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DOLLY SODS WILDERNESS AREA RISK ANALYSIS REPORT

For U.S. Army Engineer Division
Huntsville, Alabama

TECHNICAL REPORT 95-R-0007

Purchase Order: DACA87-95-P-0147

Prepared by:
QuantiTech, Inc.
6703 Odyssey Drive
Suite 304
Huntsville, AL 35805

10 February 1995

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EXECUTIVE SUMMARY

QuantiTech, Inc., was contracted by the U.S. Army Engineer Division, Huntsville, (USAEDH) to apply the Ordnance and Explosive Waste Cost-Effectiveness Risk Tool (OEW*Cert*) in evaluation of the public safety risk from unexploded ordnance (UXO) at the Dolly Sods Wilderness Area (DSWA) in West Virginia. OEW*Cert* measures risk in terms of how often people are exposed to UXO when participating in commonly performed activities at a site, e.g., hiking, camping, mountain biking, etc. The risk reduction possible with three remediation levels was to be addressed. Under Level 1 remediation, hiking trails within DSWA are cleared of UXO to 1 foot. Under Level 2 remediation, hiking trails within DSWA are cleared of UXO to 1 foot and camping areas within DSWA are cleared to 4 feet. Under Level 3 remediation, "open" areas, postulated to be former impact areas, within DSWA are cleared in addition to the clearance areas contained in Levels 1 and 2. These "open" areas have not been defined at the time this report was written, so results are presented for only Levels 1 and 2.

Risk measures utilized in the analysis effort were the reduction in expected number of exposures (risk to the many) and reduction in the probability of exposure (risk to the individual) that can be achieved through both remediation Level 1 and Level 2. These values were determined for the entire DSWA and for each sector. Nine unique sectors were identified. The risk measures were calculated for all activities occurring within DSWA and for the specific activities affected by the proposed remediation levels, hiking and camping. The analysis showed a 47% reduction in the expected number of exposures if Level 1 remediation occurred and a 56% reduction in the expected number of exposures if Level 2 remediation occurred. The probability of exposure was reduced by 21% if Level 1 remediation occurred and 24% if Level 2 remediation occurred.

Additionally, QuantiTech subjectively considered the costs of Level 1 remediation and Level 2 remediation. Since Level 2 remediation contains Level 1 remediation as a basis and adds clearance of campsites, Level 2 remediation would logically be the most expensive remediation option to implement.

DOLLY SODS WILDERNESS AREA
RISK ASSESSMENT

1.0 BACKGROUND

QuantiTech, Inc., was contracted by the U.S. Army Engineer Division, Huntsville, (USAEDH) to apply the Ordnance and Explosive Waste Cost-Effectiveness Risk Tool (OEW*Cert*) in evaluation of the public safety risk from unexploded ordnance (UXO) at the Dolly Sods Wilderness Area (DSWA) in West Virginia. OEW*Cert* measures risk in terms of how often people are exposed to UXO when participating in commonly performed activities at a site, e.g., hiking, camping, mountain biking, etc. The risk reduction possible with three remediation levels was to be addressed. Under Level 1 remediation, hiking trails (plus 20 feet on each side of the trail) within DSWA are cleared of UXO to 1 foot. Under Level 2 remediation, hiking trails within DSWA are cleared as in Level 1 and camping areas within DSWA are cleared to 4 feet. Under Level 3 remediation, "open" areas, postulated to be former impact areas, within DSWA are cleared in addition to the clearance areas contained in Levels 1 and 2. These "open" areas have not been defined at the time this report was written, so results are presented for only Levels 1 and 2.

The evaluation of risk may be approached in several ways. In all cases, the common underlying characteristic is uncertainty. In some cases, risk is addressed as a qualitative variable with subjective scores being assigned to various situations In other cases, uncertainty is quantified by assigning a probability to an event with no particular consideration being given to the consequences of the event. The most widely accepted approach to risk analysis incorporates the simultaneous consideration of the probability of an event with its associated consequences. This may be done qualitatively or it may be done quantitatively by treating the consequences of an event as random variables. The latter was chosen as the approach for the OEW*Cert* methodology:

$$\text{Risk} = p(\text{event}) \cdot (\text{Consequences of Event}).$$

For the purposes of this analysis, an event is defined as the exposure, by members of the public, to UXO. Exposure is defined as a member of the public being present in immediate proximity to UXO. An individual does not have to be aware of the presence of the ordnance item for an exposure to occur. The consequence of an exposure is the hazard

associated with UXO at the site. Therefore, the risk measure used in OEW*Cert* is defined as follows:

$$\text{Risk} = (\#\ \text{Public Exposures to UXO}) \cdot (\text{UXO Hazard Factor}).$$

Since the UXO types at DSWA are common across all the sectors (geographically continuous areas with homogeneous physical characteristics and UXO density), the UXO hazard factors are the same for each sector. This indicates that the appropriate measure to evaluate the differences in each sector's risk is purely the expected number of public exposures to UXO. In the remaining discussion, "exposure" will be used instead of risk.

Due to the multitude of uncertainties associated with each individual UXO item and the complexities in modeling an individual's actions/reactions upon being exposed to a UXO item, the probability of accident that may result from an exposure is not addressed.

