APPENDIX 2

Derivation of Generic Site Assessment Criteria For Standard Land Uses

1 Introduction

Values for two of the three standard CLEA land uses have been derived using the current implementation of the CLEA model (CLEA v1.04 beta version), as issued for use by the Environment Agency (EA). The former CLEA standard land use, Residential Without Plant Uptake, included in the CLEA UK era framework but now not part of the current system, has been retained in the BAE Systems GSAC derivation. The standard CLEA allotment scenario is not assessed. To check for any data input or computing errors, different individuals have independently entered modelling data into CLEA UK on different computers and generated assessment criteria for each contaminant assessed.

Derived GSACs are listed below.

2 Previously Adopted GSACs

Prior to the release and EA recommendation for use of CLEA v1.04, previous sets of GSAC adopted by BAE Systems Environmental were derived using the now withdrawn CLEA UK software, CLEA 2002 software and, prior to that, an approach based on the SNIFFER methodology. These previous GSACs were considered to be good practice at the time that any reports quoting them were issued; such reports should be read in the context of the UK's developing approach to contaminated land assessment. The need for updating any assessment should be made on a site by site basis in the context of a site's development status and regulatory requirements.

Generic Site Assessment Criteria Derivation: Recreational Open Space (Residential)

1 Introduction

This appendix provides the background data and justification for the parameters used by BAE Systems Environmental to develop Generic Site Assessment Criteria (GSAC) for the 'non-standard' land use of residential recreational open space.

The object of a generic quantitative risk assessment is to model the exposure of site users to contaminated soil for conservative standard land use scenarios in order to derive GSAC, against which recorded site soil concentrations are benchmarked in the first instance. These GSAC for soils are necessarily conservative and a further stage of quantitative risk assessment, based on site specific parameters, may be required should the site fail the initial screen.

In the UK, the CLEA model has been issued by the EA and DEFRA to model human exposure to soil-borne contamination. The model includes standard land uses (residential, allotments and commercial/industrial); in addition, the latest implementation of the CLEA model, CLEA v1.04, allows user defined scenarios to be modelled.

2 The Residential Recreational Open Space Scenario

In order to derive GSAC for soils for a residential recreational open space land use, the following key tasks must first be completed:

- Identify the exposure pathways. These determine how contact with contaminated soils is likely to occur and is partly governed by the form of contaminant (e.g. whether it is volatile, soluble etc.)
- Identify the characteristics of the critical receptor. This determines body weight, exposure frequency, exposure duration and averaging time.
- Selection of appropriate exposure parameters, including length of exposure, and the degree of exposure likely to be experienced by the critical receptor via the relevant pathways.

The exposure model must be consistent with UK practice and based, where possible, on guidance set out in the DEFRA / EA CLEA Framework documents issued to support the CLEA v1.04 software.

A degree of uncertainty will exist over some of the input parameters to the exposure model. However, the overall aim is to provide a GSAC that is protective of human health, and in the absence of definitive data on site usage an element of conservatism has been built into many of the assumptions.

A ‘recreational open space’ land use could cover a wide variety of specific land uses. However, the following assumptions have been made in order to facilitate the identification of the likely receptors and exposure routes:

- There are no permanent buildings, however, the open space is located in the vicinity of or within a residential area.
- No permanent employees at the site
- Organised sports do not take place
- There are no access restrictions
- No foodstuffs are grown on the site.

The open space is assumed to be open to the public at all times. Consideration is given to general exposure only and not to any specific activities/land uses (such as organised sports, groundskeeping).

Exposure Pathways

The exposure pathways considered relevant for a recreational open space land use are as follows:

- Ingestion of soil
- Dermal contact with soil
- Inhalation of fugitive soil dust outside
- Inhalation of vapours outside

The inhalation and dermal exposure to indoor dust is not included, given the uncertainties related to the amount of soil tracked back to the home from sources outwith a domestic garden, dilution effects and the overwhelming likelihood that these exposure routes are not significant when compared to outdoor ingestion, inhalation and dermal contact.

