APPENDIX C

RISK ASSESSMENT

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EAST ELLIOTT, SAN DIEGO, CALIFORNIA

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APPENDIX C

HAZARD EVALUATION AND RISK ASSESSMENT

C.0.0.1 The hazard evaluation and risk assessment conducted for East Elliott is presented in this appendix. This evaluation considers the risks to the health and welfare of potentially exposed individuals under a variety of land use scenarios. The risk assessment for East Elliott provides a basis for justifying various removal actions or risk reduction activities, if warranted.

C.0.0.2 Potential risk associated with ordnance and explosives (OE) at East Elliott was evaluated using Ordnance and Explosives Cost-Effectiveness Risk Tool (OECert) Version 2.0. The basis for using the OECert model to evaluate risk at an ordnance-impacted site is described in Ordnance and Explosives Cost-Effectiveness Risk Tool (OECert), Final Report, Version E (QuantiTech, 1995).

> "The risk estimating portion of OE*Cert* for dispersed sectors utilizes unexploded ordnance (UXO) density, the proportion of UXO on the surface of the ground, the area traversed by individuals while performing specific activities in the sector, and the number of individuals annually participating in activities to estimate the expected exposures by members of the public to surface UXO. The estimation of expected exposures by members of the public to subsurface UXO is dependent on these same parameters, plus knowledge of the intrusion depth associated with each activity and also the knowledge of the density distribution of subsurface UXO. Sweep efficiency and clearance depth are then considered in measuring the residual risk to the public after remediation."

C.0.0.3 The risk analysis presented in this section considers exposures to OE. OE exposures are defined by coming into contact with or being within destructive range of an OE item. The impact of the exposure (i.e., no impact or detonation, bodily harm, death, etc.), is not considered in this analysis. Only evaluating exposures provides a conservative approach to the risk assessment.

C.0.0.4 OECert is a risk model that provides a means of determining the estimated number of exposures at a site given different levels of removal action or no action for various land uses. Removal action alternatives based on this evaluation are identified and assessed in

Section 4.0 of this EE/CA. The removal action alternatives considered range from no action to clearance of ordnance to a depth of 4 feet below ground surface (bgs). Expected annual exposures are estimated for each of the removal action alternatives considered. Land uses evaluated include both current and future recreational uses and future construction activities. These scenarios are evaluated below.

C.0.0.5 This risk assessment was independently reviewed by Dr. Robert Mog of OR Applications of Huntsville, Alabama. Dr. Mog's resume is included in Attachment 1 to this appendix. The purpose of the independent review was to assess the technical adequacy of the risk assessment completed using the OECert and verify that the completed risk assessment was completed in accordance with the Standard Operating Procedures (SOPs) developed for the application of OECert (CEHNC, 1996). Dr. Mog reviewed and commented on the risk assessment and made recommendations for incorporation of final revisions, as appropriate. A copy of Dr. Mog's comments and responses to these comments, along with an audit report and signature page, is included in Attachment 1.

C.1 ESTIMATED OE DENSITY

C.1.0.1 OE density estimates were calculated and input to OECert based on data collected in September 1996 and summarized in OE Sampling Draft Report, Camp Elliott (East Elliott), California (CMS, 1997) and Section 2.3 of this EE/CA. The OE density estimates are based on an evaluation of sampling data obtained during the 1996 site investigation and evaluated using SiteStats/GridStats. These data are included in Appendix B.

C.1.0.2 OECert provides vertical ordnance profiles for five soil types: sand, sandy loam, loam, clay, and rock. However, although the soil type at East Elliott is loam, it contains abundant rock fragments that limit the depth of penetration of ordnance; therefore, the associated ordnance profile predicted by OECert for loam did not agree with the ordnance profile actually observed during the field survey (i.e., OECert predicted that a greater percentage of items would be found at deeper depths). To address this issue, OECert was used to calculate predicted exposures assuming that all of the OE items were on the ground surface. Using the data presented by CMS (1997), the percentage of OE on the ground surface was calculated and compared to the percentage of items found in the subsurface. Items included in this calculation, based on a consensus reached with CEHNC and CESPL during the on-board review meeting (CEHNC, 1997), were UXO, AP rounds, and fuses (live and expended); a summary of the vertical distribution of these items is provided in Table C-1.

TABLE C-1

VERTICAL DISTRIBUTION OF OE USED TO ESTIMATE RISK TO SURFACE AND SUBSURFACE ACTIVITIES AT EAST ELLIOTT[a]

Sector	Percentage of UXO, AP Rounds, and Fuses Found On the Ground Surface	Percentage of UXO, AP Rounds, and Fuses Found Below the Ground Surface
1	40	60
2	67	33
3	50	50
4	72	28

[a] Actual depth data are provided in Appendix B (Table B-2) of this EE/CA.

C.1.0.3 The OE density estimates used for each sector are presented in Table C-2. Most of the OE found at East Elliott was located on the ground surface or within the shallow subsurface (less than 1 foot bgs); no OE items of concern were found deeper than 12 inches bgs (Appendix B).

TABLE C-2

**ESTIMATED UXO DENSITY AT EAST ELLIOTT
FORMER CAMP ELLIOTT (EAST ELLIOTT)**

Sector	UXO Density[a] (items/ft^2)	UXO Density[a] (items/acre)	Percentage of OE that is UXO	Estimated Percentage of OE on the Surface[b]
1	2.8×10^{-6}	0.122	44%	40
2	2.2×10^{-6}	0.096	10%	67
3	0	0	-	50
4	2.2×10^{-6}	0.096	4%	72

[a] Inert OE are not included in the estimation of UXO density.

[b] The percentage of OE on the ground surface has been calculated to include UXO, armor-piercing (AP) rounds, and expended fuses as reported in Table 2-5.

C.1.0.4 OE density on the ground surface has been calculated using data presented by CMS for each sector. All OE items not found on the ground surface were found within 1 foot bgs. Items used to calculate the quantity of ordnance on the ground surface included UXO, armor piercing (AP) rounds (either AP-T or AP-C), and fuses (either live or expended). OE fragments and inert OE were not used to calculate the UXO density.

C.2 ESTIMATED ANNUAL EXPOSURES

C.2.0.1 OECert provides a means of determining the estimated number of exposures at a site given different levels of OE removal action for various land uses. An OE exposure is defined as coming into contact with or being in destructive range of OE (i.e., UXO). For the purposes of this risk assessment, UXO includes “live,” detonating fuses. If disturbed, either by people, animals, or physical conditions such as fire, these UXO items pose the threat of physical trauma up to and including death. However, each exposure does not necessarily result in injury or death; many exposures, especially if the UXO is not disturbed, may occur without incident. Inert OE, expended fuses, and fragments also do not pose a risk of detonation.