2.0 OEW*Cert* DESCRIPTION

Public exposure to both surface and subsurface UXO items is characterized by a Poisson process. The Poisson distribution is the appropriate distribution because it is believed that sectors can be delineated, via appropriate sampling techniques, that exhibit uniformly distributed UXO. This Uniform distribution of UXO allows the passage of participants through the site to be characterized as a Poisson process.

The public exposures result from individuals performing specific activities (both recreational and occupational) within UXO-contaminated areas. The expected number of surface UXO exposures per participant in a sector is dependent on UXO density, the proportion of UXO on the surface of the ground, and the activity participant's exposure area (the area traversed by an individual while performing an activity). The expected number of subsurface UXO exposures per participant in an area is dependent on the UXO density, the proportion of UXO beneath the surface of the ground, the density distribution of the subsurface UXO, and the area associated with an activity performed in the area.

The calculation of the total expected number of exposures to UXO at a site follows a step-by-step process. First, for each sector, the expected number of exposures for a single individual participating in a specific activity is calculated. This value is referred to as mu (μ). Second, the number of individuals that are expected to participate annually in that activity on the site is determined based on the demographics surrounding the site and activity participation data. (For DSWA analysis, this step was by-passed since a physical count at trailheads provided values to determine activity participants.) This value is referred to as N. The two values are combined as shown in the following relationship to give the total annual number of exposures expected to occur for participants in the activity that was identified.

$$E[\text{Activity Exposures}] = E[\text{exposures for single participant}] \cdot E[\text{particpants}].$$

These calculations are then performed for each activity that has been determined to be participated in at the FUDS. The values for the expected number of exposures resulting from participation in each activity are summed to yield the overall risk value for the site.

$$E[\text{Total Exposures}] = \sum_{\text{all activities}} E[\text{Activity Exposures}].$$

3.0 RISK ANALYSIS DISCUSSION

3.1 Inputs

The first step in DSWA risk analysis was establishment of sectors. Sectors are defined as geographically continuous areas with homogeneous physical traits (slope, vegetation, and soil type) and UXO density. Information provided by personnel from the Monongahela National Forest Supervisor's Office was used to identify slope, vegetation, and soil types for DSWA. Contamination density estimates were calculated from the DSWA Feasibility Study prepared by Metcalf & Eddy in January 1992. Nine distinct sectors were delineated within DSWA and are shown in Figure 3.1-1.

The analysis performed to estimate exposures for the nine sectors contained within DSWA included the consideration of three remediation levels. The first remediation level assumes that the hiking trails within DSWA are cleared of UXO to a depth of 1 foot. The area cleared within each sector is 20 feet on each side of the hiking trail, plus an assumed 1 foot for the width of the trail. The second remediation level assumes that, in addition to clearing UXO from the hiking trails to a depth of 1 foot, camping areas are cleared of UXO to a depth of 4 feet. Under this option, the area cleared within each sector (in addition to the area described under Level 1 remediation) is the product of the number of camping areas within the sector and the average campsite size. The third remediation level has yet to be defined by USAEDH, but is likely to be clearance of UXO from "open" areas within DSWA that potentially could have been former impact areas. The 1 foot clearance depth is current Army guidance for areas used purely for recreational purposes. The 4 feet clearance depth is current Army guidance for areas where intrusive activities (or activities such as campfires) are likely to occur. The "no action" alternative was included as a basis for determining the expected benefits of each remediation level, i.e., the reduction in exposures related to each level.

The data facts collected for use in the estimation of exposures with OEW*Cert*, along with the source for each, are provided in Appendix A. The data assumptions used in the estimation of exposures with OEW*Cert*, along with the rationale for each, are provided in Appendix B.

