N61414.AR.001162
NAB LITTLE CREEK
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EMAIL REGARDING U S EPA REGION III REVIEW OF RISK TABLES FOR THE MORALE, WELFARE AND RECREATION SKEET RANGE JEB LITTLE CREEK VA
10/13/2010
U S EPA REGION III

Daves, Evaleen/VBO

From: Boylan.Jeffrey@epamail.epa.gov
Sent: Wednesday, October 13, 2010 10:57 AM
To: Peed, Bryan K. CIV NAVFAC MIDLANT Norfolk; Livingston, David/VBO; peherman@deq.virginia.gov; Landin, Cecilia/VBO; Carver, Adina/VBO; Boylan.Jeffrey@epamail.epa.gov
Subject: Fw: Follow up to Voice Mail - With Regard to the Skeet Range
Attachments: LC MWR SR Table 9s.pdf; LC MWR SR Table 2s.pdf; LC MWR SR Table 3s.pdf; LC MWR SR Table 7s.pdf

Folks,

See email thread below. The Navy should be able to move forward with finalizing the MWR Skeet Range SSP Close-out Report.

Jeffrey M. Boylan
NPL/BRAC Federal Facilities Branch (3HS11)
Office of Federal Facility Remediation and Assessment
USEPA Region III
1650 Arch Street
Philadelphia, PA 19103
(215) 814-2094
Email: boylan.jeffrey@epa.gov

----- Forwarded by Jeffrey Boylan/R3/USEPA/US on 10/13/2010 10:56 AM -----

From: Dawn Ioven/R3/USEPA/US
To: Jeffrey Boylan/R3/USEPA/US@EPA
Date: 10/06/2010 12:01 PM
Subject: Re: Fw: Follow up to Voice Mail - With Regard to the Skeet Range

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Hi, Jeff. I reviewed the attached risk tables for the MWR Skeet Range at Little Creek. Based on the sampling results, there are no unacceptable risks for the exposure scenarios evaluated (including residential). Consequently, from a risk perspective, closing out this site should not be an issue. If you have any questions, please let me know. Thanks.

Dawn

Dawn A. Ioven, toxicologist
U.S. EPA - Region III
(3HS41)
1650 Arch street
Philadelphia, PA 19103
215.814.3320

From: Jeffrey Boylan/R3/USEPA/US
To: Dawn Ioven/R3/USEPA/US@EPA
Date: 10/06/2010 09:55 AM
Subject: Fw: Follow up to Voice Mail - With Regard to the Skeet Range

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Dawn,

Here are the summary tables for the MWR skeet range at NABLC.

Jeffrey M. Boylan
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----- Forwarded by Jeffrey Boylan/R3/USEPA/US on 10/06/2010 09:56 AM -----

From: <Cecilia.Landin@ch2m.com>
To: Jeffrey Boylan/R3/USEPA/US@EPA, <bryan.peed@navy.mil>
Cc: <Adina.Carver@CH2M.com>, <David.Livingston@CH2M.com>, <peherman@deq.virginia.gov>
Date: 10/05/2010 01:04 PM
Subject: RE: Follow up to Voice Mail - With Regard to the Skeet Range

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Team,

Attached are the preliminary risk tables for the MWR Skeet Range. Please keep in mind they are preliminary and will be updated for the report to include tables containing toxicity values and exposure assumptions. Within the attached tables, the toxicity values can be found on the Table 7s, however the exposure assumptions are not provided. Risks were calculated for current/future industrial worker exposure to surface soil and future adult and child resident exposure to combined surface and subsurface soil. Groundwater detections were all below screening criteria, therefore risks were not calculated for this media. Please let me know if you have any questions regarding the tables provided.

Thanks,
Cecilia

From: Boylan.Jeffrey@epamail.epa.gov [mailto:Boylan.Jeffrey@epamail.epa.gov]
Sent: Tuesday, October 05, 2010 11:34 AM
To: Peed, Bryan K. CIV NAVFAC MIDLANT Norfolk
Cc: Carver, Adina/VBO; Landin, Cecilia/VBO; Livingston, David/VBO; peherman@deq.virginia.gov
Subject: Re: Follow up to Voice Mail - With Regard to the Skeet Range

Brian,

Got your voice mail. I talk to my tox (hopefully today) from a conceptual standpoint. As Paul indicated I will likely need the risk numbers.

Jeffrey M. Boylan
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From: "Peed, Bryan K. CIV NAVFAC MIDLANT Norfolk" <bryan.peed@navy.mil>
To: <Adina.Carver@CH2M.com>, <Cecilia.Landin@ch2m.com>, <David.Livingston@CH2M.com>
Cc: <peherman@deq.virginia.gov>, Jeffrey Boylan/R3/USEPA/US@EPA
Date: 10/05/2010 09:46 AM

Subject: Follow up to Voice Mail - With Regard to the Skeet Range

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Team,

Jeff, this is a follow-up to the voice mail that I left for you. I think the only thing we have left for the Skeet Range short of finalizing the DD/Close-out is for EPA/DEQ to run the risk numbers by their technical folks to get a thumbs up. We have our semi-annual meeting with Headquarters coming up in a couple of weeks and it would be nice to have something concrete with a decision of whether we are closing this site out or not.

With that being said, if there is any way, we can get some kind of email confirmation as to what your decision is within the next few days, that would help me out tremendously. I know everyone is busy.

Thanks

Bryan Peed
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TABLE 9.1.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

MWR Skeet Range

NAB Little Creek, Virginia Beach, Virginia

Scenario Timeframe: Current
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil	Surface Soil										
			Benzo(a)anthracene	4.0E-08	N/A	3.4E-08	7.3E-08		N/A	N/A	N/A	0.0E+00
			Benzo(a)pyrene	5.9E-07	N/A	5.1E-07	1.1E-06		N/A	N/A	N/A	0.0E+00
			Benzo(b)fluoranthene	3.9E-08	N/A	3.4E-08	7.3E-08		N/A	N/A	N/A	0.0E+00
			Dibenz(a,h)anthracene	9.1E-08	N/A	7.8E-08	1.7E-07		N/A	N/A	N/A	0.0E+00
			Indeno(1,2,3-cd)pyrene	3.2E-08	N/A	2.7E-08	5.9E-08		N/A	N/A	N/A	0.0E+00
			Chemical Total	7.9E-07	0.0E+00	6.8E-07	1.5E-06		0.0E+00	0.0E+00	0.0E+00	0.0E+00
		Exposure Point Total					1.5E-06					0.0E+00
	Exposure Medium Total						1.5E-06					0.0E+00
	Air	Emissions from Surface Soil										
			Benzo(a)anthracene	N/A	1.0E-12	N/A	1.0E-12		N/A	N/A	N/A	0.0E+00
			Benzo(a)pyrene	N/A	1.5E-11	N/A	1.5E-11		N/A	N/A	N/A	0.0E+00
			Benzo(b)fluoranthene	N/A	1.0E-12	N/A	1.0E-12		N/A	N/A	N/A	0.0E+00
			Dibenz(a,h)anthracene	N/A	2.6E-12	N/A	2.6E-12		N/A	N/A	N/A	0.0E+00
			Indeno(1,2,3-cd)pyrene	N/A	8.2E-13	N/A	8.2E-13		N/A	N/A	N/A	0.0E+00
			Chemical Total	0.0E+00	2.1E-11	0.0E+00	1.0E-12		0.0E+00	0.0E+00	0.0E+00	0.0E+00
		Exposure Point Total					1.0E-12					0.0E+00
	Exposure Medium Total						1.0E-12					0.0E+00
Medium Total							1.5E-06					0.0E+00
Receptor Total							1.5E-06				Receptor HI Total	0.0E+00