C.2.0.2 Using the percentage of these items on the ground surface, the exposures calculated by OECert were weighted accordingly. For example, if all ordnance is assumed to be on the ground surface, OECert estimates that there would be 410 exposures for the motor biking scenario in Sector 1. However, only 40 percent of the ordnance items were found on the ground surface in Sector 1. Because motor biking is assumed to be a surface activity, this translates to 164 exposures (i.e., 40 percent of 410). Using similar methods, all remaining risks for other activities affecting only the ground surface were calculated.

C.2.0.3 The remainder of the ordnance was assumed to be distributed in the top foot of soil to be consistent with the data collected by CMS (1997). The only activities considered in this risk assessment which potentially impact ordnance below the ground surface are off-road vehicle (ORV) use and construction. The risks due to ORV use and construction were calculated similarly to the above, but were partitioned into surface and subsurface exposures for purposes of risk reduction calculated for the alternatives considered in this EE/CA.

C.2.0.4 An estimate of the expected annual exposures is provided for each of the following activities included in the removal action alternatives considered in this EE/CA:

- No action,
- Surface OE removal, and
- OE removal to a depth of 1 foot bgs.

C.2.0.5 Because no OE was found below 12 inches, clearance deeper than 1 foot bgs would provide no additional risk reduction; therefore, additional clearance alternatives were not considered.

C.2.0.6 The "No Action" evaluation represents the existing state of risk at the site and provides a baseline against which various remedial actions may be compared. Scenarios evaluated include both recreational use and future development scenarios anticipated for each sector. The future development scenarios include municipal landfill construction in Sectors 1 and 2, and residential construction in Sectors 3, 4, and the remaining acreage outside the proposed extent of the landfills in Sectors 1 (50 acres) and 2 (150 acres). The evaluation of these scenarios is provided below.

C.2.1 Recreational Scenarios

C.2.1.1 Recreational scenarios currently comprise the majority of current land uses at East Elliott and were considered for each of the four sectors. Sector 2, while being the site of an operating landfill, is also utilized for recreational purposes in those areas outside the existing landfill (currently 114 acres in size). Recreational activities which have been observed to take place in all four sectors (unless otherwise noted) of East Elliott include the following:

- Biking
- Hiking
- Horseback riding (Sectors 1 and 3 only)
- Jogging
- Motor biking
- ORV use

C.2.1.2 A sector-specific estimate of annual usage for each of these activities is provided in Table C-3; most of the recreational activities occur in Sector 4, with a lesser number of people engaged in these activities in the more remote areas of East Elliott, such as Sector 1. These estimates were based on site visits and interviews with individuals familiar with the site and recreational usage at Mission Trails Regional Park. Mission Trails Regional Park receives approximately 500,000 visitors each year (Mission Trails, pers. comm., 1997); however, this number includes visitors using the golf course, interpretive facilities, and lake for boating, swimming, etc., as well as the activities in common with East Elliott. Based on the degree of access to East Elliott from Mission Trails Regional Park and observations by individuals familiar with the site, the total estimated usage at East Elliott is roughly 10 percent of that value (Walker, pers. comm., 1997a; Mission Trails, pers. comm., 1997). Persons engaged in recreational activities at East Elliott have a risk of exposure to OE on the ground surface. OE present in the subsurface present a risk to ORV users only; the depth of disturbance from ORVs is about 3 inches (QuantiTech, 1995). A list of the remaining assumptions input into OECert to calculate exposures during recreational activities to OE is provided in Table C-3.

TABLE C-3

ASSUMPTIONS FOR RISK ASSESSMENT MODEL (OECert), RECREATIONAL SCENARIOS, EAST ELLIOTT

(Page 1 of 3)

Assumption	Source/Rationale
Biking, Jogging, Motor Biking, Off-Road Vehicles, Hiking, Horseback Riding in all Sectors except no horseback riding is anticipated in Sectors 2 and 4.	Site Observation and information obtained from Mission Trails Regional Park.
Sector 1 is approximately 750 acres.	Ordnance and Explosives Sampling/Draft Removal Report Camp Elliott (East Elliott), California, CMS, 1997.
Sector 2 is approximately 650 acres. Of this only 425 acres is available for recreational activities due to the presence of the County landfill.	Ordnance and Explosives Sampling/Draft Removal Report Camp Elliott (East Elliott), California, CMS, 1997.
Sector 3 is approximately 750 acres.	Ordnance and Explosives Sampling/Draft Removal Report Camp Elliott (East Elliott), California, CMS, 1997.
Sector 4 is approximately 1,050 acres.	Ordnance and Explosives Sampling/Draft Removal Report Camp Elliott (East Elliott), California, CMS, 1997.
Total Anomaly Density for Sector 1 is 6.2×10^{-4} items/ft^2.	Ordnance and Explosives Sampling/Draft Removal Report Camp Elliott (East Elliott), California, CMS, 1997.
Total Anomaly Density for Sector 2 is 2.1×10^{-3} items/ft^2.	Ordnance and Explosives Sampling/Draft Removal Report Camp Elliott (East Elliott), California, CMS, 1997.
Total Anomaly Density for Sector 3 is 1.3×10^{-3} items/ft^2.	Ordnance and Explosives Sampling/Draft Removal Report Camp Elliott (East Elliott), California, CMS, 1997.
Total Anomaly Density for Sector 4 is 5.0×10^{-3} items/ft^2.	Ordnance and Explosives Sampling/Draft Removal Report Camp Elliott (East Elliott), California, CMS, 1997.
OE Density for Sector 1 is 2.8×10^{-6} items/ft^2.	Ordnance and Explosives Sampling/Draft Removal Report Camp Elliott (East Elliott), California, CMS, 1997.
OE Density for Sector 2 is 2.2×10^{-6} items/ft^2.	Ordnance and Explosives Sampling/Draft Removal Report Camp Elliott (East Elliott), California, CMS, 1997.
OE Density for Sector 3 is 0 items/ft^2.	Ordnance and Explosives Sampling/Draft Removal Report Camp Elliott (East Elliott), California, CMS, 1997.
OE Density for Sector 4 is 2.2×10^{-6} items/ft^2.	Ordnance and Explosives Sampling/Draft Removal Report Camp Elliott (East Elliott), California, CMS, 1997.
Surface OE Density for Sector 1 is 40 percent.	Ordnance and Explosives Sampling/Draft Removal Report Camp Elliott (East Elliott), California, CMS, 1997.