3 Critical Receptors

Calculation of GSAC for soils requires the identification of an appropriate critical receptor. The current UK approach, as implemented through the CLEA model, estimates average daily exposure over a period of time, such as the first six years of life in the case of a residential land use.

In light of experience with the CLEA model and published ‘standard land uses’ the critical receptor in a recreational open space setting is likely to be a child using the site on a frequent and regular basis. This situation is likely to occur in open space areas associated with residential development or in urban areas but will also offer a means to conservatively assess more remote or less frequently used sites.

The following assumptions have been made about an area of recreational open space:

- Children under the age of 4 will not visit the site unsupervised.
- Children under the age of 2 will normally either be carried, or will sit in a pushchair / pram during walks / family outings.
- Children between 2 and 4 years (pre-school) may visit the site with parents and walk as opposed to being carried.
- Children of school age (4 to 18) may visit the site unsupervised during evenings, weekends and school holidays, especially during good weather in the summer. Informal sports may be played, resulting in additional exposure.

The following possible critical receptors have, therefore been identified based on these assumptions:

- A female child between 0 and 2 years of age who visits the site with parents
- A female pre-school child between 2 and 4 years of age visiting with parents but spending time walking / playing.
- A female child of primary school age (4 to 11 years) visiting the site at weekends, evenings and during school holidays.
- A female child of secondary school age (11 to 16 years) visiting the site at weekends, evenings and during school holidays.

Female receptors have been specified in line with the approach taken by the CLEA Framework documents. Each of these possible critical receptors needs to be assessed separately in order to identify which one is critical in terms of generating a GSAC for a particular compound.

4 Receptor Parameters

Values recommended in the CLEA Framework Documents have been applied during this project.

Exposure Frequency

Estimated conservative exposure frequencies for each of the identified receptors are as follows:

Receptor	Time Period	Numbers of Days/Year
0 to 2 year-old female child	All year	4 visits/week; 52 weeks/year
		208 days / year
2 to 4 year-old female child	Oct-March	26 weeks @ 2 days/week
	April-Sept	26 weeks @ 3 days/week
	Total	**130 days/year**
4 to 11 year-old female	Oct-March	26 weeks @ 3 days/week
	May-Sept (exc. summer hols)	20 weeks @ 4 days/week
	Summer holidays	6 weeks @ 6 days/week
	Total	**194 days/year**
11 to 16 year-old female	Oct-March	26 weeks @ 3 days/week
	May-Sept (exc. summer hols)	20 weeks @ 4 days/week
	Summer holidays	6 weeks @ 6 days/week
	Total	**194 days/year**

Exposure Duration

Receptor	Time Period	Length of Visit
0 to 2 year-old female child	All year	1 hour per visit
2 to 4 year-old female child	Oct-March	1 hour per visit
	April-Sept	2 hours per visit
4 to 11 year-old female	Oct-March	2 hours per visit
	May-Sept	2 hours per visit
	Summer holidays	4 hours per visit
11 to 16 year-old female	Oct-March	2 hours per visit
	May-Sept (exc. summer hols)	2 hours per visit
	Summer holidays	4 hours per visit

Soil Ingestion Rates

Estimated conservative soil ingestion rates for each of the identified receptors are as follows:

Receptor	Soil Ingestion Rate (mg/day)	Justification
0 to 2 year old female child	30	Regular intake assumed to be minimal – child assumed to be carried or in pram. 6 intakes of 1g each per year; based on one occurrence per month during April to September Averaged using exposure frequency to give a value in mg/day for a single year.

2 to 4 year old female child	100	Mean value for ingestion given in CLR10
4 to 16 year old female child	121	Single value for ingestion given in CLR10 plus additional exposure to allow for informal games / sports – 2g intake assume on 2 occasions each year, averaged across no. of visits per year.

5 GSAC Calculation

The receptor characteristics discussed above were entered into the CLEA v1.04 model for each receptor along with adopted toxicological and physio-chemical parameters for the contaminants considered.