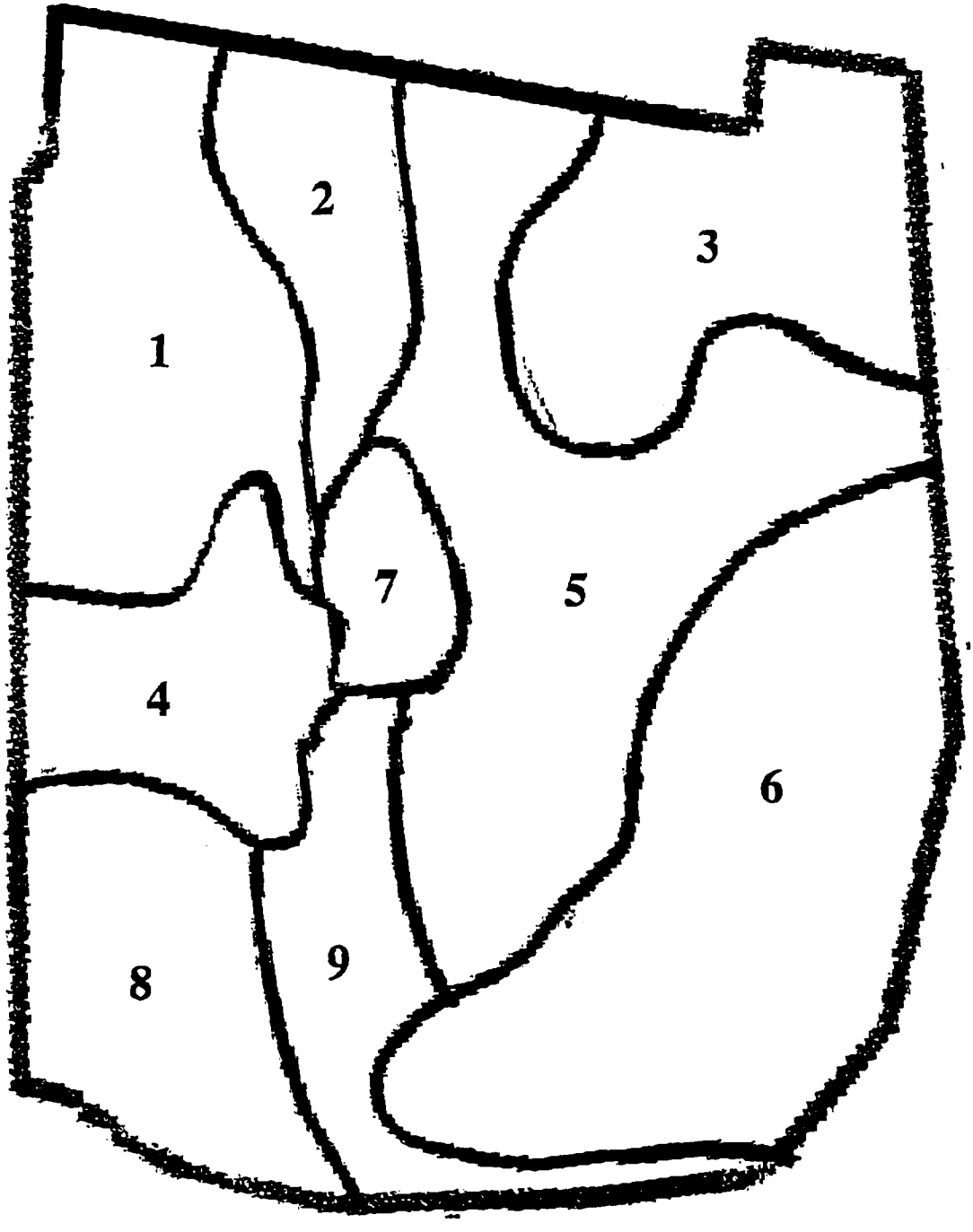

Figure 3.1-1. Identified Sectors of DSWA

3.2 Results

Table 3.2-1 shows the expected exposures to OEW by members of the public in each sector, as well as the site total, for each remediation level. This value can be thought of as the "risk to the many," since it considers the annual visitors to DSWA. The range of values is derived from a range of participants in each sector. This range of participants is derived from DSWA trail usage data described in the assumptions provided in Appendix B.

Table 3.2-1. Total Expected Exposures

	OEW Remediation Level					
	No Action		Level 1		Level 2	
Sector	Low	High	Low	High	Low	High
1	0	0	0	0	0	0
2	7	14	3	6	3	6
3	0	0	0	0	0	0
4	0	0	0	0	0	0
5	658	1201	362	640	282	498
6	0	0	0	0	0	0
7	23	43	7	13	6	13
8	0	0	0	0	0	0
9	0	0	0	0	0	0
	688	1258	372	659	291	517

The activities occurring within DSWA affected by the remediation are hiking on trails and camping. Table 3.2-2 shows the expected exposures to OEW by members of the public hiking on trails within each sector, as well as the site total, for each remediation level. Table 3.2-3 shows the expected exposures to OEW by members of the public camping within each sector, as well as the site total, for each remediation level. In both tables, the range of values based on a low or high number of participants is given.

Table 3.2-2. Expected Exposures from Hiking on Trails

	OEW Remediation Level					
	No Action		Level 1		Level 2	
Sector	Low	High	Low	High	Low	High
1	0	0	0	0	0	0
2	5	10	1	2	1	2
3	0	0	0	0	0	0
4	0	0	0	0	0	0
5	422	748	106	187	106	187
6	0	0	0	0	0	0
7	21	40	5	10	5	10
8	0	0	0	0	0	0
9	0	0	0	0	0	0
	448	798	112	199	112	199

Table 3.2-3. Expected Exposures from Camping

	OEW Remediation Level					
	No Action		Level 1		Level 2	
Sector	Low	High	Low	High	Low	High
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	0	0	0	0	0	0
5	107	189	107	189	27	47
6	0	0	0	0	0	0
7	1	1	1	1	0	1
8	0	0	0	0	0	0
9	0	0	0	0	0	0
	108	190	108	190	27	48

Table 3.2-4 shows a probability of exposure measure for DSWA. The values displayed indicate the probability that an individual participating in any activity, in the indicated sector, will be exposed to at least one UXO item in a single year if no remediation occurs at DSWA, if Level 1 remediation is implemented at DSWA, or if Level 2 is implemented at DSWA. This measure can be thought of as the "risk to an individual,"

because it does not consider the annual visitors to DSWA, but only one visitor. Since this risk measure is applicable for a single individual, no range of values based on a low or high number of participants is applicable.