TABLE C-3

ASSUMPTIONS FOR RISK ASSESSMENT MODEL (OECert),
RECREATIONAL SCENARIOS, EAST ELLIOTT
(Page 2 of 3)

Assumption	Source/Rationale
Surface OE Density for Sector 2 is 75 percent.	Ordnance and Explosives Sampling/Draft Removal Report Camp Elliott (East Elliott), California, CMS, 1997.
Surface OE Density for Sector 3 is 50 percent.	Conservative Assumption based on Ordnance and Explosives Sampling/Draft Removal Report Camp Elliott (East Elliott), California, CMS, 1997.
Surface OE Density for Sector 4 is 72 percent.	Ordnance and Explosives Sampling/Draft Removal Report Camp Elliott (East Elliott), California, CMS, 1997.
Sweep efficiencies for surface anomalies are 95 percent.	Guidance by U.S. Army Engineering and Support Center, Huntsville (USAESCH)
Sweep efficiencies for anomaly depth 0 to 1 ft. are 92.3 percent.	Guidance by USAESCH
Effective Area of Trails in Sector 1 for biking, jogging, motor biking, hiking, and horseback riding is 22.4 acres.	Orthotopographic maps, topographic maps, and aerial photos.
Effective Area of Trails in Sector 2 for biking, jogging, motor biking, hiking, and horseback riding is 17.5 acres.	Orthotopographic maps, topographic maps, and aerial photos.
Effective Area of Trails in Sector 3 for biking, jogging, motor biking, hiking, and horseback riding is 23.2 acres.	Orthotopographic maps, topographic maps, and aerial photos.
Effective Area of Trails in Sector 4 for biking, jogging, motor biking, hiking, and horseback riding is 55.5 acres.	Orthotopographic maps, topographic maps, and aerial photos.
Effective Area of Trails in Sector 1 for off-road vehicle use is 19.8 acres.	Orthotopographic maps, topographic maps, and aerial photos.
Effective Area of Trails in Sector 2 for off-road vehicle use is 16.6 acres.	Orthotopographic maps, topographic maps, and aerial photos.
Effective Area of Trails in Sector 1 for off-road vehicle use is 21.2 acres.	Orthotopographic maps, topographic maps, and aerial photos.
Effective Area of Trails in Sector 1 for off-road vehicle use is 54.1 acres.	Orthotopographic maps, topographic maps, and aerial photos.
3,000 estimated annual uses for biking in Sectors 1 and 2.	Site visits, interviews, and Mission Trails Usage used as baseline.
3,500 estimated annual uses for biking in Sectors 3 and 4.	Site visits, interviews, and Mission Trails Usage used as baseline.
2,700 estimated annual uses for hiking in Sector 1.	Site visits, interviews, and Mission Trails Usage used as baseline.
2,700 estimated annual uses for hiking in Sector 2.	Site visits, interviews, and Mission Trails Usage used as baseline.
4,500 estimated annual uses for hiking in Sector 3.	Site visits, interviews, and Mission Trails Usage used as baseline.
6,700 estimated annual uses for hiking in Sector 4.	Site visits, interviews, and Mission Trails Usage used as baseline.
500 estimated annual uses for ORV use in Sector 1.	Site visits, interviews, and Mission Trails Usage used as baseline.
1,000 estimated annual uses for ORV use in Sector 2.	Site visits, interviews, and Mission Trails Usage used as baseline.

TABLE C-3

ASSUMPTIONS FOR RISK ASSESSMENT MODEL (OECert), RECREATIONAL SCENARIOS, EAST ELLIOTT
(Page 3 of 3)

Assumption	Source/Rationale
1,000 estimated annual uses for ORV use in Sector 3.	Site visits, interviews, and Mission Trails Usage used as baseline.
1,000 estimated annual uses for ORV use in Sector 4.	Site visits, interviews, and Mission Trails Usage used as baseline.
500 estimated annual uses for jogging in Sector 1.	Site visits, interviews, and Mission Trails Usage used as baseline.
500 estimated annual uses for jogging in Sector 2.	Site visits, interviews, and Mission Trails Usage used as baseline.
1,000 estimated annual uses for jogging in Sector 3.	Site visits, interviews, and Mission Trails Usage used as baseline.
1,500 estimated annual uses for jogging in Sector 4.	Site visits, interviews, and Mission Trails Usage used as baseline.
150 estimated annual uses for motor biking in Sector 1.	Site visits, interviews, and Mission Trails Usage used as baseline.
50 estimated annual uses for motor biking in Sector 2.	Site visits, interviews, and Mission Trails Usage used as baseline.
50 estimated annual uses for motor biking in Sector 3.	Site visits, interviews, and Mission Trails Usage used as baseline.
50 estimated annual uses for motor biking in Sector 4.	Site visits, interviews, and Mission Trails Usage used as baseline.
250 estimated annual uses for horseback riding in Sector 1.	Site visits, interviews, and Mission Trails Usage used as baseline.
Zero estimated annual uses for horseback riding in Sectors 2 and 4.	Site visits, interviews, and Mission Trails Usage used as baseline.
500 estimated annual uses for horseback riding in Sector 3.	Site visits, interviews, and Mission Trails Usage used as baseline.
Population of the City of San Diego is 1,110,549.	US Census Bureau (1990 Census).
Population of the County of San Diego is 2,498,016.	US Census Bureau (1990 Census).
Area of the City of San Diego is 330.7 square miles.	US Census Bureau (1990 Census).
Area of the County of San Diego is 4204.5 square miles.	US Census Bureau (1990 Census).

C.2.1.3 The activity-specific risk assessment results for continuing recreational land use are presented in Table C-4. These risk estimates apply to both current and potential future recreational land uses if no action is taken at East Elliott.

TABLE C-4

CURRENT EXPECTED ANNUAL OE EXPOSURES FOR RECREATIONAL ACTIVITIES FORMER CAMP ELLIOTT (EAST ELLIOTT)

Activity	Sector 1	Sector 2	Sector 3	Sector 4	All Sectors
Biking	3,278	3,773	0	13,403	20,454
Hiking	2,951	3,396	0	25,657	32,004
Horseback Riding	273	0	0	0	273
Jogging	546	629	0	5,744	6,919
Motor Biking	164	63	0	191	418
ORV Use	1,207	1,591	0	5,185	7,983
Total No. of OE Exposures per Year[a]	8,419	9,452	0	50,180	68,051

[a] Assuming No Action is taken at East Elliott

C.2.1.4 The results of the analysis indicate that Sector 4 has the highest potential for recreational exposures. This is due primarily to the fact that Sector 4 experiences considerably more usage than Sectors 1 or 2 while having roughly the same OE density. In addition, Sector 4 has nearly double the percentage of OE on the ground surface than Sector 1. There are no predicted annual exposures for Sector 3 because no UXO or "live" fuses were found during the sampling; only inert OE and fragments were found.