Results of the GSAC calculation for each potential critical receptor and the adopted GSAC are presented in Table C-1.

Contaminant	CLEA v1.04 Output (mg/kg)				GSAC
	0 to 2 years	2 to 4 years	4 to 11 years	11 to 16 years	
Metals & Metalloids					
As	93	100	100	230	93
Be	190	320	460	1300	190
Cd	200	190	180	570	180
Cr	800	910	950	2100	800
Cu	15000	20000	24000	62000	15000
Hg	800	750	730	1500	730
Pb	n/a *	n/a *	n/a *	n/a *	450 *
Ni	2300	2200	2800	7700	2200
Se	1400	1800	1900	4500	1400
V	290	480	700	2000	290
Zn	58000	75000	92000	230000	58000
Explosives					
EGDN	620	800	990	2500	620
HMX	970	1200	1500	3900	970
NG	170	220	270	700	170
PETN	4200	5500	6800	17000	4200
Picric Acid	190	250	300	770	190
Picrite	19000	25000	30000	77000	10000**
RDX	580	750	920	2300	580
Tetryl	2500	3200	4000	10000	2500
TNT	97	120	150	390	97

Table 1: Calculated GSAC for each potential critical receptor and adopted GSAC for the Residential Recreational Open Space land use scenario

* For standard land use scenarios the published SGV is based on blood lead levels. The residential GSAC is adopted as a conservative approach.

** The GSAC for explosives compounds where calculated values based on human health considerations exceed 10,000 mg/kg (1%) are taken to be this value. 1% represents a very conservative threshold for explosive risk in soils and is based on the sensitivity of PETN with a safety factor of 10 applied.

Contaminant	CLEA v1.04 Output (mg/kg)				GSAC
	0 to 2 years	2 to 4 years	4 to 11 years	11 to 16 years	
Petroleum Hydrocarbon Fractions					
Aliphatic >EC5-EC6	260000	370000	490000	100%	260000
Aliphatic >EC6-EC8	290000	410000	530000	100%	290000
Aliphatic >EC8-EC10	17000	23000	28000	70000	17000
Aliphatic >EC10-EC12	18000	24000	30000	75000	18000
Aliphatic >EC12-EC16	19000	24000	30000	76000	19000
Aliphatic >EC16-EC35	380000	500000	610000	100%	380000
Aliphatic >EC35-EC44	380000	500000	610000	100%	380000
Aromatic >EC5-EC7 (Benzene)	55	71	88	220	55
Aromatic >EC7-EC8 (Toluene)	42000	55000	68000	170000	42000
Aromatic >EC8-EC10	7100	9400	11000	29000	7100
Aromatic >EC10-EC12	7500	9800	12000	30000	7500
Aromatic >EC12-EC16	7600	10000	12000	30000	7600
Aromatic >EC16-EC21	5800	7500	9200	23000	5800
Aromatic >EC21-EC35	5800	7500	9200	23000	5800
Aromatic >EC35-EC44	5800	7500	9200	23000	5800
Aliphatic & Aromatic >EC44-EC70	5800	7500	9200	23000	5800
PAH					
Acenaphthene	9000	12000	16000	41000	9000
Acenaphthylene	200	290	410	920	200
Anthracene	50000	68000	88000	230000	50000
Benz[a]anthracene	32	44	57	150	32
Benzo[a]pyrene	3.3	4.5	5.8	15	3.3
Benzo[b]fluoranthene	33	45	58	150	33
Benzo[g,h,i]perylene	5000	6800	8800	23000	5000
Benzo[k]fluoranthene	33	45	58	150	33
Chrysene	320	450	580	1500	320
Dibenz[a,h]anthracene	3.3	4.5	5.8	15	3.3
Fluoranthene	6700	9100	11000	31000	6700
Fluorene	6700	9100	11000	31000	6700
Ideno[1,2,3-c,d]pyrene	33	45	58	150	33
Naphthalene	2500	3700	5000	12000	2500
Phenanthrene	6600	9000	11000	31000	6600
Pyrene	6000	6800	8800	23000	6000