Table 3.2-4. Probability of Exposure

	OEW Remediation Level		
Sector	**No Action**	**Level 1**	**Level 2**
1	0	0	0
2	$1/35$	$1/41$	$1/42$
3	0	0	0
4	0	0	0
5	$1/5.5$	$1/6.5$	$1/7$
6	0	0	0
7	$1/8$	$1/13$	$1/13$
8	0	0	0
9	0	0	0
	$1/3.3$	$1/4.1$	$1/4.3$

The activities occurring within DSWA affected by the remediation are hiking on trails and camping. Table 3.2-5 shows the probability of exposures to OEW by members of the public hiking on trails within each sector for each remediation level. Table 3.2-6 shows the probability of exposures to OEW by members of the public camping within each sector for each remediation level.

Table 3.2-5. Probability of Exposure While Hiking on Trails

Sector	OEW Remediation Level		
	No Action	Level 1	Level 2
1	0	0	0
2	1/144	1/573	1/573
3	0	0	0
4	0	0	0
5	1/23	1/91	1/91
6	0	0	0
7	1/16	1/62	1/62
8	0	0	0
9	0	0	0
	1/9.1	1/35	1/35

Table 3.2-6. Probability of Exposure While Camping

Sector	OEW Remediation Level		
	No Action	Level 1	Level 2
1	0	0	0
2	1/33.334	1/33,334	1/133.334
3	0	0	0
4	0	0	0
5	1/63	1/63	1/250
6	0	0	0
7	1/962	1/962	1/3.847
8	0	0	0
9	0	0	0

FACSIMILE TRANSMITTAL HEADER SHEET

PART II 14 PAGES

US Army Corps of Engineers
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NUMBER OF PAGES (including header) ~~29~~ PART I 16 PAGES

FROM: Kevin Healy / Bill Sargent
OFFICE SYMBOL: CEHND-ED-CS-F DATE: 1 May 96
PHONE NUMBER: 205-895-1627 / 1562

MESSAGE:

Rick,

As per ORD-OC's request, here's the justification for the risk #'s given in the Dolly Sods AM.

We're sending the whole report so that there'll be no questions about how the analysis works.

Kevin

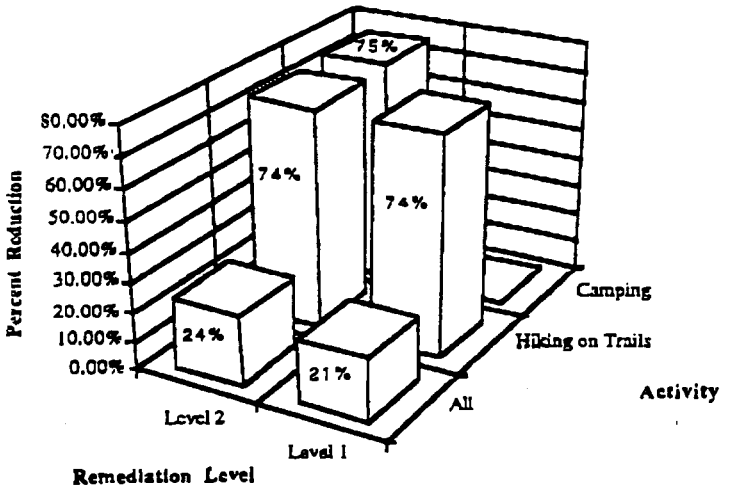

Figure 3.3-2. Probability of Exposure Reduction

4.0 SUBJECTIVE COST STATEMENT

The QuantiTech contract for this effort stated that a cost analysis should not be performed, however, a statement should be provided identifying which of the alternatives would logically be the most expensive to implement. Again, only Level 1 remediation (clearing the hiking trails of UXO to 1 foot) and Level 2 (also clearing the hiking trails, but additionally clearing the camping areas of UXO to 4 feet) have been identified. Of these two remediation levels, Level 2 would be the most expensive to implement.

On a sector basis, only those sectors with identified UXO contamination would require remediation efforts. Those are sectors 2, 5, and 7. Of these three sectors, sector 5 would be the most expensive to remediate because it is larger than the other two sectors, has a steeper slope (terrain conditions that would lead to increased time for UXO clearance), and a greater UXO density than both the other sectors.

APPENDIX A

DATA FACTS COLLECTED FOR DOLLY SODS RISK ASSESSMENT

The following table includes the facts used as inputs to the risk analysis performed for the Dolly Sods Wilderness Area using the OEW Cost-Effectiveness Tool (OEW*Cert*). Each fact is accompanied by its source and an indicator for its applicability for each remediation level.