TABLE 9.2.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

MWR Skeet Range

NAB Little Creek, Virginia Beach, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface and Subsurface Soil	Surface and Subsurface Soil	Surface and Subsurface Soil	Benzo(a)anthracene	N/A	N/A	N/A	0.0E+00		N/A	N/A	N/A	0.0E+00
			Benzo(a)pyrene	N/A	N/A	N/A	0.0E+00		N/A	N/A	N/A	0.0E+00
			Benzo(b)fluoranthene	N/A	N/A	N/A	0.0E+00		N/A	N/A	N/A	0.0E+00
			Dibenz(a,h)anthracene	N/A	N/A	N/A	0.0E+00		N/A	N/A	N/A	0.0E+00
			Indeno(1,2,3-cd)pyrene	N/A	N/A	N/A	0.0E+00		N/A	N/A	N/A	0.0E+00
			Arsenic	N/A	N/A	N/A	0.0E+00	Skin, Blood	3.0E-03	N/A	3.6E-04	3.3E-03
			Chemical Total	0.0E+00	0.0E+00	0.0E+00	0.0E+00		3.0E-03	0.0E+00	3.6E-04	3.3E-03
		Exposure Point Total					0.0E+00					3.3E-03
	Exposure Medium Total						0.0E+00					3.3E-03
	Air	Emissions from Surface and Subsurface Soil	Benzo(a)anthracene	N/A	N/A	N/A	0.0E+00		N/A	N/A	N/A	0.0E+00
			Benzo(a)pyrene	N/A	N/A	N/A	0.0E+00		N/A	N/A	N/A	0.0E+00
			Benzo(b)fluoranthene	N/A	N/A	N/A	0.0E+00		N/A	N/A	N/A	0.0E+00
			Dibenz(a,h)anthracene	N/A	N/A	N/A	0.0E+00		N/A	N/A	N/A	0.0E+00
			Indeno(1,2,3-cd)pyrene	N/A	N/A	N/A	0.0E+00		N/A	N/A	N/A	0.0E+00
			Arsenic	N/A	N/A	N/A	0.0E+00	Development, Cardiovascular system, Nervous system	N/A	3.1E-05	N/A	3.1E-05
			Chemical Total	0.0E+00	0.0E+00	0.0E+00	0.0E+00		0.0E+00	3.1E-05	0.0E+00	3.1E-05
		Exposure Point Total					0.0E+00					3.1E-05
	Exposure Medium Total						0.0E+00					3.1E-05
Medium Total							0.0E+00					3.4E-03
Receptor Total							0.0E+00				Receptor HI Total	3.4E-03

TABLE 9.3.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
MWR Skeet Range
NAB Little Creek, Virginia Beach, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface and Subsurface Soil	Surface and Subsurface Soil	Surface and Subsurface Soil	Benzo(a)anthracene	N/A	N/A	N/A	0.0E+00		N/A	N/A	N/A	0.0E+00
			Benzo(a)pyrene	N/A	N/A	N/A	0.0E+00		N/A	N/A	N/A	0.0E+00
			Benzo(b)fluoranthene	N/A	N/A	N/A	0.0E+00		N/A	N/A	N/A	0.0E+00
			Dibenz(a,h)anthracene	N/A	N/A	N/A	0.0E+00		N/A	N/A	N/A	0.0E+00
			Indeno(1,2,3-cd)pyrene	N/A	N/A	N/A	0.0E+00		N/A	N/A	N/A	0.0E+00
			Arsenic	N/A	N/A	N/A	0.0E+00	Skin, Blood	2.8E-02	N/A	2.3E-03	3.0E-02
			Chemical Total	0.0E+00	0.0E+00	0.0E+00	0.0E+00		2.8E-02	0.0E+00	2.3E-03	3.0E-02
		Exposure Point Total					0.0E+00					3.0E-02
	Exposure Medium Total						0.0E+00					3.0E-02
	Air	Emissions from Surface and Subsurface Soil	Benzo(a)anthracene	N/A	N/A	N/A	0.0E+00		N/A	N/A	N/A	0.0E+00
			Benzo(a)pyrene	N/A	N/A	N/A	0.0E+00		N/A	N/A	N/A	0.0E+00
			Benzo(b)fluoranthene	N/A	N/A	N/A	0.0E+00		N/A	N/A	N/A	0.0E+00
			Dibenz(a,h)anthracene	N/A	N/A	N/A	0.0E+00		N/A	N/A	N/A	0.0E+00
			Indeno(1,2,3-cd)pyrene	N/A	N/A	N/A	0.0E+00		N/A	N/A	N/A	0.0E+00
			Arsenic	N/A	N/A	N/A	0.0E+00	Development, Cardiovascular system, Nervous system	N/A	3.1E-05	N/A	3.1E-05
			Chemical Total	0.0E+00	0.0E+00	0.0E+00	0.0E+00		0.0E+00	3.1E-05	0.0E+00	3.1E-05
		Exposure Point Total					0.0E+00					3.1E-05
	Exposure Medium Total						0.0E+00					3.1E-05
Medium Total							0.0E+00					3.0E-02
Receptor Total							0.0E+00				Receptor HI Total	3.0E-02

TABLE 9.4.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
MWR Skeet Range
NAB Little Creek, Virginia Beach, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult/Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface and Subsurface Soil	Surface and Subsurface Soil	Surface and Subsurface Soil	Benzo(a)anthracene	5.1E-07	N/A	2.0E-07	7.0E-07		N/A	N/A	N/A	0.0E+00
			Benzo(a)pyrene	7.5E-06	N/A	2.9E-06	1.0E-05		N/A	N/A	N/A	0.0E+00
			Benzo(b)fluoranthene	8.3E-07	N/A	3.2E-07	1.1E-06		N/A	N/A	N/A	0.0E+00
			Dibenz(a,h)anthracene	5.7E-07	N/A	2.2E-07	7.9E-07		N/A	N/A	N/A	0.0E+00
			Indeno(1,2,3-cd)pyrene	6.8E-07	N/A	2.6E-07	9.4E-07		N/A	N/A	N/A	0.0E+00
			Arsenic	1.5E-06	N/A	1.5E-07	1.7E-06		N/A	N/A	N/A	0.0E+00
			Chemical Total	1.2E-05	0.0E+00	4.0E-06	1.6E-05		0.0E+00	0.0E+00	0.0E+00	0.0E+00
		Exposure Point Total					1.6E-05					0.0E+00
	Exposure Medium Total						1.6E-05					0.0E+00
	Air	Emissions from Surface and Subsurface Soil	Benzo(a)anthracene	N/A	8.8E-12	N/A	8.8E-12		N/A	N/A	N/A	0.0E+00
			Benzo(a)pyrene	N/A	1.3E-10	N/A	1.3E-10		N/A	N/A	N/A	0.0E+00
			Benzo(b)fluoranthene	N/A	1.4E-11	N/A	1.4E-11		N/A	N/A	N/A	0.0E+00
			Dibenz(a,h)anthracene	N/A	1.1E-11	N/A	1.1E-11		N/A	N/A	N/A	0.0E+00
			Indeno(1,2,3-cd)pyrene	N/A	1.2E-11	N/A	1.2E-11		N/A	N/A	N/A	0.0E+00
			Arsenic	N/A	8.5E-10	N/A	8.5E-10		N/A	N/A	N/A	0.0E+00
			Chemical Total	0.0E+00	1.0E-09	0.0E+00	1.0E-09		0.0E+00	0.0E+00	0.0E+00	0.0E+00
		Exposure Point Total					1.0E-09					0.0E+00
	Exposure Medium Total						1.0E-09					0.0E+00
Medium Total							1.6E-05					0.0E+00
Receptor Total							1.6E-05				Receptor HI Total	0.0E+00