Table 1 (cont): Calculated GSAC for each potential critical receptor and adopted GSAC for the Residential Recreational Open Space land use scenario

Contaminant	CLEA v1.04 Output (mg/kg)				GSAC
	0 to 2 years	2 to 4 years	4 to 11 years	11 to 16 years	
BTEX					
Benzene	55	71	88	220	55
Toluene	42000	55000	68000	170000	42000
Ethylbenzene	18000	24000	30000	76000	18000
Xylenes (lowest of m-, o-, and p-)	29000	39000	50000	120000	29000
VOC					
Tetrachloroethene (127-18-4)	2500	3300	4100	10000	2500
1,1,1-Trichloroethane (71-55-6)	98000	130000	160000	400000	98000
Trichloroethene (79-01-6)	900	1200	1500	3600	900
Vinyl Chloride (75-01-4)	2.6	3.4	4.2	10	2.6
1,1,2,2-Tetrachloroethane (79-34-5)	1000	1400	1700	4400	1000
1,2-Dichloroethane (107-06-2)	21	28	35	87	21
Carbon Tetrachloride (56-23-5)	250	330	410	1000	250
Other Organics					
Phenol	126000	169000	210000	530000	126000

Table 1 (cont): Calculated GSAC for each potential critical receptor and adopted GSAC for the Residential Recreational Open Space land use scenario

Generic Site Assessment Criteria Derivation: Recreational Open Space (Country Park)

1. Introduction

This document provides the background data and justification for the parameters used by BAE Systems Environmental to develop Generic Site Assessment Criteria (GSAC) for the 'non-standard' land use of 'country park' style open space.

The object of a generic quantitative risk assessment is to model the exposure of site users to contaminated soil for conservative standard land use scenarios in order to derive GSAC, against which recorded site soil concentrations are benchmarked in the first instance. These GSAC for soils are necessarily conservative and a further stage of quantitative risk assessment, based on site specific parameters, may be required should the site fail the initial screen.

In the UK, the CLEA model has been issued by the EA and DEFRA to model human exposure to soil-borne contamination. The model includes standard land uses (residential, allotments and commercial/industrial); in addition, the latest implementation of the CLEA model, CLEA v1.04, allows user defined scenarios to be modelled.

2. The Country Park Scenario

In order to derive GSAC for soils for a land use, the following key tasks must first be completed:

- Identify the exposure pathways. These determine how contact with contaminated soils is likely to occur and is partly governed by the form of contaminant (e.g. whether it is volatile, soluble etc.)

- Identify the characteristics of the critical receptor. This determines body weight, exposure frequency, exposure duration and averaging time.

- Selection of appropriate exposure parameters, including length of exposure, and the degree of exposure likely to be experienced by the critical receptor via the relevant pathways.

The exposure model must be consistent with UK practice and based, where possible, on guidance set out in the DEFRA / EA CLEA Framework documents issued to support the CLEA v1.04 software.

A degree of uncertainty will exist over some of the input parameters to the exposure model. However, the overall aim is to provide a GSAC that is protective of human health, and in the absence of definitive data on site usage an element of conservatism has been built into many of the assumptions.

Recreational open space covers a potentially wide variety of specific land uses. However, the following assumptions have been made in order to facilitate the identification of the likely receptors and exposure routes:

- There are no permanent buildings
- No permanent employees at the site
- Organised sports do not take place
- There are no access restrictions
- No foodstuffs are grown on the site.

The open space is assumed to be open to the public at all times. Consideration is given to general exposure only and not to any specific activities/land uses (such as organised sports, groundskeeping).

Exposure Pathways

The exposure pathways considered relevant for a recreational open space land use are as follows:

- Ingestion of soil
- Dermal contact with soil
- Inhalation of fugitive soil dust outside
- Inhalation of vapours outside

The inhalation and dermal exposure to indoor dust is not included, given the uncertainties related to the amount of soil tracked back to the home, and the overwhelming likelihood that these exposure routes are not significant when compared to outdoor ingestion, inhalation and dermal contact.