C.2.1.5 Annual exposures for current and future recreational use were also calculated for each sector assuming that OE was removed from the ground surface and the percentage of risk reduction compared to the "No Action" or baseline risk was calculated. The percentage of risk reduction assuming that OE on the ground surface would be removed is presented in Table C-5. The estimated risk for each recreational activity after surface OE removal is included in Table C-6.

TABLE C-5

ANTICIPATED RISK REDUCTION FOR RECREATIONAL ACTIVITIES
SURFACE OE REMOVAL
FORMER CAMP ELLIOTT (EAST ELLIOTT)

Sector	No Action (Exposures/Year)	Surface OE Removal (Exposures/Year)	Percent Risk Reduction[a]
1	8,419	1,110	87
2	9,452	668	93
3	0	0	- -
4	50,180	2,888	94
Total	68,051	4,666	93

[a] Relative to No Action.

TABLE C-6

ANTICIPATED FUTURE EXPOSURES BY ACTIVITY
SURFACE OE REMOVAL
FORMER CAMP ELLIOTT (EAST ELLIOTT)

Activity	Sector 1	Sector 2	Sector 3	Sector 4	Site Total
Biking	164	101	0	372	637
Hiking	148	91	0	713	952
Horseback Riding	14	0	0	0	14
Jogging	27	17	0	160	204
Motor Biking	8	2	0	5	15
ORV Use	749	457	0	1,638	2,844
Total for all Activities	1,110	668	0	2,888	4,666

C.2.1.6 As shown in Table C-5, the estimated percentage of risk reduction for recreational users that would occur if OE is removed from the surface ranges from 87 to 94 percent. This reduction applies to current and future recreational users for the scenarios listed above. The greatest reduction in risk is for activities which only impact the surface, i.e. recreational uses other than ORV use (Table C-6). It should be noted that the risk for these activities is not eliminated by surface removal because a variety of factors impact the sweep efficiency of the removal action. Sweep efficiencies refer to the percentage of ordnance present which would actually be removed if the area was swept for ordnance. OECert uses default sweep efficiencies based on field tests; default sweep efficiencies include 95 percent for surface anomalies and 92.3

percent for subsurface anomalies from 0 to 1 foot (Table C-3). As indicated, the efficiency of the ordnance removal operations in the subsurface decreases with increased depth (QuantiTech, 1995).

C.2.1.7 The percentage of risk reduction assuming that OE on the ground surface and in the subsurface down to 1 foot bgs would be removed is presented in Table C-7; the estimated risk for each recreational activity after subsurface OE removal to a depth of 1 foot is shown in Table C-8.

TABLE C-7

ANTICIPATED RISK REDUCTION FOR RECREATIONAL ACTIVITIES SURFACE AND SUBSURFACE OE REMOVAL TO A DEPTH OF 1 FOOT FORMER CAMP ELLIOTT (EAST ELLIOTT)

Sector	No Action (Exposures/Year)	Surface and Subsurface Removal (Exposures/Year)	Percent Risk Reduction[a]
1	8,419	441	95
2	9,452	301	97
4	0	0	- -
4	50,180	1,548	97
Total	68,051	2,290	97

[a] Relative to No Action.

TABLE C-8

**ANTICIPATED FUTURE EXPOSURES BY ACTIVITY
SURFACE AND SUBSURFACE OE REMOVAL TO A DEPTH OF 1 FOOT
FORMER CAMP ELLIOTT (EAST ELLIOTT)**

Activity	Sector 1	Sector 2	Sector 3	Sector 4	Site Total
Biking	164	101	0	372	637
Hiking	148	91	0	713	952
Horseback Riding	14	0	0	0	14
Jogging	27	17	0	160	204
Motor Biking	8	2	0	5	15
ORV Use	80	90	0	298	468
Total for all Activities	441	301	0	1,548	2,290

C.2.1.8 As shown in Table C-6, the estimated percentage of risk reduction that would occur if OE is removed from the ground surface and subsurface to a depth of 1 foot bgs is approximately 95 percent. The greatest reduction in risk resulting from this removal action compared to surface clearance alone is in Sector 1 (an increase of 8 percent). The risk reduction for Sector 1 is due to the predominance of OE within the shallow subsurface (60 percent) compared to other sectors (Table C-2).

C.2.2 Construction Scenarios

C.2.2.1 Construction at East Elliott would result in potential risks to workers involved in excavation and other activities that could result in the disturbance of both surface and subsurface UXO. To estimate the number of exposures associated with construction at East Elliott, the potential construction scenarios for each sector were identified. These construction scenarios include:

- Residential
- Sanitary Landfill (Sectors 1 and 2)

C.2.2.2 Currently, the only construction occurring at East Elliott is the expansion of the San Diego County landfill located in Sector 2. Although the Sycamore Canyon Landfill is currently only 114 acres in size, development plans include expansion up to a maximum area of approximately 500 acres. In addition, the City of San Diego has proposed constructing a 700-acre landfill in Sector 1.

C.2.2.3 It is also possible that residential development will occur in the areas outside of the proposed landfills. For the residential development scenario, the number of privately owned parcels and property owners were identified for each sector based on Assessor's parcel maps originally obtained from the County of San Diego and presented in the Archive Search Report (Montgomery Watson, 1995). East Elliott is currently zoned R-1-40 for single-family residential construction with a minimum lot size of 40,000 square feet (or slightly less than 1 acre), of which no more than 45 percent would be designated as a building area. Most lots at East Elliott presently consist of a minimum of 5 acres; therefore, it was assumed that some property owners would subdivide their parcel into multiple lots.

C.2.2.4 The presence of geologic hazards such as landslides, debris flows, expansive soils, and steep slopes at East Elliott suggests that the available building sites will be limited. The percentage of potential building area within each sector was therefore estimated based on the Elliott Community Plan open-space system (San Diego Planning Department, 1971), available topographic maps, and site observations. For Sectors 1, 2, and 4, it was estimated that approximately 40, 50, and 60 percent, respectively, of the privately owned land could be potentially developed. For Sector 3, it was estimated that 35 percent of the privately owned land in the north and 50 percent of the land in the south (including private and public land) could be potentially developed. The lower estimated building area for Sector 3 is due to the presence of steep slopes and narrow ridges along Spring Canyon.

C.2.2.5 After determining the amount of usable area in each sector, the number of building sites was estimated by assuming that two residences would be built on each usable acre as described in the Elliott Community Plan (San Diego Planning Department, 1971), with the minimum lot size maintained by the undeveloped area. In addition, it was assumed that a minimum of one residence would be constructed in each parcel. The estimated number of residential sites for each sector is provided in Table C-8.