Table 2.1

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

MWR Skeet Range, Little Creek

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier	Maximum [1] Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection
Surface Soil	91-57-6	2-Methylnaphthalene	3.6E-03 J	3.6E-03 J	MG/KG	LSR01-SS13-0610	1/8	0.0086 - 0.049	3.6E-03		3.1E+01 N			NO	BSL
	83-32-9	Acenaphthene	6.2E-03 J	1.3E-02	MG/KG	LSR01-SS13-0610	2/8	0.0086 - 0.049	1.3E-02		3.4E+02 N			NO	BSL
	208-96-8	Acenaphthylene	6.4E-04 J	5.2E-03 J	MG/KG	LSR01-SS01-0610	3/8	0.0086 - 0.049	5.2E-03		3.4E+02 N			NO	BSL
	120-12-7	Anthracene	7.2E-04 J	2.4E-02	MG/KG	LSR01-SS13-0610	5/8	0.0086 - 0.049	2.4E-02		1.7E+03 N			NO	BSL
	56-55-3	**Benzo(a)anthracene**	**7.8E-04 J**	**2.1E-01**	**MG/KG**	**LSR01-SS13-0610 : LSR01-SS13P-0610**	**6/8**	**0.0086 - 0.049**	**2.1E-01**		**1.5E-01 C**			**YES**	**ASL**
	50-32-8	**Benzo(a)pyrene**	**1.0E-03 J**	**3.1E-01**	**MG/KG**	**LSR01-SS13P-0610**	**6/8**	**0.0086 - 0.049**	**3.1E-01**		**1.5E-02 C**			**YES**	**ASL**
	205-99-2	**Benzo(b)fluoranthene**	**1.8E-03 J**	**3.1E-01**	**MG/KG**	**LSR01-SS13-0610**	**6/8**	**0.0086 - 0.049**	**3.1E-01**		**1.5E-01 C**			**YES**	**ASL**
	191-24-2	Benzo(g,h,i)perylene	8.0E-04 J	2.6E-01	MG/KG	LSR01-SS13P-0610	6/8	0.0086 - 0.049	2.6E-01		1.7E+02 N			NO	BSL
	207-08-9	Benzo(k)fluoranthene	1.2E-03 J	2.3E-01	MG/KG	LSR01-SS13P-0610	6/8	0.0086 - 0.049	2.3E-01		1.5E+00 C			NO	BSL
	218-01-9	Chrysene	1.0E-03 J	2.9E-01	MG/KG	LSR01-SS13-0610	6/8	0.0086 - 0.049	2.9E-01		1.5E+01 C			NO	BSL
	53-70-3	**Dibenz(a,h)anthracene**	**1.2E-03 J**	**7.8E-02**	**MG/KG**	**LSR01-SS13P-0610**	**5/8**	**0.0086 - 0.049**	**7.8E-02**		**1.5E-02 C**			**YES**	**ASL**
	206-44-0	Fluoranthene	5.0E-03 J	2.6E-01	MG/KG	LSR01-SS13P-0610	5/8	0.0086 - 0.049	2.6E-01		2.3E+02 N			NO	BSL
	86-73-7	Fluorene	2.1E-03 J	6.3E-03 J	MG/KG	LSR01-SS13-0610	2/8	0.0086 - 0.049	6.3E-03		2.3E+02 N			NO	BSL
	193-39-5	**Indeno(1,2,3-cd)pyrene**	**1.3E-03 J**	**2.9E-01**	**MG/KG**	**LSR01-SS13P-0610**	**5/8**	**0.0086 - 0.049**	**2.9E-01**		**1.5E-01 C**			**YES**	**ASL**
	85-01-8	Phenanthrene	2.7E-03 J	9.9E-02	MG/KG	LSR01-SS13-0610	5/8	0.0086 - 0.049	9.9E-02		1.7E+03 N			NO	BSL
	129-00-0	Pyrene	7.5E-04 J	2.2E-01	MG/KG	LSR01-SS13-0610	7/8	0.0086 - 0.049	2.2E-01		1.7E+02 N			NO	BSL
	7440-50-8	Copper	1.4E+00	1.4E+00	MG/KG	LSR01-SS13-0610	1/1	0.52 - 0.52	1.4E+00		3.1E+02 N			NO	BSL
	7439-92-1	Lead	2.0E+00 J	9.9E+01	MG/KG	LSR01-SS09P-0610	8/8	0.29 - 0.35	9.9E+01		4.0E+02 N			NO	BSL
	7440-66-6	Zinc	1.1E+01	1.1E+01	MG/KG	LSR01-SS13-0610	1/1	2.1 - 2.1	1.1E+01		2.3E+03 N			NO	BSL

[1] Minimum/Maximum detected concentrations.

[2] Maximum concentration is used for screening.

[3] Background values not available.

[4] Oak Ridge National Laboratory (ORNL). May, 2010. Regional Screening Levels for Chemical Contaminants at Superfund Sites. http://epa-prgs.ornl.gov/chemicals/index.shtml
Residential Soil RSL,RSL based on non-cancer divided by 10.
RSL value for Acenaphthene used as surrogate for Acenaphthylene.
RSL value for pyrene used as surrogate for benzo(g,h,i)perylene.
RSL value for anthracene used as surrogate for phenanthrene.
The soil value of 400 mg/kg for lead is from the Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities, USEPA, July 14, 1994.

[5] Rationale Codes

Selection Reason: Above Screening Levels (ASL)

Deletion Reason: No Toxicity Information (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

J = Estimated Value

K = Biased High

L = Biased Low

C = Carcinogenic

C* = N screening level < 100x C screening level, therefore N screening value used as screening level

C** = N screening level < 10x C screening level, therefore N screening value/10 used as screening level

N = Noncarcinogenic

Table 2.2

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

MWR Skeet Range, Little Creek

Scenario Timeframe: Future
Medium: Surface and Subsurface Soil
Exposure Medium: Surface and Subsurface Soil