Table A-1. Dolly Sods Wilderness Area Data Facts

Fact	Source	Applicability	
		Level 1	Level 2
Area of DSWA = 10,215 acres	DSWA Feasibility Study, Metcalf & Eddy, Inc., January 21, 1992	√	√
Vegetation of Sector 1 = Grass/Brush	Monongahela National Forest Ecological Landtype Maps	√	√
Vegetation of Sector 2 = Grass/Brush	Monongahela National Forest Ecological Landtype Maps	√	√
Vegetation of Sector 3 = Grass/Brush	Monongahela National Forest Ecological Landtype Maps	√	√
Vegetation of Sector 4 = Grass/Brush	Monongahela National Forest Ecological Landtype Maps	√	√
Vegetation of Sector 5 = Brush/Trees, Wet	Monongahela National Forest Ecological Landtype Maps	√	√
Vegetation of Sector 6 = Grass/Brush	Monongahela National Forest Ecological Landtype Maps	√	√
Vegetation of Sector 7 = Brush/Trees	Monongahela National Forest Ecological Landtype Maps	√	√
Vegetation of Sector 8 = Grass/Brush	Monongahela National Forest Ecological Landtype Maps	√	√
Vegetation of Sector 9 = Clear/Grass	Monongahela National Forest Ecological Landtype Maps	√	√
Slope of Sector 1 = (10° - 30°)	Monongahela National Forest Ecological Landtype Maps	√	√
Slope of Sector 2 = (0° - 10°)	Monongahela National Forest Ecological Landtype Maps	√	√
Slope of Sector 3 = (0° - 10°)	Monongahela National Forest Ecological Landtype Maps	√	√
Slope of Sector 4 = (0° - 10°)	Monongahela National Forest Ecological Landtype Maps	√	√
Slope of Sector 5 = (>30°)	Monongahela National Forest Ecological Landtype Maps	√	√
Slope of Sector 6 = (10° - 30°)	Monongahela National Forest Ecological Landtype Maps	√	√

Table A-1. Dolly Sods Wilderness Area Data Facts (Cont'd.)

Fact	Source	Applicability	
		Level 1	Level 2
Slope of Sector 8 = (>30°)	Monongahela National Forest Ecological Landtype Maps	√	√
Slope of Sector 9 = (>30°)	Monongahela National Forest Ecological Landtype Maps	√	√
Soil Type of Sector 1 = Medium	Monongahela National Forest Ecological Landtype Maps	√	√
Soil Type of Sector 2 = Medium	Monongahela National Forest Ecological Landtype Maps	√	√
Soil Type of Sector 3 = Light	Monongahela National Forest Ecological Landtype Maps	√	√
Soil Type of Sector 4 = Heavy	Monongahela National Forest Ecological Landtype Maps	√	√
Soil Type of Sector 5 = Medium	Monongahela National Forest Ecological Landtype Maps	√	√
Soil Type of Sector 6 = Medium	Monongahela National Forest Ecological Landtype Maps	√	√
Soil Type of Sector 7 = Medium	Monongahela National Forest Ecological Landtype Maps	√	√
Soil Type of Sector 8 = Medium	Monongahela National Forest Ecological Landtype Maps	√	√
Soil Type of Sector 9 = Medium	Monongahela National Forest Ecological Landtype Maps	√	√

APPENDIX B

DATA ASSUMPTIONS FOR DOLLY SODS RISK ASSESSMENT

The following table includes the assumptions used as inputs to the risk analysis performed for the Dolly Sods Wilderness Area using the OEW Cost-Effectiveness Tool (OEW*Cert*). Each assumption is accompanied by its source/rationale and an indicator for its applicability for each remediation level.

Table B-1. Dolly Sods W ness Area Data Assumptions

Assumption	Rationale	Applicability	
		Level 1	Level 2
Hiking on trails in sectors 1 - 9.	Figure 1, DSWA Distribution of Trail Use, Summer 1991, page 10, DSWA Study: Draft Report, West Virginia University, November 2, 1991	√	√
Camping in sectors 1 - 9.	Map with campsites identified. Received from MNF SO in January 1995.	√	√
Hunting in sectors 1-3, 5-6, and 8-9.	Map with hunting areas identified. Received from MNF SO in December 1994.	√	√
Hiking off-trail in sectors 1 - 9.	Individuals are free to travel anywhere accessible in DSWA.	√	√
10,000 annual visitors to trailhead of trail #514	Physical trailhead count by Forest Service, 1994. Per Jill Shoemaker.	√	√
Sector 1 has 0 UXO/acre and 0 non-UXO/acre.	Feasibility Study DSWA, Metcalf & Eddy, Inc., January 21, 1992. Sample number 8.	√	√
Sector 2 has 0.048 UXO/acre and 0.087 non-UXO/acre. 20% of UXO are on surface.	Feasibility Study DSWA, Metcalf & Eddy, Inc., January 21, 1992. Sample numbers 1, 4, and 5.	√	√
Sector 3 has 0 UXO/acre and 2.96 non-UXO/acre.	Feasibility Study DSWA, Metcalf & Eddy, Inc., January 21, 1992. Sample numbers 3, 9, and 18.	√	√
Sector 4 has 0 UXO/acre and 0 non-UXO/acre.	Feasibility Study DSWA, Metcalf & Eddy, Inc., January 21, 1992. Sample number 13.	√	√
Sector 5 has 0.091 UXO/acre and 7.080 non-UXO/acre. 67% of UXO are on surface.	Feasibility Study DSWA, Metcalf & Eddy, Inc., January 21, 1992. Sample numbers 2, 7, 10, and 17.	√	√
Sector 6 has 0 UXO/acre and 0 non-UXO/acre.	Feasibility Study DSWA, Metcalf & Eddy, Inc., January 21, 1992. Sample numbers 6, 15, and 16.	√	√
Sector 7 has 0.090 UXO/acre and 0.120 non-UXO/acre. 100% of UXO are on surface.	Feasibility Study DSWA, Metcalf & Eddy, Inc., January 21, 1992. Sample numbers 11 and 14.	√	√
Sector 8 has 0 UXO/acre and 0.592 non-UXO/acre.	Feasibility Study DSWA, Metcalf & Eddy, Inc., January 21, 1992. Sample number 12.	√	√
Sector 9 has not been sampled.	Feasibility Study DSWA, Metcalf & Eddy, Inc., January 21, 1992	√	√
Sector 1 covers 1648 acres.	Estimated from scale on USGS Quadrangles from Blackburd Knob, Hopeville, Blackwater Falls, and Laneville, WV.	√	√

Table B-1. Dolly Sods Wilderness Area Data Assumptions (Cont'd.)