TABLE C-9

FUTURE RESIDENTIAL CONSTRUCTION ESTIMATES FORMER CAMP ELLIOTT (EAST ELLIOTT)

Sector	Estimated Usable Area (Acres)	Estimated No. of Residences	Estimated Population
1	20	40	120
2	75	155	480
3	235	450	1,400
4	340	680	2,110

C.2.2.6 For the effective construction area, which includes the surface and subsurface area that would be affected during construction, it was assumed that the maximum area of each landfill would be excavated such that any subsurface OE may be disturbed. For residential construction, it was estimated that approximately 10,000 square feet of surface area would be disturbed during the construction of each residence, including landscaped areas and additional access roads (most of the roads needed for residential development would most likely be constructed along existing alignments which have already been disturbed). It was also estimated that approximately 4,000 square feet of each building site would be excavated to allow construction of the residence, including the foundation and a swimming pool. The effective construction areas for Sectors 1 through 4 are listed on Table C-10.

TABLE C-10

EFFECTIVE CONSTRUCTION AREA FORMER CAMP ELLIOTT (EAST ELLIOTT)

Sector	Estimated Surface Construction Area[a] (Acres)	Estimated Subsurface Construction Area[b] (Acres)
1	275	269
2	535	514
3	184	122
4	279	185

[a] Includes 10,000 square feet per residence and entire landfill area in Sectors 1 and 2.

[b] Includes 4,000 square feet per residence and entire landfill area in Sectors 1 and 2.

C.2.2.7 The risk assessment also includes an estimate of the number of construction workers that will be involved in grading and excavation activities at the site. According to the County of San Diego (Prasad, pers. comm., 1997), the excavation crew involved in the initial expansion of the landfill cells or the Sycamore Canyon Landfill (Sector 2) would consist of two workers operating heavy equipment. In addition, the initial geotechnical crew required to be on site during the investigation and design of the landfill would consist of five workers. For the proposed City landfill in Sector 1, the excavation crew involved in the initial construction of the landfill cells would likely consist of 10 workers operating heavy equipment because of the larger effort required to construct a new landfill and associated support facilities compared to expansion of an existing landfill. As for the County landfill, the initial geotechnical crew required to be on site during the investigation and design of the landfill would consist of five workers.

C.2.2.8 For residential development, the typical labor crew for foundation construction generally consists of five workers. It is assumed a single foundation construction company would be expected to work on more than one residence. Therefore, a maximum number of 125 workers (five workers from each of 25 separate crews) are anticipated to be involved in excavation at East Elliott.

C.2.2.9 A list of remaining assumptions input into OECert to calculate exposures during construction is provided in Table C-11; assumptions common to both recreational use and construction scenarios are included in Table C-3. Based on these assumptions, risk of exposure for construction workers were calculated using OECert. These results of the baseline risk evaluation for the No Action scenario are presented in Table C-12.

TABLE C-11

**ASSUMPTIONS FOR RISK ASSESSMENT MODEL (OECert),
CONSTRUCTION SCENARIOS, EAST ELLIOTT**

Assumption	Source/Rationale
Sector 1 surface excavation area is 275 acres; subsurface excavation area is 269 acres.	Land use planning, zoning, and upcoming construction data.
Sector 2 surface excavation area is 535 acres; subsurface excavation area is 514 acres.	Land use planning, zoning, and upcoming construction data.
Sector 3 surface excavation area is 184 acres; subsurface excavation area is 122 acres.	Land use planning, zoning, and upcoming construction data.
Sector 4 surface excavation area is 279 acres; subsurface excavation area is 185 acres.	Land use planning, zoning, and upcoming construction data.
Sector 1 is residential construction only and assumes 125 persons participating in construction activities.	Construction analysis.
Sectors 2, 3, and 4 assume both residential construction and landfill construction. 127 persons are assumed to be participating in excavation activities.	Construction analysis and personal communication between Braham Prasad (County of San Diego) and Steve Sonnen (Montgomery Watson).

Note: Only exposure assumptions which differ from the recreational scenarios (Table C-3) are presented in this table.

TABLE C-12

EXPECTED FUTURE EXPOSURES FOR CONSTRUCTION, NO ACTION FORMER CAMP ELLIOTT (EAST ELLIOTT)

Sector	Total No. of OE Exposures
1	4,199
2	6,516
3	0
4	3,402
Site Total	14,117

C.2.2.10 In addition, annual exposures for future construction use were calculated for each sector assuming that OE removal from the ground surface was conducted and the percentage of risk reduction compared to the "No Action" or baseline risk was calculated. The percentage of risk reduction assuming that OE on the ground surface would be removed is presented in Table C-13.

TABLE C-13

EXPECTED FUTURE EXPOSURES FOR CONSTRUCTION SURFACE OE REMOVAL FORMER CAMP ELLIOTT (EAST ELLIOTT)

Sector	No Action (Total No. of OE Exposures)	Surface Removal (Total No. of OE Exposures)	Percent Risk Reduction
1	4,199	2,603	38
2	6,516	1,873	71
3	0	0	- -
4	3,402	1,075	68
Total	14,117	5,551	61

C.2.2.11 As shown in Table C-13, the estimated risk reduction that would occur if OE is removed from the surface is 38, 71, and 68 percent for Sectors 1, 2, and 4, respectively. This applies to the risk to construction workers involved in grading and excavation for landfill construction in Sectors 1 and 2, and residential construction in the remaining areas of Sectors 1 and 2, and all of Sectors 3 and 4. There is no measurable risk reduction in Sector 3 because no

UXO were found in this sector. The reason that the percentage risk reduction for Sector 1 is dramatically less than the reduction for either Sector 2 or 4 is due to the smaller percentage of OE on the surface of Sector 1 (40 percent) relative to Sectors 2 (75 percent) or 4 (72 percent). Because construction activities may take place up to 10 feet bgs, construction workers in Sector 1 would expect to have higher exposures to subsurface OE than workers in Sectors 2 and 4. It should be noted that the risk for these activities is not eliminated by surface removal because a variety of factors impact the sweep efficiency of the removal action.

C.2.2.12 The percentage of risk reduction for the construction scenario assuming that OE on the ground surface and in the subsurface up to 1 foot bgs would be removed is presented in Table C-14.