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier	Maximum [1] Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection
Surface and Subsurface Soil	91-57-6	2-Methylnaphthalene	3.6E-03 J	3.6E-03 J	MG/KG	LSR01-SS13-0610	1/26	0.0085 - 0.049	3.6E-03		3.1E+01 N			NO	BSL
	83-32-9	Acenaphthene	6.6E-04 J	1.3E-02	MG/KG	LSR01-SS13-0610	4/26	0.0085 - 0.049	1.3E-02		3.4E+02 N			NO	BSL
	208-96-8	Acenaphthylene	6.4E-04 J	5.2E-03 J	MG/KG	LSR01-SS01-0610	7/26	0.0085 - 0.049	5.2E-03		3.4E+02 N			NO	BSL
	120-12-7	Anthracene	6.5E-04 J	2.4E-02	MG/KG	LSR01-SS13-0610	10/26	0.0085 - 0.049	2.4E-02		1.7E+03 N			NO	BSL
	56-55-3	**Benzo(a)anthracene**	**7.3E-04 K**	**2.1E-01**	**MG/KG**	**LSR01-SS13-0610 : LSR01-SS13P-0610**	**19/26**	**0.0085 - 0.049**	**2.1E-01**		**1.5E-01 C**			**YES**	**ASL**
	50-32-8	**Benzo(a)pyrene**	**5.6E-04 J**	**3.1E-01**	**MG/KG**	**LSR01-SS13P-0610**	**20/26**	**0.0085 - 0.049**	**3.1E-01**		**1.5E-02 C**			**YES**	**ASL**
	205-99-2	**Benzo(b)fluoranthene**	**7.9E-04 J**	**3.1E-01**	**MG/KG**	**LSR01-SS13-0610**	**20/26**	**0.0085 - 0.049**	**3.1E-01**		**1.5E-01 C**			**YES**	**ASL**
	191-24-2	Benzo(g,h,i)perylene	6.1E-04 J	2.6E-01	MG/KG	LSR01-SS13P-0610	17/26	0.0085 - 0.049	2.6E-01		1.7E+02 N			NO	BSL
	207-08-9	Benzo(k)fluoranthene	6.0E-04 J	2.3E-01	MG/KG	LSR01-SS13P-0610	20/26	0.0085 - 0.049	2.3E-01		1.5E+00 C			NO	BSL
	218-01-9	Chrysene	1.0E-03 J	2.9E-01	MG/KG	LSR01-SS13-0610	16/26	0.0085 - 0.049	2.9E-01		1.5E+01 C			NO	BSL
	53-70-3	**Dibenz(a,h)anthracene**	**8.2E-04 J**	**7.8E-02**	**MG/KG**	**LSR01-SS13P-0610**	**9/26**	**0.0085 - 0.049**	**7.8E-02**		**1.5E-02 C**			**YES**	**ASL**
	206-44-0	Fluoranthene	1.6E-03 J	2.6E-01	MG/KG	LSR01-SS13P-0610	17/26	0.0085 - 0.049	2.6E-01		2.3E+02 N			NO	BSL
	86-73-7	Fluorene	5.5E-04 J	6.3E-03 J	MG/KG	LSR01-SS13-0610	5/26	0.0085 - 0.049	6.3E-03		2.3E+02 N			NO	BSL
	193-39-5	**Indeno(1,2,3-cd)pyrene**	**6.0E-04 J**	**2.9E-01**	**MG/KG**	**LSR01-SS13P-0610**	**17/26**	**0.0085 - 0.049**	**2.9E-01**		**1.5E-01 C**			**YES**	**ASL**
	85-01-8	Phenanthrene	1.6E-03 J	9.9E-02	MG/KG	LSR01-SS13-0610	13/26	0.0085 - 0.049	9.9E-02		1.7E+03 N			NO	BSL
	129-00-0	Pyrene	7.5E-04 J	2.2E-01	MG/KG	LSR01-SS13-0610	22/26	0.0085 - 0.049	2.2E-01		1.7E+02 N			NO	BSL
	7440-38-2	**Arsenic**	**5.6E-01 J**	**1.0E+00 J**	**MG/KG**	**LSR01-SB07-0610**	**5/26**	**0.96 - 1.3**	**1.0E+00**		**3.9E-01 C***			**YES**	**ASL**
	7440-50-8	Copper	1.0E+00	1.4E+00	MG/KG	LSR01-SS13-0610	2/2	0.52 - 0.53	1.4E+00		3.1E+02 N			NO	BSL
	7439-92-1	Lead	1.3E+00	9.9E+01	MG/KG	LSR01-SS09P-0610	26/26	0.29 - 0.38	9.9E+01		4.0E+02 N			NO	BSL
	7440-66-6	Zinc	6.1E+00	1.1E+01	MG/KG	LSR01-SS13-0610	2/2	2 - 2.1	1.1E+01		2.3E+03 N			NO	BSL

[1] Minimum/Maximum detected concentrations.

[2] Maximum concentration is used for screening.

[3] Background values not available.

[4] Oak Ridge National Laboratory (ORNL). May, 2010. Regional Screening Levels for Chemical Contaminants at Superfund Sites. http://epa-prgs.ornl.gov/chemicals/index.shtml
Residential Soil RSL,RSL based on non-cancer divided by 10.
RSL value for Acenaphthene used as surrogate for Acenaphthylene.
RSL value for pyrene used as surrogate for benzo(g,h,i)perylene.
RSL value for anthracene used as surrogate for phenanthrene.
The soil value of 400 mg/kg for lead is from the Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities, USEPA, July 14, 1994.

[5] Rationale Codes

Selection Reason: Above Screening Levels (ASL)

Deletion Reason: No Toxicity Information (NTX)
Essential Nutrient (NUT)

COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered
J = Estimated Value
K = Biased High
C = Carcinogenic
C* = N screening level < 100x C screening level, therefore N screening value used as screening level
C** = N screening level < 10x C screening level, therefore N screening value/10 used as screening level
N = Noncarcinogenic

Table 2.2

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

MWR Skeet Range, Little Creek

Scenario Timeframe: Future
Medium: Surface and Subsurface Soil
Exposure Medium: Surface and Subsurface Soil

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier	Maximum [1] Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection

Below Screening Level (BSL)

Table 3.1.RME
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
MWR Skeet Range
NAB Little Creek, Virginia Beach, Virginia

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)		Maximum Concentration (Qualifier)	Exposure Point Concentration			
							Value	Units	Statistic	Rationale
Surface Soil										
	Benzo(a)anthracene	mg/kg	4.1E-02	1.6E-01	NP	2.1E-01	1.6E-01	mg/kg	95% KM-c	1, 3
	Benzo(a)pyrene	mg/kg	6.1E-02	2.3E-01	NP	3.1E-01	2.3E-01	mg/kg	95% KM-c	1, 3
	Benzo(b)fluoranthene	mg/kg	7.7E-02	1.5E-01	NP	3.1E-01	1.5E-01	mg/kg	95% KM-t	1, 2, 3
	Dibenz(a,h)anthracene	mg/kg	1.5E-02	3.6E-02	NP	7.8E-02	3.6E-02	mg/kg	95% KM-BCA	1, 3
	Indeno(1,2,3-cd)pyrene	mg/kg	5.4E-02	1.2E-01	NP	2.9E-01	1.2E-01	mg/kg	95% KM-t	1, 2, 3

ProUCL, Version 4.00.05 used to determine distribution of data and calculate RME EPC and arithmetic mean, following recommendations from model and users guide (USEPA. April 2010. ProUCL, Version 4.00.05. Prepared by Lockheed Martin Environmental Services).
Options: 95% Kaplan-Meier (Chebyshev) UCL - (95% KM-c); 95% Kaplan-Meier (t) UCL - (95% KM-t); 95% Kaplan-Meier (BCA) UCL - 95% KM-BCA

(1) Shapiro-Wilk W Test/Lilliefors test indicates data (based on detects only) are log-normally distributed.
(2) Shapiro-Wilk W Test/Lilliefors indicates data (based on detects only) are normally distributed.
(3) Anderson-Darling Test and/or Kolmogorov-Smirnov Test indicate data (based on detects only) are gamma distributed.
(4) Distribution tests are inconclusive (data are not normal, log-normal, or gamma-distributed).