Assumption	Rationale	Applicability	
		Level 1	Level 2
Sector 2 covers 735 acres.	Estimated from scale on USGS Quadrangles from Blackburd Knob, Hopeville, Blackwater Falls, and Laneville, WV.	√	√
Sector 3 covers 1051 acres.	Estimated from scale on USGS Quadrangles from Blackburd Knob, Hopeville, Blackwater Falls, and Laneville, WV.	√	√
Sector 4 covers 767 acres.	Estimated from scale on USGS Quadrangles from Blackburd Knob, Hopeville, Blackwater Falls, and Laneville, WV.	√	√
Sector 5 covers 1565 acres.	Estimated from scale on USGS Quadrangles from Blackburd Knob, Hopeville, Blackwater Falls, and Laneville, WV.	√	√
Sector 6 covers 2156 acres.	Estimated from scale on USGS Quadrangles from Blackburd Knob, Hopeville, Blackwater Falls, and Laneville, WV.	√	√
Sector 7 covers 282 acres.	Estimated from scale on USGS Quadrangles from Blackburd Knob, Hopeville, Blackwater Falls, and Laneville, WV.	√	√
Sector 8 covers 1192 acres.	Estimated from scale on USGS Quadrangles from Blackburd Knob, Hopeville, Blackwater Falls, and Laneville, WV.	√	√
Sector 9 covers 819 acres.	Estimated from scale on USGS Quadrangles from Blackburd Knob, Hopeville, Blackwater Falls, and Laneville, WV.	√	√
Average campsite is 632.5 ft^2.	Page 12, DSWA Study: Draft Report, West Virginia University, November 2, 1991		√
Sector 1 contains 4 campsites.	Counted on map with campsites identified. Map received from MNF SO in January 1995.		√
Sector 2 contains 2 campsites.	Counted on map with campsites identified. Map received from MNF SO in January 1995.		√
Sector 3 contains 1 campsite.	Counted on map with campsites identified. Map received from MNF SO in January 1995.		√
Sector 4 contains 5 campsites.	Counted on map with campsites identified. Map received from MNF SO in January 1995.		√

Table B-1. Dolly Sods Wilderness Area Data Assumptions (Cont'd.)

Assumption	Rationale	Applicability	
		Level 1	Level 2
Sector 5 contains 41 campsites.	Counted on map with campsites identified. Map received from MNF SO in January 1995.		√
Sector 6 contains 21 campsites.	Counted on map with campsites identified. Map received from MNF SO in January 1995.		√
Sector 7 contains 5 campsites.	Counted on map with campsites identified. Map received from MNF SO in January 1995.		√
Sector 8 contains 15 campsites.	Counted on map with campsites identified. Map received from MNF SO in January 1995.		√
Sector 9 contains 7 campsites.	Counted on map with campsites identified. Map received from MNF SO in January 1995.		√
Sector 1 contains 2.35 miles of hiking trails (includes portions of trails 553 and 513)	Estimated from scale on Figure 1, DSWA Distribution of Trail Use, Summer 1991, page 10, DSWA Study: Draft Report, West Virginia University, November 2, 1991	√	√
Sector 2 contains 1.05 miles of hiking trails (includes portions of trail 553)	Estimated from scale on Figure 1, DSWA Distribution of Trail Use, Summer 1991, page 10, DSWA Study: Draft Report, West Virginia University, November 2, 1991	√	√
Sector 3 contains 0.44 miles of hiking trails (includes portions of trail 510)	Estimated from scale on Figure 1, DSWA Distribution of Trail Use, Summer 1991, page 10, DSWA Study: Draft Report, West Virginia University, November 2, 1991	√	√
Sector 4 contains 1.63 miles of hiking trails (includes portions of trails 558 and 552)	Estimated from scale on Figure 1, DSWA Distribution of Trail Use, Summer 1991, page 10, DSWA Study: Draft Report, West Virginia University, November 2, 1991	√	√
Sector 5 contains 7.88 miles of hiking trails (includes portions of trails 510, 514, 508, 554 and 513)	Estimated from scale on Figure 1, DSWA Distribution of Trail Use, Summer 1991, page 10, DSWA Study: Draft Report, West Virginia University, November 2, 1991	√	√
Sector 6 contains 3.34 miles of hiking trails (includes portions of trails 508 and 560)	Estimated from scale on Figure 1, DSWA Distribution of Trail Use, Summer 1991, page 10, DSWA Study: Draft Report, West Virginia University, November 2, 1991	√	√
Sector 7 contains 0.69 miles of hiking trails (includes portion of trail 513)	Estimated from scale on Figure 1, DSWA Distribution of Trail Use, Summer 1991, page 10, DSWA Study: Draft Report, West Virginia University, November 2, 1991	√	√
Sector 8 contains 2.50 miles of hiking trails (includes portions of trails 514 and 552)	Estimated from scale on Figure 1, DSWA Distribution of Trail Use, Summer 1991, page 10, DSWA Study: Draft Report, West Virginia University, November 2, 1991	√	√

Table B-1. Dolly Sods Wilderness A[illegible] Data Assumptions (Cont'd.)