TABLE C-14

EXPECTED FUTURE EXPOSURES FOR CONSTRUCTION SURFACE AND SUBSURFACE OE REMOVAL TO A DEPTH OF 1 FOOT FORMER CAMP ELLIOTT (EAST ELLIOTT)

Sector	No Action (Total No. of OE Exposures)	Surface and Subsurface Removal (Total No. of OE Exposures)	Percent Risk Reduction
1	4,199	278	93
2	6,516	370	94
3	0	0	- -
4	3,402	196	94
Total	14,117	844	94

C.2.2.13 As shown in Table C-14, the estimated risk reduction for construction that would occur if UXO is removed from the ground surface and subsurface to a depth of 1 foot bgs is approximately 94 percent. Sector 1 benefits the most from additional clearance (i.e., subsurface clearance to 1 foot in addition to surface clearance). A 55 percent reduction in construction risks is noted for Sector 1 relative to surface clearance alone. Sectors 2 and 4 show additional reductions in risk of 23 percent and 26 percent, respectively.

C.2.3 Summary of Risk Reduction for All Activities

C.2.3.1 After combining the relative risk reduction for both recreational activities (Section C.2.1) and construction (Section C.2.2), the overall risk reductions provided by surface clearance in Sectors 1, 2, and 4 are 71, 84, and 93 percent, respectively, as shown in Table C-15. The lower risk reduction provided by this clearance alternative in Sector 1 is due to the predominance of OE found in the shallow subsurface compared to the surface. In addition, Sector 4 has the highest risk reduction for surface clearance because a greater percentage of OE was found on the surface and because the greatest number of baseline exposures were attributable to recreational users during activities that affect only the ground surface, such as hiking.

TABLE C-15

ANTICIPATED RISK REDUCTION FOR ALL ACTIVITIES
SURFACE OE REMOVAL
FORMER CAMP ELLIOTT (EAST ELLIOTT)

Sector	No Action (Exposures/Year)[a]	Surface OE Removal (Exposures/Year)	Percent Risk Reduction[a]
1	12,618	3,713	71
2	15,968	2,541	84
3	0	0	- -
4	53,582	3,963	93

[a] Includes estimated exposures for recreational and construction activities.

C.2.3.2 The overall risk reductions for both recreational and construction activities provided by surface and subsurface clearance in Sectors 1, 2, and 4 are 94, 96 and 97 percent, respectively, as shown in Table C-16. The lowest risk reduction provided by this alternative is within Sector 1 because the efficiency of clearance activities is less for OE found below the ground surface compared to on the ground surface. However, the greatest increase in relative risk reduction is also in Sector 1 (23 percent) because more ordnance was found below the ground surface and because construction activities for the proposed City landfill were expected to impact the subsurface within the majority of the total sector area. In comparison, the risk reduction estimated for Sector 2 was 12 percent for surface and subsurface clearance in addition to the risk reduction provided by surface clearance alone.

TABLE C-16

**ANTICIPATED RISK REDUCTION FOR ALL ACTIVITIES
SURFACE AND SUBSURFACE OE REMOVAL TO A DEPTH OF 1 FOOT
FORMER CAMP ELLIOTT (EAST ELLIOTT)**

Sector	No Action (Exposures/Year)[a]	Surface OE Removal (Exposures/Year)	Percent Risk Reduction[a]
1	12,618	719	94
2	15,968	671	96
3	0	0	- -
4	53,582	1,744	97

[a] Includes estimated exposures for recreational and construction activities.

ATTACHMENT 1

INDEPENDENT RISK ASSESSMENT REVIEW

OR APPLICATIONS

Innovative and Cost-Effective Operations Research Solutions

January 16, 1998

Montgomery Watson Americas, Inc.
1340 Treat Blvd., Suite 300
Walnut Creek, CA 94596

Subject: Risk Assessment Review for Former Camp Elliot (East Elliot)

This letter presents the results of my review of the Hazard Evaluation and Risk Assessment (HERA) presented in the Engineering Evaluation/Cost Analyses (EE/CA) for Former Camp Elliot (East Elliot) in San Diego, California. My responsibility is to express an opinion on the technical aspects of this HERA based on my review. The preparation of this HERA is the responsibility of Montgomery Watson.

I conducted my review of this HERA in accordance with generally accepted standards, which require that I plan and perform the review to obtain reasonable assurance about whether the technical statements made herein are free of material misstatements. My review included examining, on a test basis, evidence supporting the numbers and associated statements made in this HERA. I also reviewed the raw calculations of OE densities and performed test checks on relative annual exposures. In my opinion, the accompanying HERA for Former Camp Elliot (East Elliot) forms a technically adequate representation for the purpose to which it was applied, and meets the Standard Operating Procedures developed for the application of OECert, the risk assessment software used.

Robert A. Mog

Robert A. Mog, Ph.D.

Principal Investigator, Operations Research

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EDUCATION

Ph.D. in Industrial and Systems Engineering, Major in Operations Research, Minors in Mathematics and Systems, Dissertation Title: "Discrete Posynomial Programming With Applications To Spacecraft Protective Structures Design Optimization," University of Alabama In Huntsville; Huntsville, Alabama, Dec. 1990.

Master of Science in Industrial and Systems Engineering, Major in Operations Research, Minors in Systems and Applied Statistics, University of Alabama In Huntsville; Huntsville, Alabama, Dec. 1989.

Master of Arts in Mathematics, Concentration in Partial Differential Equations and Matrix Theory, University of Alabama In Huntsville; Huntsville, Alabama, June, 1985.

Bachelor of Science in General Engineering, Field of Specialization: Mathematical Analysis, University of Illinois; Champaign-Urbana, Illinois, Jan. 1983.

Numerous Continuing Education Units, including "Analyzing Risk: Science, Assessment, and Management" by the Harvard School of Public Health.

PROFESSIONAL EXPERIENCE

Summary: A multifaceted fifteen year career that includes performing, directing, and consulting in the areas of operations research, engineering design, technical marketing and management, and contract management. Continuing education through publications, national conference presentations, graduate level teaching, and three advanced degrees earned while working full time for the government and industry. Efforts directed toward mathematically intensive econometric, environmental, aerospace, and Defense-related programs of business and national interest. Common thread is the nearly universal application of high return on investment operations research methodologies to engineering, science, business, and management.

June 1995 to Present
OR Applications
Huntsville, Al. 35802

Position: Founder and Principal Investigator, Operations Research

Responsible for the business and technical operations of value-added, team-oriented applications of operations research in business decision-making and high volume situations, including environmental sampling and manufacturing Quality Assurance/Quality Control. Focuses on high return-on-investment applications of risk management, systems complexity, decision science, and econometrics. Currently providing strategic planning guidance using econometric, forecasting, and efficient portfolio development methodologies for a real estate investment management firm. Performing simulation verification, validation, and enhancement utilizing unique Monte Carlo acceleration methods. Developing advanced statistical decision tools for environmental sampling and risk management. Performing research in the area of analytic stochastics for manufacturing systems and processes. Developed strategic business plans for analytic stochastic maintenance optimization of commercial processes. Developed sequential sample size requirements for hospital Quality Assurance auditing of post-operative infections.