N = Normal
T = Log-Transformed
NP = Non-Parametric
G = Gamma

mg/kg = milligrams per kilogram

Table 3.2.RME
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
MWR Skeet Range
NAB Little Creek, Virginia Beach, Virginia

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Air

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)		Maximum Concentration (Qualifier)	Exposure Point Concentration			
							Value	Units	Statistic	Rationale
Air										
	Benzo(a)anthracene	ug/m^3	3.0E-08	1.1E-07	NP	1.5E-07	1.1E-07	ug/m^3	95% KM-c	1, 3
	Benzo(a)pyrene	ug/m^3	4.5E-08	1.7E-07	NP	2.3E-07	1.7E-07	ug/m^3	95% KM-c	1, 3
	Benzo(b)fluoranthene	ug/m^3	5.6E-08	1.1E-07	NP	2.3E-07	1.1E-07	ug/m^3	95% KM-t	1, 2, 3
	Dibenz(a,h)anthracene	ug/m^3	1.1E-08	2.6E-08	NP	5.7E-08	2.6E-08	ug/m^3	95% KM-BCA	1, 3
	Indeno(1,2,3-cd)pyrene	ug/m^3	4.0E-08	9.1E-08	NP	2.1E-07	9.1E-08	ug/m^3	95% KM-t	1, 2, 3

ProUCL, Version 4.00.05 used to determine distribution of data and calculate RME EPC and arithmetic mean, following recommendations from model and users guide (USEPA. April 2010. ProUCL, Version 4.00.05. Prepared by Lockheed Martin Environmental Services).
users guide (USEPA. April 2007. ProUCL, Version 4.0. Prepared by Lockheed Martin Environmental Services).
Options: 95% Kaplan-Meier (Chebyshev) UCL - (95% KM-c); 95% Kaplan-Meier (t) UCL - (95% KM-t); 95% Kaplan-Meier (BCA) UCL - 95% KM-BCA

(1) Shapiro-Wilk W Test/Lilliefors test indicates data (based on detects only) are log-normally distributed.
(2) Shapiro-Wilk W Test/Lilliefors indicates data (based on detects only) are normally distributed.
(3) Anderson-Darling Test and/or Kolmogorov-Smirnov Test indicate data (based on detects only) are gamma distributed.
(4) Distribution tests are inconclusive (data are not normal, log-normal, or gamma-distributed).

N = Normal
T = Log-Transformed
NP = Non-Parametric
G = Gamma

ug/m^3 = micrograms per cubic meter

Table 3.3.RME
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
MWR Skeet Range
NAB Little Creek, Virginia Beach, Virginia

Scenario Timeframe: Future
Medium: Surface and Subsurface Soil
Exposure Medium: Surface and Subsurface Soil

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)		Maximum Concentration (Qualifier)		Exposure Point Concentration			
								Value	Units	Statistic	Rationale
Surface Soil											
	Benzo(a)anthracene	mg/kg	1.8E-02	1.0E-01	NP	2.1E-01		1.0E-01	mg/kg	99% KM-c	4
	Benzo(a)pyrene	mg/kg	2.6E-02	1.5E-01	NP	3.1E-01		1.5E-01	mg/kg	99% KM-c	4
	Benzo(b)fluoranthene	mg/kg	3.1E-02	1.7E-01	NP	3.1E-01		1.7E-01	mg/kg	99% KM-c	4
	Dibenz(a,h)anthracene	mg/kg	6.6E-03	1.2E-02	NP	7.8E-02		1.2E-02	mg/kg	95% KM-t	1, 3
	Indeno(1,2,3-cd)pyrene	mg/kg	2.3E-02	1.4E-01	NP	2.9E-01		1.4E-01	mg/kg	99% KM-c	1
	Arsenic	mg/kg	6.1E-01	6.6E-01	NP	1.0E+00	J	6.6E-01	mg/kg	95% KM-t	1, 2, 3

ProUCL, Version 4.00.05 used to determine distribution of data and calculate RME EPC and arithmetic mean, following recommendations from model and users guide (USEPA. April 2010. ProUCL, Version 4.00.05. Prepared by Lockheed Martin Environmental Services).
Options: 95% Kaplan-Meier (t) UCL - (95% KM-t); 95% Kaplan-Meier (Percentile Bootstrap) UCL - 95% KM-pb
99% Kaplan-Meier (Chebyshev) UCL - (99% KM-c)

(1) Shapiro-Wilk W Test/Lilliefors test indicates data (based on detects only) are log-normally distributed.
(2) Shapiro-Wilk W Test/Lilliefors indicates data (based on detects only) are normally distributed.
(3) Anderson-Darling Test and/or Kolmogorov-Smirnov Test indicate data (based on detects only) are gamma distributed.
(4) Distribution tests are inconclusive (data are not normal, log-normal, or gamma-distributed).
(5) Max value used because 95% UCL greater than max.

N = Normal
T = Log-Transformed
NP = Non-Parametric
G = Gamma

mg/kg = milligrams per kilogram
J = Estimated Value

Table 3.4.RME
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
MWR Skeet Range
NAB Little Creek, Virginia Beach, Virginia

Scenario Timeframe: Future
Medium: Surface and Subsurface Soil
Exposure Medium: Air

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)		Maximum Concentration (Qualifier)		Exposure Point Concentration			
								Value	Units	Statistic	Rationale
Air											
	Benzo(a)anthracene	ug/m^3	1.3E-08	7.6E-08	NP	1.5E-07		7.6E-08	ug/m^3	99% KM-c	4
	Benzo(a)pyrene	ug/m^3	1.9E-08	1.1E-07	NP	2.3E-07		1.1E-07	ug/m^3	99% KM-c	4
	Benzo(b)fluoranthene	ug/m^3	2.3E-08	1.2E-07	NP	2.3E-07		1.2E-07	ug/m^3	99% KM-c	4
	Dibenz(a,h)anthracene	ug/m^3	4.8E-09	8.5E-09	NP	5.7E-08		8.5E-09	ug/m^3	95% KM-t	1, 3
	Indeno(1,2,3-cd)pyrene	ug/m^3	1.7E-08	1.0E-07	NP	2.1E-07		1.0E-07	ug/m^3	99% KM-c	1
	Arsenic	ug/m^3	4.5E-07	4.8E-07	NP	7.4E-07	J	4.8E-07	ug/m^3	95% KM-t	1, 2, 3

ProUCL, Version 4.00.05 used to determine distribution of data and calculate RME EPC and arithmetic mean, following recommendations from model and users guide (USEPA. April 2010. ProUCL, Version 4.00.05. Prepared by Lockheed Martin Environmental Services).
users guide (USEPA. April 2007. ProUCL, Version 4.0. Prepared by Lockheed Martin Environmental Services).
Options: 95% Kaplan-Meier (t) UCL - (95% KM-t); 95% Kaplan-Meier (Percentile Bootstrap) UCL - 95% KM-pb
99% Kaplan-Meier (Chebyshev) UCL - (99% KM-c)

(1) Shapiro-Wilk W Test/Lilliefors test indicates data (based on detects only) are log-normally distributed.
(2) Shapiro-Wilk W Test/Lilliefors indicates data (based on detects only) are normally distributed.
(3) Anderson-Darling Test and/or Kolmogorov-Smirnov Test indicate data (based on detects only) are gamma distributed.
(4) Distribution tests are inconclusive (data are not normal, log-normal, or gamma-distributed).
(5) Max value used because 95% UCL greater than max.