Assumption	Rationale	Applicability	
		Level 1	Level 2
Sector 9 contains 1.01 miles of hiking trails (includes portions of trails 514 and 513)	Estimated from scale on Figure 1, DSWA Distribution of Trail Use, Summer 1991, page 10, DSWA Study: Draft Report, West Virginia University, November 2, 1991	√	√
Weight of ordnance in Sector 2 is 35 lbs	Only 4.2" located in sampling. Weight of 4.2" is 35 lbs.	√	√
Weight of ordnance in Sector 5 is 18.2 lbs	Only 81mm located in sampling. Weight of 81mm is 18.2 lbs.	√	√
Weight of ordnance in Sector 7 is 16.4 lbs	One 57 mm and two 81 mm located in sampling. Weighted average weight of the items is 16.4 lbs.	√	√
53.3% of individuals in DSWA hike trails. Includes 44.4% hiking, 6.7% nature study, 1.1% photography, and 1.1% birdwatching.	Table 2, Visitors' Most Important Activity, page 5, DSWA Study: Draft Report, West Virginia University, November 2, 1991. Individuals' actions for nature study, photography, and birdwatching do not differ significantly from those hiking, thus exposure potentials are similar.	√	√
36.6% of visitors to DSWA camp. Includes 23.3% camping, 8.9% spending time alone, 3.3% swimming, and 1.1% fishing.	Table 2, Visitors' Most Important Activity, page 5, DSWA Study: Draft Report, West Virginia University, November 2, 1991. Individuals are unlikely to enter DSWA purely to swim or fish. Most likely would perform these activities while camping, thus can be included in same category.		√
6.7% of visitors to DSWA hunt.	Table 2, Visitors' Most Important Activity, page 5, DSWA Study: Draft Report, West Virginia University, November 2, 1991. Listed in table as "other," but considering the amount of hunters observed during the site visit in December, 1994, it seems a reasonable estimate.	√	√
3.3% of visitors to DSWA hike off trails.	Table 2, Visitors' Most Important Activity, page 5, DSWA Study: Draft Report, West Virginia University, November 2, 1991.	√	√
14% of total trail use is at Laneville segment of trail 514. (This means that 14% of total visitors to DSWA is 10,000--per headcount taken at this area in 1994.)	Page 9, DSWA Study: Draft Report, West Virginia University, November 2, 1991. (10,000 number provided by Forest Service personnel during site visit in December 1994.)	√	√
>50% of total trail use is concentrated on trail 514.	Page 9, DSWA Study: Draft Report, West Virginia University, November 2, 1991	√	√

Table B-1. Dolly Sods Wilderness Area Data Assumptions (Cont'd.)

Assumption	Rationale	Applicability	
		Level 1	Level 2
In Sector 1, the expected visitors and their activities are: between 1173 and 2272 hiking on trails, between 819 and 1586 camping, between 155 and 300 hunting; and between 67 and 129 hiking off trails.	Used trail usage estimates (given as a range 0-3%, 3-6%, 6-9%, 9-12%, or >12%) in Figure 1, DSWA Distribution of Trail Use, Summer 1991, page 10, DSWA Study: Draft Report, West Virginia University, November 2, 1991 to estimate portion of trail (thus portion of usage by visitors) in each sector. Since all visitors, regardless of activities, must use the trails to enter DSWA, this assumption is valid. Used activity percentages for each activity to break-out the total sector visitors into appropriate activities.	√	√
In Sector 2, the expected visitors and their activities are: between 704 and 1363 hiking on trails, between 492 and 952 camping, between 93 and 180 hunting; and between 40 and 77 hiking off trails.	Used trail usage estimates (given as a range 0-3%, 3-6%, 6-9%, 9-12%, or >12%) in Figure 1, DSWA Distribution of Trail Use, Summer 1991, page 10, DSWA Study: Draft Report, West Virginia University, November 2, 1991 to estimate portion of trail (thus portion of usage by visitors) in each sector. Since all visitors, regardless of activities, must use the trails to enter DSWA, this assumption is valid. Used activity percentages for each activity to break-out the total sector visitors into appropriate activities.	√	√
In Sector 3, the expected visitors and their activities are: between 0 and 568 hiking on trails, between 0 and 397 camping, between 0 and 75 hunting; and between 0 and 32 hiking off trails.	Used trail usage estimates (given as a range 0-3%, 3-6%, 6-9%, 9-12%, or >12%) in Figure 1, DSWA Distribution of Trail Use, Summer 1991, page 10, DSWA Study: Draft Report, West Virginia University, November 2, 1991 to estimate portion of trail (thus portion of usage by visitors) in each sector. Since all visitors, regardless of activities, must use the trails to enter DSWA, this assumption is valid. Used activity percentages for each activity to break-out the total sector visitors into appropriate activities.	√	√

Table B-1. Dolly Sods Wilderness A. Data Assumptions (Cont'd.)

