3.3 ± 0.3
VS44	0-15	0.95 ± 0.2
VS45	split sample	1.3 ± 0.4
VS46	0-15	3.5 ± 0.6
VS47	0-15	0.60 ± 0.3
	Verification miscellaneous sample	
VM1	*d*	0.62 ± 0.2
	Verification biased samples[e]	
VB1	0-15	4.2 ± 0.6
VB2	0-15	108
VB3	0-15	38
VB4	0-15	61
VB5	0-15	8.4 ± 0.6
VB6	0-15	4.1 ± 0.6
VB7	0-15	2.2 ± 0.4

[a]Sample locations are shown on Figs. 2 and 3.

[b]Indicated counting error is at the 95% confidence level ($\pm 2\sigma$). Results for other radionuclides are typical of background concentrations and are not included in the table.

[c]Systematic samples are taken at locations irrespective of gamma exposure rates.

[d]Composite scoop sample taken from east/west terra-cotta pipe under north bathroom wall.

[e]Biased samples are taken from areas with elevated gamma exposure rates. Sample locations VB2, VB3, and VB4 were remediated after the samples were screened in the field.

Table 4. Results of analysis of smears from the former Associate Aircraft Tool and Manufacturing Company Site, Fairfield, Ohio

Smear number[a]	Removable activity levels	
	Alpha level (dpm/100 cm^2)[b]	Beta/gamma level [c] (dpm/100 cm^2)
VT7	58	150
VT8	27	<MDA
VT10	<MDA	125
VT11	27	<MDA
VT40	39	121
VT42	30	<MDA
VT53	55	407
VT54	39	138
VT59	58	315
VT60	36	<MDA

[a]Smears were numbered consecutively from VT1 through VT77. Locations of all smears analyzed during the verification survey are shown on Fig. 2. Smears with values below the minimum detectable activity (MDA) for both alpha and beta/gamma removable contamination are not included in this table.
[b]MDA for removable alpha contamination is equal to 25 dpm/100 cm^2.
[c]MDA for removable beta contamination is equal to 110 dpm/100 cm^2.

INTERNAL DISTRIBUTION

1–3. K. J. Brown
4. R. F. Carrier
5. R. D. Foley
6. R. C. Gosslee
7. C. A. Johnson
8–9. M. E. Murray
10. P. T. Owen
11. D. E. Rice
12. D. A. Roberts
13. R. E. Rodriguez
14. R. E. Swaja
15. M. S. Uziel
16. J. K. Williams
17–19. Laboratory Records
20. Laboratory Records - RC
21. Central Research Library
22. ORNL Technical Library, Y–12
23. ORNL Patent Section
24–29. MAD Records Center

EXTERNAL DISTRIBUTION

30. D. G. Adler, Former Sites Restoration Division, Oak Ridge Field Office, U.S. Department of Energy, P. O. Box 2001, Oak Ridge, TN 37831-8723

31. W. L. Beck, ORISE, E/ESD, 1299 Bethel Valley Road, Oak Ridge, TN 37831

32. J. J. Fiore, Director, Office of Eastern Area Programs, Office of Environmental Restoration, Cloverleaf Bldg. (EM-24) U. S. Department of Energy, 19901 Germantown Rd., Germantown, MD 20874-1290

33. A. G. Toddings, FUSRAP Project Administrator, Bechtel National, Inc., FUSRAP Department, Oak Ridge Corporate Center, 151 Lafayette Drive, P.O. Box 350, Oak Ridge, TN 37831-0350

34. FUSRAP Document Center, Science Applications International Corp., P.O. Box 2501, 301 Laboratory Road, Oak Ridge, TN 37831

35. L. K. Price, Director, Former Sites Restoration Division, Oak Ridge Field Office, U.S. Department of Energy, P.O. Box 2001, Oak Ridge, TN 37831-8723

36. J. W. Wagoner II, Director, Division of Off-Site Programs, Office of Eastern Area Programs, Office of Environmental Restoration, U.S. Department of Energy, Cloverleaf Bldg., 19901 Germantown Road, Germantown, MD 20874-1290

37–39. W. Alexander Williams, Designation and Certification Manager, Division of Off-Site Programs, Office of Eastern Area Programs, Office of Environmental Restoration, U.S. Department of Energy, Cloverleaf Bldg. (EM-421), 19901 Germantown Road, Germantown, MD 20874-1290

40-42. Office of Assistant Manager, Energy Research and Development, DOE Oak Ridge Operations, P.O. Box 2001, Oak Ridge, TN 37831-8600

43-45. Office of Scientific and Technical Information, U.S. Department of Energy, P.O. Box 62, Oak Ridge, TN 37831