N = Normal
T = Log-Transformed
NP = Non-Parametric
G = Gamma

ug/m^3 = micrograms per cubic meter
J = Estimated Value

TABLE 7.1.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

MWR Skeet Range

NAB Little Creek, Virginia Beach, Virginia

Scenario Timeframe: Current/Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Surface Soil	Surface Soil	Surface Soil	Ingestion	Benzo(a)anthracene	1.6E-01	mg/kg	5.4E-08	mg/kg/day	7.3E-01	1/mg/kg-day	4.0E-08	1.5E-07	mg/kg/day	N/A	mg/kg/day	N/A
				Benzo(a)pyrene	2.3E-01	mg/kg	8.1E-08	mg/kg/day	7.3E+00	1/mg/kg-day	5.9E-07	2.3E-07	mg/kg/day	N/A	mg/kg/day	N/A
				Benzo(b)fluoranthene	1.5E-01	mg/kg	5.4E-08	mg/kg/day	7.3E-01	1/mg/kg-day	3.9E-08	1.5E-07	mg/kg/day	N/A	mg/kg/day	N/A
				Dibenz(a,h)anthracene	3.6E-02	mg/kg	1.3E-08	mg/kg/day	7.3E+00	1/mg/kg-day	9.1E-08	3.5E-08	mg/kg/day	N/A	mg/kg/day	N/A
				Indeno(1,2,3-cd)pyrene	1.2E-01	mg/kg	4.3E-08	mg/kg/day	7.3E-01	1/mg/kg-day	3.2E-08	1.2E-07	mg/kg/day	N/A	mg/kg/day	N/A
			Exp. Route Total								7.9E-07					0.0E+00
			Dermal Absorption	Benzo(a)anthracene	1.6E-01	mg/kg	4.6E-08	mg/kg/day	7.3E-01	1/mg/kg-day	3.4E-08	1.3E-07	mg/kg/day	N/A	mg/kg/day	N/A
				Benzo(a)pyrene	2.3E-01	mg/kg	6.9E-08	mg/kg/day	7.3E+00	1/mg/kg-day	5.1E-07	1.9E-07	mg/kg/day	N/A	mg/kg/day	N/A
				Benzo(b)fluoranthene	1.5E-01	mg/kg	4.6E-08	mg/kg/day	7.3E-01	1/mg/kg-day	3.4E-08	1.3E-07	mg/kg/day	N/A	mg/kg/day	N/A
				Dibenz(a,h)anthracene	3.6E-02	mg/kg	1.1E-08	mg/kg/day	7.3E+00	1/mg/kg-day	7.8E-08	3.0E-08	mg/kg/day	N/A	mg/kg/day	N/A
				Indeno(1,2,3-cd)pyrene	1.2E-01	mg/kg	3.7E-08	mg/kg/day	7.3E-01	1/mg/kg-day	2.7E-08	1.0E-07	mg/kg/day	N/A	mg/kg/day	N/A
			Exp. Route Total								6.8E-07					0.0E+00
		Exposure Point Total									1.5E-06					0.0E+00
	Exposure Medium Total										1.5E-06					0.0E+00
	Air	Emissions from Surface Soil	Inhalation	Benzo(a)anthracene	1.1E-07	ug/m^3	9.3E-09	ug/m^3	1.1E-04	$(\mu g/m^3)^{-1}$	1.0E-12	2.6E-11	mg/m^3	N/A		N/A
				Benzo(a)pyrene	1.7E-07	ug/m^3	1.4E-08	ug/m^3	1.1E-03	$(\mu g/m^3)^{-1}$	1.5E-11	3.9E-11	mg/m^4	N/A		N/A
				Benzo(b)fluoranthene	1.1E-07	ug/m^3	9.2E-09	ug/m^3	1.1E-04	$(\mu g/m^3)^{-1}$	1.0E-12	2.6E-11	mg/m^5	N/A		N/A
				Dibenz(a,h)anthracene	2.6E-08	ug/m^3	2.1E-09	ug/m^3	1.2E-03	$(\mu g/m^3)^{-1}$	2.6E-12	6.0E-12	mg/m^6	N/A		N/A
				Indeno(1,2,3-cd)pyrene	9.1E-08	ug/m^3	7.4E-09	ug/m^3	1.1E-04	$(\mu g/m^3)^{-1}$	8.2E-13	2.1E-11	mg/m^7	N/A		N/A
			Exp. Route Total								2.1E-11					0.0E+00
		Exposure Point Total									2.1E-11					0.0E+00
	Exposure Medium Total										2.1E-11					0.0E+00
Medium Total											1.5E-06					0.0E+00
										Total of Receptor Risks Across All Media	1.5E-06				Total of Receptor Hazards Across All Media	0.0E+00

N/A = Not applicable.

Dermal absorption factors (DABs) used to calculated dermal absorption intake from soil are chemical specific. DABS of 0.13 used for the PAHs, DABS of 0.03 used for arsenic.

TABLE 7.2.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

MWR Skeet Range

NAB Little Creek, Virginia Beach, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Surface and Subsurface Soil	Surface and Subsurface Soil	Surface and Subsurface Soil	Ingestion													
				Benzo(a)anthracene	1.0E-01	mg/kg	N/A		N/A		N/A	1.4E-07	mg/kg/day	N/A	mg/kg/day	N/A
				Benzo(a)pyrene	1.5E-01	mg/kg	N/A		N/A		N/A	2.1E-07	mg/kg/day	N/A	mg/kg/day	N/A
				Benzo(b)fluoranthene	1.7E-01	mg/kg	N/A		N/A		N/A	2.3E-07	mg/kg/day	N/A	mg/kg/day	N/A
				Dibenz(a,h)anthracene	1.2E-02	mg/kg	N/A		N/A		N/A	1.6E-08	mg/kg/day	N/A	mg/kg/day	N/A
				Indeno(1,2,3-cd)pyrene	1.4E-01	mg/kg	N/A		N/A		N/A	1.9E-07	mg/kg/day	N/A	mg/kg/day	N/A
				Arsenic	6.6E-01	mg/kg	N/A		N/A		N/A	9.0E-07	mg/kg/day	3.0E-04	mg/kg/day	3.0E-03
			Exp. Route Total								N/A					3.0E-03
			Dermal Absorption	Benzo(a)anthracene	1.0E-01	mg/kg	N/A		N/A		N/A	7.4E-08	mg/kg/day	N/A	mg/kg/day	N/A
				Benzo(a)pyrene	1.5E-01	mg/kg	N/A		N/A		N/A	1.1E-07	mg/kg/day	N/A	mg/kg/day	N/A
				Benzo(b)fluoranthene	1.7E-01	mg/kg	N/A		N/A		N/A	1.2E-07	mg/kg/day	N/A	mg/kg/day	N/A
				Dibenz(a,h)anthracene	1.2E-02	mg/kg	N/A		N/A		N/A	8.2E-09	mg/kg/day	N/A	mg/kg/day	N/A
				Indeno(1,2,3-cd)pyrene	1.4E-01	mg/kg	N/A		N/A		N/A	9.9E-08	mg/kg/day	N/A	mg/kg/day	N/A
				Arsenic	6.6E-01	mg/kg	N/A		N/A		N/A	1.1E-07	mg/kg/day	3.0E-04	mg/kg/day	3.6E-04
			Exp. Route Total								N/A					3.6E-04
		Exposure Point Total									N/A					3.3E-03
	Exposure Medium Total										N/A					3.3E-03
	Air	Emissions from Soil	Inhalation	Benzo(a)anthracene	7.6E-08	ug/m^3	N/A		N/A		N/A	7.3E-11	mg/m^3	N/A	mg/m^3	N/A
				Benzo(a)pyrene	1.1E-07	ug/m^3	N/A		N/A		N/A	1.1E-10	mg/m^3	N/A	mg/m^3	N/A
				Benzo(b)fluoranthene	1.2E-07	ug/m^3	N/A		N/A		N/A	1.2E-10	mg/m^3	N/A	mg/m^3	N/A
				Dibenz(a,h)anthracene	8.5E-09	ug/m^3	N/A		N/A		N/A	8.2E-12	mg/m^3	N/A	mg/m^3	N/A
				Indeno(1,2,3-cd)pyrene	1.0E-07	ug/m^3	N/A		N/A		N/A	9.8E-11	mg/m^3	N/A	mg/m^3	N/A
				Arsenic	4.8E-07	ug/m^3	N/A		N/A		N/A	4.6E-10	mg/m^3	1.5E-05	mg/m^3	3.1E-05
			Exp. Route Total								N/A					3.1E-05
		Exposure Point Total									N/A					3.1E-05
	Exposure Medium Total										N/A					3.1E-05
Medium Total											N/A					3.4E-03
							Total of Receptor Risks Across All Media				N/A	Total of Receptor Hazards Across All Media				3.4E-03