June 1995 to January 1996
QuantiTech, Inc.
Huntsville, Al. 35806

Position: Consulting Statistician

Responsible for advanced statistical development and analyses for the U.S Army Corps of Engineers, Huntsville Division (USAEDH) programs. Responsible for developmental enhancements of DOD standard in environmental sampling software, GridStats and SiteStats. Advised Architectural/Engineering firms and USAEDH on improving sequential processes for environmental sampling area sizing.

March 1994 to June 1995
QuantiTech, Inc.
Huntsville, Al. 35806

Position: Director of Technical Staff and Principal Investigator

Directed environmental risk assessment. statistical sampling (GridStats), and risk management policies using operations research and decision theory methodologies. Integrated risk assessment and dynamic statistical sampling techniques for the U.S. Army Corps of Engineers program to remediate formerly used defense sites (FUDS) which are contaminated by ordnance and explosives (OE). Developed cost-effective statistical sampling methodologies using hypergeometric and binomial sequential probability ratio test algorithms. Responsible for identifying internal project managers for QuantiTech projects, approving timecards and decision support system acquisitions, and ensuring that projects were completed within cost and schedule constraints, while maintaining a high return on investment for the customer.

January 1991 to 1997
The University of Alabama In Huntsville
Huntsville, Al. 35899

Position: Assistant Professor (Adjunct)
Department of Industrial and Systems Engineering

Responsible for teaching upper level graduate courses in Mathematical Programming and Operations Research in the Department of Industrial and Systems Engineering. Courses include discrete linear and nonlinear optimization, stochastic and Markov processes, advanced nonlinear optimization, nonlinear programming, fuzzy mathematical programming, simulation, advanced simulation design, and statistical quality control. Published in refereed journals and sponsored course projects in the application of operation research techniques, including the areas of economics, commercial manufacturing, and the International Space Station. Developed a budget allocation tool for municipal planning, and developed a personal investment portfolio analysis and decision-making tool. Served on numerous Master's and Ph.D.-level supervisory committees, and served as Thesis Advisor for Master's and Ph.D. candidates in Operations Research.

June 1985 to March 1994
Science Applications International Corporation (SAIC)
6725 Odyssey Drive
Huntsville, Al. 35806

Position: Applied Mathematician, Systems Survivability Engineer

NASA-Related: Developed optimal protective structures design configurations for the International Space Station. Using advanced operations research techniques, integrated spacecraft mission requirements, hypervelocity impact phenomenology, structural design considerations, and particulate space environment data into a single stochastically analytic optimal protective structures design capability. Developed multibumper hypervelocity impact predictors using multivariate nonlinear regression techniques applied to the MSFC Materials and Processes Hypervelocity Impact Test Database. Developed design requirements for manned Mars missions. Developed multivariate nonlinear regression models for Space Station seal failure criteria for numerous material types and environmental conditions. Directed software development efforts for decision aids in this field. R&D methodologies included geometric programming, Hooke and Jeeves pattern search algorithms, random and Fibonacci searches, penalty function techniques, and discrete nonlinear optimization tools.

DOD-Related: Developed and applied fuzzy programming methods to interceptor firing doctrine problems for Theatre Missile Defense. Developed experimental design methodologies for TMD Test and Evaluation efforts. Served as Principal Investigator for a DARPA effort involving ceramic shield design for satellite protection against hypervelocity impact. Directed, developed, and employed stochastic and deterministic simulation models to investigate Preplanned Response Options, Defense Employment Options, inventory balancing, and multistage discrimination threshold optimization for the System Engineer. Optimized interceptor coverages for stochastic force-on-force models. Developed and applied life cycle cost models for Systems Architect.

February 1983 to June 1985
National Aeronautics and Space Administration (NASA)
George C. Marshall Space Flight Center
Marshall Space Flight Center, Al. 35812

Position: Aerospace Engineer

Responsible for the original Space Station *Freedom* protective structures design configuration. Developed codes to design bumper/pressure wall configurations to defeat the meteoroid and space debris environments for the Space Station, Space Shuttle, and Space Telescope. Developed codes to determine appropriate hypervelocity test parameters for use in MSFC's Light Gas Gun Facility. Participated in contractor proposal evaluations and served as technical reviewer for the Hubble Space Telescope Meteoroid Analysis.

Served as Planning Engineer in MSFC's Test Laboratory; wrote work orders for space hardware fabrication and interacted with QA/QC and production personnel. Performed ultrasonic analyses in the Nondestructive Evaluation Division of the Materials and Processes Laboratory. Reviewed and developed stress analyses on the Space Shuttle Main Engines and Hubble Space Telescope in the Stress Analysis Division. Designed structural flight hardware for the successful and recently completed Space Telescope Refurbishment Mission using the IGDS CAD system.

PUBLICATIONS

Mog, R. A., "A Leveraged Frontier Model for Real Estate Investment Decisions," OR Applications, September 1996.

Mog, R.A., "Complexity and Meta^{2}modeling Innovations for Electronic Manufacturing Systems Decision and Modeling Support," OR Applications, September, 1996.

Mog, R. A., "Risk Assessment Methodologies for Spacecraft in Particulate Environments: Enhancements Through Operations Research," OR Applications, August 1996.

Mog, R. A., "Portfolio Diversification in a Real Estate Investment Environment," OR Applications, March 1996.

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Mog, R. A., and Helman, D. R., "Meteoroid/Orbital Debris Implications to the System Engineer," Program Information Report 92-237, Aug. 1992.

Robinson, J. H., and Mog, R. A., "Preliminary Design of a Meteoroid/Orbital Debris Shield System for a Mars Mission Spacecraft," AIAA Space Programs and Technologies Conference, March 1992.

Mog, R. A., and Margopoulos, W. B., "A Survey of Kinetic and Orbital Debris Implications to the System Engirieer," Program Information Report No. 91-235, Sept. 27, 1991.

Mog, R. A., "The Role of Risk and Uncertainty in Optimizing the Design of Space Station *Freedom* Protective Structures to Defeat Meteoroids and Space Debris," The 7th Annual TABES (Technical and Business Exhibition/Symposium), May 1991.

Mog, R. A., Spacecraft Protective Structures Design Optimization, *AIAA Journal of Spacecraft and Rockets,* Vol. 28, No. 1, Jan.-Feb. 1991.

Mog, R. A., Discrete Posynomial Programming With Applications To Spacecraft Protective Structures Design Optimization, Dissertation, Dec. 1990.