3. Critical Receptors

Calculation of GSAC for soils requires the identification of an appropriate critical receptor. The current UK approach, as implemented through the CLEA model, estimates average daily exposure over a period of time, such as the first six years of life in the case of a residential land use.

In light of experience with the CLEA model and published ‘standard land uses’ the critical receptor in a recreational open space setting is likely to be a child using the site on a frequent and regular basis. This situation is likely to occur in open space areas associated with residential development or in urban areas but will also offer a means to conservatively assess more remote or less frequently used sites.

The following assumptions have been made about an area of recreational open space:

- Children under the age of 4 will not visit the site unsupervised.
- Children under the age of 2 will normally either be carried, or will sit in a pushchair / pram during walks / family outings.
- Children between 2 and 4 years (pre-school) may visit the site with parents and walk as opposed to being carried.
- Children of school age (4 to 16) may visit the site unsupervised during evenings, weekends and school holidays, especially during good weather in the summer. Informal sports may be played, resulting in additional exposure.

The following possible critical receptors have, therefore been identified based on these assumptions:

- A female child between 0 and 2 years of age who visits the site with parents
- A female pre-school child between 2 and 4 years of age visiting with parents but spending time walking / playing.
- A female child of primary school age (4 to 11 years) visiting the site at weekends, evenings and during school holidays.
- A female child of secondary school age (11 to 16 years) visiting the site at weekends, evenings and during school holidays.

It should be noted that although exposure frequencies are the same in the 4 to 11 and 11 to 16 groups, these two groups have been assessed separately given the wide range of body weights within this age range. Female receptors have been specified in line with the approach taken by the CLEA Framework documents. Each of these possible critical receptors needs to be assessed separately in order to identify which one is critical in terms of generating a GSAC for a particular compound.

4. Receptor Parameters

Values recommended in the CLEA Framework Documents have been applied during this project.

Exposure Frequency

Estimated conservative exposure frequencies for each of the identified receptors are as follows:

Receptor	**Time Period**	**Numbers of Days/Year**
0 to 2 year-old female	Oct-March	26 weeks @ 1 days/week
	April-Sept	26 weeks @ 2 days/week
	Total	**78 days/year**
2 to 4 year-old female	Oct-March	26 weeks @ 1 days/week
	April-Sept	26 weeks @ 2 days/week
	Total	**78 days/year**
4 to 11 year-old female	Oct-March	26 weeks @ 1 days/week
	May-Sept (exc. summer hols)	20 weeks @ 2 days/week
	Summer holidays	6 weeks @ 4 days/week
	Total	**70 days/year**
11 to 16 year-old female	Oct-March	26 weeks @ 1 days/week
	May-Sept (exc. summer hols)	20 weeks @ 2 days/week
	Summer holidays	6 weeks @ 4 days/week
	Total	**70 days/year**

Exposure Duration

Receptor	**Time Period**	**Length of Visit**
0 to 2 year-old female	All year	1 hour per visit
2 to 4 year-old female	Oct-March	1 hour per visit
	April-Sept	2 hours per visit
4 to 11 year-old female	Oct-March	2 hours per visit
	May-Sept (exc. summer hols)	2 hours per visit
	Summer holidays	4 hours per visit
11 to 16 year-old female	Oct-March	2 hours per visit
	May-Sept (exc. summer hols)	2 hours per visit
	Summer holidays	4 hours per visit

Soil Ingestion Rates

Estimated conservative soil ingestion rates for each of the identified receptors are as follows:

Receptor	**Soil Ingestion Rate (mg/day)**	**Justification**
0 to 2 year old female child	30	Regular intake assumed to be minimal – child assumed to be carried or in pram. 6 intakes of 1g each per year; based on one occurrence per month during April to September Averaged using exposure frequency to give a value in mg/day for a single year.
2 to 4 year old female child	100	Mean value for ingestion given in CLEA Framework documents
4 to 11 year old female child	100	Mean value for ingestion given in CLEA Framework documents
11 to 16 year old female child	100	Mean value for ingestion given in CLEA Framework documents

5. GSAC Calculation

The receptor characteristics discussed above were entered into the CLEA v1.04 model for each receptor along with adopted toxicological and physio-chemical parameters for the contaminants considered.