Notes-

N/A = Not applicable.

Dermal absorption factors (DABs) used to calculated dermal absorption intake from soil are chemical specific. DABS of 0.13 used for the PAHs, DABS of 0.03 used for arsenic.

TABLE 7.3.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

MQE Skeet Range

NAB Little Creek, Virginia Beach, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Surface and Subsurface Soil	Surface and Subsurface Soil	Surface and Subsurface Soil	Ingestion													
				Benzo(a)anthracene	1.0E-01	mg/kg	N/A		N/A		N/A	1.3E-06	mg/kg/day	N/A	mg/kg/day	N/A
				Benzo(a)pyrene	1.5E-01	mg/kg	N/A		N/A		N/A	2.0E-06	mg/kg/day	N/A	mg/kg/day	N/A
				Benzo(b)fluoranthene	1.7E-01	mg/kg	N/A		N/A		N/A	2.2E-06	mg/kg/day	N/A	mg/kg/day	N/A
				Dibenz(a,h)anthracene	1.2E-02	mg/kg	N/A		N/A		N/A	1.5E-07	mg/kg/day	N/A	mg/kg/day	N/A
				Indeno(1,2,3-cd)pyrene	1.4E-01	mg/kg	N/A		N/A		N/A	1.8E-06	mg/kg/day	N/A	mg/kg/day	N/A
				Arsenic	6.6E-01	mg/kg	N/A		N/A		N/A	8.4E-06	mg/kg/day	3.0E-04	mg/kg/day	2.8E-02
			Exp. Route Total								N/A					2.8E-02
			Dermal Absorption	Benzo(a)anthracene	1.0E-01	mg/kg	N/A		N/A		N/A	4.8E-07	mg/kg/day	N/A	mg/kg/day	N/A
				Benzo(a)pyrene	1.5E-01	mg/kg	N/A		N/A		N/A	7.2E-07	mg/kg/day	N/A	mg/kg/day	N/A
				Benzo(b)fluoranthene	1.7E-01	mg/kg	N/A		N/A		N/A	7.9E-07	mg/kg/day	N/A	mg/kg/day	N/A
				Dibenz(a,h)anthracene	1.2E-02	mg/kg	N/A		N/A		N/A	5.4E-08	mg/kg/day	N/A	mg/kg/day	N/A
				Indeno(1,2,3-cd)pyrene	1.4E-01	mg/kg	N/A		N/A		N/A	6.5E-07	mg/kg/day	N/A	mg/kg/day	N/A
				Arsenic	6.6E-01	mg/kg	N/A		N/A		N/A	7.0E-07	mg/kg/day	3.0E-04	mg/kg/day	2.3E-03
			Exp. Route Total								N/A					2.3E-03
		Exposure Point Total									N/A					3.0E-02
	Exposure Medium Total										N/A					3.0E-02
	Air	Emissions from Surface and Subsurface Soil	Inhalation	Benzo(a)anthracene	7.6E-08	ug/m^3	N/A		N/A		N/A	7.3E-11	mg/m^3	N/A	mg/m^3	N/A
				Benzo(a)pyrene	1.1E-07	ug/m^3	N/A		N/A		N/A	1.1E-10	mg/m^3	N/A	mg/m^4	N/A
				Benzo(b)fluoranthene	1.2E-07	ug/m^3	N/A		N/A		N/A	1.2E-10	mg/m^3	N/A	mg/m^5	N/A
				Dibenz(a,h)anthracene	8.5E-09	ug/m^3	N/A		N/A		N/A	8.2E-12	mg/m^3	N/A	mg/m^6	N/A
				Indeno(1,2,3-cd)pyrene	1.0E-07	ug/m^3	N/A		N/A		N/A	9.8E-11	mg/m^3	N/A	mg/m^7	N/A
				Arsenic	4.8E-07	ug/m^3	N/A		N/A		N/A	4.6E-10	mg/m^3	1.5E-05	mg/m^8	3.1E-05
			Exp. Route Total								N/A					3.1E-05
		Exposure Point Total									N/A					3.1E-05
	Exposure Medium Total										N/A					3.1E-05
Medium Total											N/A					3.0E-02
									Total of Receptor Risks Across All Media		N/A	Total of Receptor Hazards Across All Media				3.0E-02

Notes-

N/A = Not applicable.

Dermal absorption factors (DABs) used to calculated dermal absorption intake from soil are chemical specific. DABS of 0.13 used for the PAHs, DABS of 0.03 used for arsenic.