Assumption	Rationale	Applicability	
		Level 1	Level 2
In Sector 4, the expected visitors and their activities are: between 1263 and 2749 hiking on trails, between 886 and 1929 camping, and between 66 and 145 hiking off trails.	Used trail usage estimates (given as a range 0-3%, 3-6%, 6-9%, 9-12%, or >12%) in Figure 1, DSWA Distribution of Trail Use, Summer 1991, page 10, DSWA Study: Draft Report, West Virginia University, November 2, 1991 to estimate portion of trail (thus portion of usage by visitors) in each sector. Since all visitors, regardless of activities, must use the trails to enter DSWA, this assumption is valid. Used activity percentages for each activity to break-out the total sector visitors into appropriate activities.	√	√
In Sector 5, the expected visitors and their activities are: between 9548 and 16922 hiking on trails, between 6666 and 11814 camping, between 1261 and 2235 hunting; and between 540 and 958 hiking off trails.	Used trail usage estimates (given as a range 0-3%, 3-6%, 6-9%, 9-12%, or >12%) in Figure 1, DSWA Distribution of Trail Use, Summer 1991, page 10, DSWA Study: Draft Report, West Virginia University, November 2, 1991 to estimate portion of trail (thus portion of usage by visitors) in each sector. Since all visitors, regardless of activities, must use the trails to enter DSWA, this assumption is valid. Used activity percentages for each activity to break-out the total sector visitors into appropriate activities.	√	√
In Sector 6, the expected visitors and their activities are: between 1056 and 3180 hiking on trails, between 737 and 2220 camping, between 140 and 420 hunting; and between 60 and 180 hiking off trails.	Used trail usage estimates (given as a range 0-3%, 3-6%, 6-9%, 9-12%, or >12%) in Figure 1, DSWA Distribution of Trail Use, Summer 1991, page 10, DSWA Study: Draft Report, West Virginia University, November 2, 1991 to estimate portion of trail (thus portion of usage by visitors) in each sector. Since all visitors, regardless of activities, must use the trails to enter DSWA, this assumption is valid. Used activity percentages for each activity to break-out the total sector visitors into appropriate activities.	√	√

Table B-1. Dolly Sods Wilderness Area Data Assumptions (Cont'd.)

Assumption	Rationale	Applicability	
		Level 1	Level 2
In Sector 7, the expected visitors and their activities are: between 316 and 611 hiking on trails, between 222 and 429 camping, and between 17 and 32 hiking off trails.	Used trail usage estimates (given as a range 0-3%, 3-6%, 6-9%, 9-12%, or >12%) in Figure 1, DSWA Distribution of Trail Use, Summer 1991, page 10, DSWA Study: Draft Report, West Virginia University, November 2, 1991 to estimate portion of trail (thus portion of usage by visitors) in each sector. Since all visitors, regardless of activities, must use the trails to enter DSWA, this assumption is valid. Used activity percentages for each activity to break-out the total sector visitors into appropriate activities.	√	√
In Sector 8, the expected visitors and their activities are: between 6474 and 8423 hiking on trails, between 4520 and 5880 camping, between 855 and 1113 hunting; and between 366 and 477 hiking off trails.	Used trail usage estimates (given as a range 0-3%, 3-6%, 6-9%, 9-12%, or >12%) in Figure 1, DSWA Distribution of Trail Use, Summer 1991, page 10, DSWA Study: Draft Report, West Virginia University, November 2, 1991 to estimate portion of trail (thus portion of usage by visitors) in each sector. Since all visitors, regardless of activities, must use the trails to enter DSWA, this assumption is valid. Used activity percentages for each activity to break-out the total sector visitors into appropriate activities.	√	√
In Sector 9, the expected visitors and their activities are: between 3504 and 4657 hiking on trails, between 2446 and 3251 camping, between 463 and 615 hunting; and between 198 and 264 hiking off trails.	Used trail usage estimates (given as a range 0-3%, 3-6%, 6-9%, 9-12%, or >12%) in Figure 1, DSWA Distribution of Trail Use, Summer 1991, page 10, DSWA Study: Draft Report, West Virginia University, November 2, 1991 to estimate portion of trail (thus portion of usage by visitors) in each sector. Since all visitors, regardless of activities, must use the trails to enter DSWA, this assumption is valid. Used activity percentages for each activity to break-out the total sector visitors into appropriate activities.	√	√
Annual visitors to DSWA (total) is between 45,000 and 76,000.	Sum of the ranges of visitors determine per sector.	√	√
75% sweep efficiency	Default value established in Nominal Group Technique session with UXO Safety Specialists from USAEDH.	√	√
Estimated exposures are rounded to next higher integer.	Non-integer exposures are physically impossible.	√	√

FACSIMILE TRANSMITTAL HEADER SHEET

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FROM: Kevin Healy / Bill Sargent
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MESSAGE:

Rick,

As per ORD-OC's request, here's the justification for the risk #'s given in the Dolly Sods AM.

We're sending the whole report so that there'll be no questions about how the analysis works.

Kevin