Results of the GSAC calculation for each potential critical receptor and the adopted GSAC are presented in Table 1.

Contaminant	CLEA v1.04 Output (mg/kg)					GSAC
	0 to 2 years	3 to 4 years	5 to 11 years	12 to 16 years	0 to 6 years	
Metals & Metalloids						
As	240	190	270	500	190	**190**
Be	510	540	940	2,100	520	**520**
Cd	540	320	480	1,400	390	**320**
Cr	2,100	1,500	2,400	5,600	1,700	**1,500**
Cu	41,000	33,000	50,000	96,000	36,000	**33,000**
Hg	2,100	1,200	1,900	4,000	1,500	**1,200**
Pb	n/a *	n/a *	n/a *	n/a *	n/a *	**450***
Ni	6,300	3,700	7,400	19,000	4,500	**3,700**
Se	3,900	3,000	5,100	11,000	3,400	**3,000**
V	770	800	1,400	3,100	770	**770**
Zn	150,000	120,000	180,000	360,000	130,000	**120,000**
Explosives						
EGDN	1,600	1,300	2,000	3,800	1,400	**1,300**
HMX	2,500	2,100	3,100	6,000	2,200	**2,100**
NG	460	370	560	1,000	410	**370**
PETN	11,000	9,200	13,000	26,000	10,000	**9,200**
Picric Acid	510	420	620	1,200	450	**420**
Picrite	51,000	41,000	62,000	120,000	45,000	**10,000****
RDX	1,500	1,200	1,800	3,600	1,300	**1,200**
Tetryl	6,700	5,400	8,100	15,000	5,900	**5,400**
TNT	260	210	310	600	220	**210**

Table C-1: Calculated GSAC for each potential critical receptor and adopted GSAC for the Recreational Open Space land use scenario

* For standard land use scenarios the published SGV is based on blood lead levels. The residential GSAC is adopted as a conservative approach.

** The GSAC for explosives compounds where calculated values based on human health considerations exceed 10,000 mg/kg (1%) are taken to be this value. 1% represents a very conservative threshold for explosive risk in soils and is based on the sensitivity of PETN with a safety factor of 10 applied.

Contaminant	CLEA v1.04 Output (mg/kg)					GSAC
	0 to 2 years	3 to 4 years	5 to 11 years	12 to 16 years	0 to 6 years	
Petroleum Hydrocarbon Fractions						
Aliphatic >EC5-EC6	700,000	620,000	990,000	100%	910,000	**620,000**
Aliphatic >EC6-EC8	790,000	680,000	100%	100%	910,000	**680,000**
Aliphatic >EC8-EC10	46,000	38,000	58,000	110,000	45,000	**38,000**
Aliphatic >EC10-EC12	49,000	40,000	60,000	110,000	45,000	**40,000**
Aliphatic >EC12-EC16	50,000	41,000	61,000	110,000	45,000	**41,000**
Aliphatic >EC16-EC35	100%	830,000	100%	100%	900,000	**830,000**
Aliphatic >EC35-EC44	100%	830,000	100%	100%	900,000	**830,000**
Aromatic >EC5-EC7 (Benzene)	140	110	170	340	130	**110**
Aromatic >EC7-EC8 (Toluene)	110,000	92,000	130,000	260,000	100,000	**92,000**
Aromatic >EC8-EC10	19,000	15,000	23,000	45,000	17,000	**15,000**
Aromatic >EC10-EC12	20,000	16,000	24,000	47,000	18,000	**16,000**
Aromatic >EC12-EC16	20,000	16,000	24,000	47,000	18,000	**16,000**
Aromatic >EC16-EC21	15,000	12,000	18,000	36,000	13,000	**12,000**
Aromatic >EC21-EC35	15,000	12,000	18,000	36,000	13,000	**12,000**
Aromatic >EC35-EC44	15,000	12,000	18,000	36,000	13,000	**12,000**
Aliphatic & Aromatic >EC44-EC70	15,000	12,000	18,000	36,000	13,000	**12,000**
PAH						
Acenaphthene	24,000	20,000	31,000	59,000	22,000	**20,000**
Acenaphthylene	530	490	790	1,400	590	**490**
Anthracene	130,000	110,000	160,000	320,000	120,000	**110,000**
Benz[a]anthracene	87	74	110	210	80	**74**
Benzo[a]pyrene	8.8	7.5	11	21	8.0	**7.5**
Benzo[b]fluoranthene	88	75	110	210	80	**75**
Benzo[g,h,i]perylene	13,000	11,000	16,000	32,000	12,000	**11,000**
Benzo[k]fluoranthene	88	75	110	210	80	**75**
Chrysene	870	740	1,100	2,100	800	**740**
Dibenz[a,h]anthracene	8.8	7.5	11	21	8.0	**7.5**
Fluoranthene	17,000	15,000	22,000	43,000	16,000	**15,000**
Fluorene	17,000	15,000	22,000	43,000	16,000	**15,000**
Ideno[1,2,3-c,d]pyrene	88	75	110	210	80	**75**
Naphthalene	6,800	6,200	9,600	18,000	7,000	**6,200**
Phenanthrene	17,000	15,000	22,000	42,000	16,000	**15,000**
Pyrene	13,000	11,000	16,000	32,000	12,000	**11,000**