Mog, R. A., and Price, D. M., "Geometric Programming Design of Spacecraft Protective Structures to Defeat Earth-Orbital Space Debris," AIAA-90-3662, Space Programs and Technologies '90 Conference, Sept. 1990.

Mog, R. A., and Horn, J. R., "Geometric Programming Prediction of Design Trends for OMV Protective Structures," NASA TM-4206, June 1990.

Mog, R. A., and Lovett, J. N., "A Survey of Geometric Programming - White Paper," March 1990.

Mog, R. A., "Spacecraft Protective Structures Design Optimization," AIAA-90-0087, 28th Aerospace Sciences Meeting, Jan. 1990.

Mog, R. A., Lovett, J. N., and Avans, S. L., "Global Nonlinear Optimization of Spacecraft Protective Structures Design," NASA TM-100387, Jan. 1990.

Mog, R. A., "Posynomial Regression Analysis for Hypervelocity Impact Prediction - White Paper," September 1989.

Evans, J. L., Chilukuri, S., and Mog, R. A., "Manufacturing Process Model for the 1991 Bendix Anti-Skid Brake Module," August 1989.

Mog, R. A., "Spacecraft Protective Structures Design Optimization: Space Debris Implications," TABES '89, May 18, 1989.

Mog, R. A., "Discrete Nonlinear Optimization of Spacecraft Protective Structures Design - White Paper," August 1988.

Mog, R. A., "Comparison of Nonlinear Optimization Techniques for Spacecraft Protective Structures Design - White Paper," June 1988.

Mog, R. A., "Linear Programming Estimation of the Nonlinear Spacecraft Protective Systems Design Optimization Problem - White Paper," March 1988.

Preliminary Audit Issues and Responses for East Elliott Risk Assessment

1. General: What version of OECert is being used? Is it for Excel 97? Since there are apparently a couple of software glitches in this version, it may be wise to state the version when you first introduce it in the Executive Summary and Report, itself.

Response: OECert version 2.0 (August 1995) is being used for this analysis. The text has been revised to indicate which version of OECert is being used.

2. Page ES-7: Why does surface clearance in Sector 1 cost about the same as subsurface clearance in Sector 2, when the sectors are roughly the same size, with the same % of UXO on surface, and Sector 2's densities (anomaly and UXO) are greater than those for Sector 1? I would think that subsurface costs would be higher than surface clearance, everything else being equal?

Response: Landfill operations are currently in progress. The current extent of the landfill, which has already been extensively graded, is approximately 115 acres. Because this area has been extensively disturbed and covered, it is assumed that no further surface or subsurface clearance operations will be required within the existing footprint. In addition, expansion operations are beginning in an area encompassing 110 acres within the northeastern portion of Sector 2. CEHNC and CESPL are already providing construction support (i.e., clearance to approximately 3 feet during the geotechnical investigation and any grading activities) within the area of expansion. By the time the recommended alternatives presented in the EE/CA are implemented, approximately 225 acres (existing landfill and expansion) of Sector 2 will have been already cleared. The costs for surface and subsurface clearance within Sector 2 were therefore calculated assuming that only 425 acres would require surface or subsurface clearance. In comparison, clearance operations for Sector 1 would need to include 750 acres. Montgomery Watson will clarify these assumption in the text.

3. Page 2-32: I get the same values for OE density for Sectors 1 and 3, but not for Sectors 2 and 4. For Sector 2, I get:

$$\frac{3}{23(20{,}000)} = 6.52E - 06$$

For Sector 4, I get:

$$\frac{2}{23(20{,}000)} = 4.35E - 06$$

Since these values are the reverse of those listed on page 2-32, did they get reversed accidentally, or are the tables in Appendix B mislabeled?

Response: CMS prepared the "Ordnance and Explosives (OE) Sampling Draft Removal Report Camp Elliott (East Elliott) California." During the risk evaluation, several discrepancies between values listed in the text of their report and value listed in the appendices to their report. Conversations with CMS indicated that when discrepancies between their text and their appendices existed, the data in the appendices should be considered more reliably. The ordnance data presented above uses the data presented in CMS's appendices.

The number of grids for Sectors 2 and 4 and their associated areas shown in the above calculations agree with our calculations. However, after further review of the data provided by CMS in Appendix A of the CMS report (with clarification from representatives from CESPL who were present when the sampling occurred) we have 1 UXO item in Sector 2 and 1 UXO item in Sector 4"

Sector 2: 75 mm HE M48 w/M51 Fuze
Sector 4: 75 mm HE M41 w/M48 Fuze

Therefore, OE densities should be:

Sector 2: $1 \div (23(20{,}000)) = 2.17 \times 10^{-6}$
Sector 4: $1 \div (23(20{,}000)) = 2.17 \times 10^{-6}$

Values listed in Appendix B and on page 2-32 will be revised such that they are in agreement.

4. Page 2-35, paragraph 2.4.2.1.4: Other contributing reasons for Sector 4 exposures being higher than exposures for Sectors 1 and 2 are: the OE density is higher in Sector 4 (if it hasn't been reversed with Sector 2's density); the % of OE on the surface is higher in Sector 4; and Sector 4 is the largest sector. Although this is obvious, particularly to us, it would not hurt to include these reasons. Now, if we use those factors in comparing Sectors 1 and 4, we get that Sector 4 exposures should be about 20 times Sector 1 exposures. In fact, Sector 4 exposures are roughly 60 times Sector 1's exposures. **Is this due to higher (roughly 3 times) demographics/usage in Sector 4 versus Sector 1?**

Response: Additional text has been added to more fully describe what contributes to the risks in each sector. Sector 4 is significantly more likely to have recreational usage than Sector 1. This is because Sector 4 is located adjacent to the school and residential areas.

5. Page 2-38, paragraph 2.4.3.0.7: Why doesn't Sector 4 have the highest construction exposures, since it has the highest density, and highest estimated number of residences?

Response: The method used to determine the effective construction area for residential development is currently described in the text. It was assumed that approximately 10,000 square feet of surface area and 4,000 square feet of subsurface area would be disturbed by residential construction. This is only a fraction of the total area within each sector because the residential density specified by the zoning laws is one dwelling per acre; in addition, not all of the area within the sector is available for construction.

In comparison, it was assumed that 100% of the available area would be disturbed and excavated during landfill construction. Therefore, construction workers involved in landfill construction would be more likely to encounter UXO that residential workers.

6. Page 4-30, end of paragraph 4.3.4.1.2: On what basis is the statement concerning a risk reduction of 2-8% for construction workers made?

Response: Risks for construction scenarios presented in the pre-draft EE/CA were re-calculated using the method described in Section C.2 (C.2.0.2 and C.2.0.3) of the draft EE/CA.