TABLE 7.4.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

MWR Skeet Range

NAB Little Creek, Virginia Beach, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Surface and Subsurface Soil	Surface and Subsurface Soil	Surface and Subsurface Soil	Ingestion	Benzo(a)anthracene	1.0E-01	mg/kg	(1)		7.3E-01	mg/kg/day	5.1E-07	N/A		N/A		N/A
				Benzo(a)pyrene	1.5E-01	mg/kg	(1)		7.3E+00	mg/kg/day	7.5E-06	N/A		N/A		N/A
				Benzo(b)fluoranthene	1.7E-01	mg/kg	(1)		7.3E-01	mg/kg/day	8.3E-07	N/A		N/A		N/A
				Dibenz(a,h)anthracene	1.2E-02	mg/kg	(1)		7.3E+00	mg/kg/day	5.7E-07	N/A		N/A		N/A
				Indeno(1,2,3-cd)pyrene	1.4E-01	mg/kg	(1)		7.3E-01	mg/kg/day	6.8E-07	N/A		N/A		N/A
				Arsenic	6.6E-01	mg/kg	1.0E-06	mg/kg/day	1.5E+00	mg/kg/day	1.5E-06	N/A		N/A		N/A
			Exp. Route Total								1.2E-05					N/A
			Dermal Absorption	Benzo(a)anthracene	1.0E-01	mg/kg	(1)		7.3E-01	mg/kg/day	2.0E-07	N/A		N/A		N/A
				Benzo(a)pyrene	1.5E-01	mg/kg	(1)		7.3E+00	mg/kg/day	2.9E-06	N/A		N/A		N/A
				Benzo(b)fluoranthene	1.7E-01	mg/kg	(1)		7.3E-01	mg/kg/day	3.2E-07	N/A		N/A		N/A
				Dibenz(a,h)anthracene	1.2E-02	mg/kg	(1)		7.3E+00	mg/kg/day	2.2E-07	N/A		N/A		N/A
				Indeno(1,2,3-cd)pyrene	1.4E-01	mg/kg	(1)		7.3E-01	mg/kg/day	2.6E-07	N/A		N/A		N/A
				Arsenic	6.6E-01	mg/kg	9.7E-08	mg/kg/day	1.5E+00	mg/kg/day	1.5E-07	N/A		N/A		N/A
			Exp. Route Total								4.0E-06					N/A
		Exposure Point Total									1.6E-05					N/A
	Exposure Medium Total										1.6E-05					N/A
	Air	Emissions from Surface and Subsurface Soil	Inhalation	Benzo(a)anthracene	7.6E-08	ug/m^3	(1)		1.1E-04	$(\mu g/m^3)^{-1}$	8.8E-12	N/A		N/A		N/A
				Benzo(a)pyrene	1.1E-07	ug/m^3	(1)		1.1E-03	$(\mu g/m^3)^{-1}$	1.3E-10	N/A		N/A		N/A
				Benzo(b)fluoranthene	1.2E-07	ug/m^3	(1)		1.1E-04	$(\mu g/m^3)^{-1}$	1.4E-11	N/A		N/A		N/A
				Dibenz(a,h)anthracene	8.5E-09	ug/m^3	(1)		1.2E-03	$(\mu g/m^3)^{-1}$	1.1E-11	N/A		N/A		N/A
				Indeno(1,2,3-cd)pyrene	1.0E-07	ug/m^3	(1)		1.1E-04	$(\mu g/m^3)^{-1}$	1.2E-11	N/A		N/A		N/A
				Arsenic	4.8E-07	ug/m^3	2.0E-07	ug/m^3	4.3E-03	$(\mu g/m^3)^{-1}$	8.5E-10	N/A		N/A		N/A
			Exp. Route Total								1.0E-09					N/A
		Exposure Point Total									1.0E-09					N/A
	Exposure Medium Total										1.0E-09					N/A
Medium Total											1.6E-05					N/A
										Total of Receptor Risks Across All Media	1.6E-05				Total of Receptor Hazards Across All Media	N/A

Notes-

N/A = Not applicable.

Dermal absorption factors (DABs) used to calculated dermal absorption intake from soil are chemical specific. DABS of 0.13 used for the PAHs, DABS of 0.03 used for arsenic.

(1) See Table 7.4.RME Supplement A, for calculation of risks for chemicals that act via a mutagenic mode of action.

TABLE 7.4.RME Supplement A

CALCULATION OF CHEMICAL CANCER RISKS FOR COPC WITH MUTAGENIC MODE OF ACTION

REASONABLE MAXIMUM EXPOSURE

MWR Skeet Range, NAB Little Creek, Virginia Beach, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult/Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations									
							Intake					CSF/Unit Risk				Cancer Risk
					Value	Units	Value				Units	Value				Units	
							0-2 yrs	2-6 yrs	6-16 years	16-30 yrs		0-2 yrs (ADAF=10)	2-6 yrs (ADAF=3)	6-16 yrs (ADAF=3)	16-30 yrs (ADAF=1)		
Surface and Subsurface Soil	Surface and Subsurface Soil	Surface and Subsurface Soil	Ingestion	Benzo(a)anthracene	1.0E-01	mg/kg	3.8E-08	7.6E-08	2.0E-08	2.8E-08	mg/kg/day	7.3E+00	2.2E+00	2.2E+00	7.3E-01	mg/kg/day	5.1E-07
				Benzo(a)pyrene	1.5E-01	mg/kg	5.6E-08	1.1E-07	3.0E-08	4.2E-08	mg/kg/day	7.3E+01	2.2E+01	2.2E+01	7.3E+00	mg/kg/day	7.5E-06
				Benzo(b)fluoranthene	1.7E-01	mg/kg	6.2E-08	1.2E-07	3.3E-08	4.6E-08	mg/kg/day	7.3E+00	2.2E+00	2.2E+00	7.3E-01	mg/kg/day	8.3E-07
				Dibenz(a,h)anthracene	1.2E-02	mg/kg	4.2E-09	8.5E-09	2.3E-09	3.2E-09	mg/kg/day	7.3E+01	2.2E+01	2.2E+01	7.3E+00	mg/kg/day	5.7E-07
				Indeno(1,2,3-cd)pyrene	1.4E-01	mg/kg	5.1E-08	1.0E-07	2.7E-08	3.8E-08	mg/kg/day	7.3E+00	2.2E+00	2.2E+00	7.3E-01	mg/kg/day	6.8E-07
			Dermal	Benzo(a)anthracene	1.0E-01	mg/kg	1.4E-08	2.8E-08	1.1E-08	1.5E-08	mg/kg/day	7.3E+00	2.2E+00	2.2E+00	7.3E-01	mg/kg/day	2.0E-07
				Benzo(a)pyrene	1.5E-01	mg/kg	2.0E-08	4.1E-08	1.6E-08	2.2E-08	mg/kg/day	7.3E+01	2.2E+01	2.2E+01	7.3E+00	mg/kg/day	2.9E-06
				Benzo(b)fluoranthene	1.7E-01	mg/kg	2.3E-08	4.5E-08	1.7E-08	2.4E-08	mg/kg/day	7.3E+00	2.2E+00	2.2E+00	7.3E-01	mg/kg/day	3.2E-07
				Dibenz(a,h)anthracene	1.2E-02	mg/kg	1.5E-09	3.1E-09	1.2E-09	1.6E-09	mg/kg/day	7.3E+01	2.2E+01	2.2E+01	7.3E+00	mg/kg/day	2.2E-07
				Indeno(1,2,3-cd)pyrene	1.4E-01	mg/kg	1.9E-08	3.7E-08	1.4E-08	2.0E-08	mg/kg/day	7.3E+00	2.2E+00	2.2E+00	7.3E-01	mg/kg/day	2.6E-07
	Ambient Air	Emissions from Surface and Subsurface Soil	Inhalation	Benzo(a)anthracene	7.6E-08	$\mu g/m^3$	2.1E-09	4.2E-09	1.0E-08	1.5E-08	mg/kg/day	1.1E-03	3.3E-04	3.3E-04	1.1E-04	$(\mu g/m^3)^{-1}$	8.8E-12
				Benzo(a)pyrene	1.1E-07	$\mu g/m^3$	3.1E-09	6.2E-09	1.5E-08	2.2E-08	mg/kg/day	1.1E-02	3.3E-03	3.3E-03	1.1E-03	$(\mu g/m^3)^{-1}$	1.3E-10
				Benzo(b)fluoranthene	1.2E-07	$\mu g/m^3$	3.4E-09	6.8E-09	1.7E-08	2.4E-08	mg/kg/day	1.1E-03	3.3E-04	3.3E-04	1.1E-04	$(\mu g/m^3)^{-1}$	1.4E-11
				Dibenz(a,h)anthracene	8.5E-09	$\mu g/m^3$	2.3E-10	4.7E-10	1.2E-09	1.6E-09	mg/kg/day	1.2E-02	3.6E-03	3.6E-03	1.2E-03	$(\mu g/m^3)^{-1}$	1.1E-11
				Indeno(1,2,3-cd)pyrene	1.0E-07	$\mu g/m^3$	2.8E-09	5.6E-09	1.4E-08	2.0E-08	mg/kg/day	1.1E-03	3.3E-04	3.3E-04	1.1E-04	$(\mu g/m^3)^{-1}$	1.2E-11