Table C-1 (cont): Calculated GSAC for each potential critical receptor and adopted GSAC for the Recreational Open Space (Country Park) land use scenario

Contaminant	CLEA v1.04 Output (mg/kg)					GSAC
	0 to 2 years	3 to 4 years	5 to 11 years	12 to 16 years	0 to 6 years	
BTEX						
Benzene	140	110	170	340	130	**110**
Toluene	110,000	92,000	130,000	260,000	100,000	**92,000**
Ethylbenzene	150,000	41,000	61,000	110,000	44,000	**41,000**
Xylenes (lowest of m-, o-, and p-)	250,000	66,000	100,000	190,000	74,000	**66,000**
VOC						
Tetrachloroethene (127-18-4)	21,000	5,600	8,400	16,000	6,100	**5,600**
1,1,1-Trichloroethane (71-55-6)	840,000	220,000	340,000	640,000	250,000	**220,000**
Trichloroethene (79-01-6)	7,500	2,000	3,000	5,700	2,200	**2,000**
Vinyl Chloride (75-01-4)	21	5.8	8.6	16	6.3	**5.8**
1,1,2,2-Tetrachloroethane (79-34-5)	8,800	2,300	3,500	6,800	2,500	**2,300**
1,2-Dichloroethane (107-06-2)	170	47	71	130	52	**47**
Carbon Tetrachloride (56-23-5)	2,100	560	840	1,600	610	**560**
Other Organics						
Phenol	100%	280,000	300,000	420,000	830,000	**280,000**

Table C-1 (cont): Calculated GSAC for each potential critical receptor and adopted GSAC for the Recreational Open Space land use scenario

June 2009 **All Values in mg/kg**

BAE SYSTEMS

BAE Systems Environmental: Generic Site Assessment Criteria - Human Health

	Sandy Soil; 1% Soil Organic Matter			
Substance	Residential with Plant Uptake	Recreational Open Space		Commercial
	CDA Residential	**CDA ROS**	**Country Park**	**CDA Commercial & Retained Land**
Metals & Metalloids				
Arsenic	22	93	160	330
Beryllium	16	190	520	220
Cadmium	28	180	320	290
Chromium (hexavalent)	37	800	1500	330
Copper	660	15000	33000	45000
Lead	450	450	450	750
Mercury	170	730	1200	3600
Nickel	110	930	1600	980
Selenium	350	1400	3000	13000
Vanadium	140	290	770	4800
Zinc	2100	58000	120000	560000
PAH				
Acenaphthene	3.9	9000	20000	520
Acenaphthylene	3.2	200	490	380
Anthracene	8500	50000	110000	540000
Benz[a]anthracene	7.0	32	74	140
Benzo[a]pyrene	0.85	3.3	7.5	14
Benzo[b]fluoranthene	8.1	33	75	140
Benzo[g,h,i]perylene	2200	5000	11000	54000
Benzo[k]fluoranthene	8.7	33	75	140
Chrysene	66	320	740	1400
Dibenz[a,h]anthracene	0.9	3.3	7.5	14
Fluoranthene	820	6700	15000	72000
Fluorene	670	6700	15000	71000
Ideno[1,2,3-c,d]pyrene	7.7	33	75	140
Naphthalene	5.5	2500	6200	1000
Phenanthrene	940	6600	15000	71000
Pyrene	680	6000	11000	54000
Total Petroleum Hydrocarbons				
Aliphatic >C5-C6	21	260000	620000	4100
Aliphatic >C6-C8	49	290000	680000	9700
Aliphatic >C8-C10	6.8	17000	38000	1800
Aliphatic >C10-C12	40	18000	40000	10000
Aliphatic >C12-C16	200	19000	41000	42000
Aliphatic >C16-C35	37000	380000	830000	100%
Aliphatic >C35-C44	37000	380000	830000	100%
Aromatic >EC5-EC7 (Benzene)	0.054	55	110	15
Aromatic >EC7-EC8 (Toluene)	92	42000	92000	35000
Aromatic >EC8-EC10	10	7100	15000	2000
Aromatic >EC10-EC12	54	7500	16000	11000
Aromatic >EC12-EC16	190	7600	16000	41000
Aromatic >EC16-EC21	500	5800	12000	53000
Aromatic >EC21-EC35	1700	5800	12000	56000
Aromatic >EC35-EC44	1700	5800	12000	56000
Aliphatic & Aromatic >EC44-EC70	2300	5800	12000	56000
BTEX				
Benzene	0.054	55	110	15
Toluene	92	42000	92000	35000
Ethylbenzene	42	18000	41000	9600
Xylenes	19	29000	66000	34000

June 2009 **All Values in mg/kg**

BAE SYSTEMS

BAE Systems Environmental: Generic Site Assessment Criteria - Human Health

	Sandy Soil; 1% Soil Organic Matter			
Other VOC				
CT - Carbon Tetrachloride	0.0077	250	560	1.7
DCA - 1,2-Dichloroethane	0.0022	21	47	0.35
PCA - 1,1,2,2-Tetrachloroethane	0.77	1000	2300	150
PCE - Tetrachloroethene	0.53	2500	5600	90
TCA - 1,1,1-Trichloroethane	2.6	98000	220000	390
TCE - Trichloroethene	0.045	900	2000	6.6
VC - Vinyl Chloride	0.00024	2.6	5.8	0.04
Explosives				
EGDN	n/a [1]	620	1300	n/a [1]
HMX	9.5	970	2100	9400
HNS	n/a [1]	n/a [1]	n/a [1]	n/a [1]
NG	2.6	170	370	1600
PA	0.36	190	420	1800
PETN	94	4200	9200	10000 [2]
Picrite	1.6	10000 [2]	10000 [2]	10000 [2]
RDX	3.2	580	1200	5600
Tetryl	72	2500	5400	10000 [2]
TNT	1.3	97	210	940
Others				
Cyanide (free)	20 [3]	20 [3]	20 [3]	20 [3]
Phenol	400	126000	280000	100%

Notes

1 - Insufficient physio-chemical or toxicological data is available to derive a criterion for this scenario.

2 - GSAC for an explosive compound is set to 10,000 mg/kg (1%) where this calculated human health values exceed this value. The adopted GSAC is based on a conservative explosive threshold for explosives in soils.

3 - Value derived from acute toxicity data in Tox5; value to apply to all scenarios to protect one-off exposure to child visitor