Uploaded to the VFC Website
▶▶ ▶▶ February 2014 ◀◀ ◀◀

This Document has been provided to you courtesy of Veterans-For-Change!

Feel free to pass to any veteran who might be able to use this information!

For thousands more files like this and hundreds of links to useful information, and hundreds of "Frequently Asked Questions, please go to:

Veterans-For-Change

Veterans-For-Change is a A 501(c)(3) Non-Profit Organizaton
Tax ID #27-3820181
CA Incorporation ID #3340400
CA Dept. of Charities ID #: CT-0190794

If Veterans don't help Veterans, who will?

We appreciate all donations to continue to provide information and services to Veterans and their families.

https://www.paypal.com/cgi-bin/webscr?cmd=_s-xclick&hosted_button_id=WGT2M5UTB9A78

Note: VFC is not liable for source information in this document, it is merely provided as a courtesy to our members & subscribers.

11901 Samuel, Garden Grove, CA 92840-2546

PROJECT: **Phase I Site Soil Sampling**

LOCATION: **Camp Carroll**   G&EE NO.: **11-032E**   INSPECTOR:

DATE STARTED: **18 Jul 11**   FINISHED: **18 Jul 11**   DRILLER:

DRILLING METHOD/EQUIPMENT: **BEC50PM-1**

DRILLING AGENCY: **BEC**   HOLE DIAMETER: **5.5 cm**   TOTAL DEPTH: **10.0 m**

OVERBURDEN THICKNESS: DEPTH DRILLED: **10.0 m**   WATER DEPTH: **No Water; AD**

COORDINATES: N: **3,983,391.3** E: **447,621.3**   GROUND ELEV.: **50.17 m**   DATUM: **MSL**

GROUND COVER: **Grass**   CONTAMINATION:

TYPE OF HOLE: ☐ Piezometer   ☐ Monitoring Well   ☐ Test Pit   ☐ Auger Hole   ☒ other **Direct push sampling hole**

ELEVATION / DEPTH (meters)	SAMPLE TYPE / NUMBER	GRAPHIC LOG	CONTAMINATED	BLOW COUNT	SPT N-VALUE	USCS / STRATA	DESCRIPTION OF MATERIALS	FIELD DATA	LAB DATA
50 — 0						AC	Asphalt pavement thickness = 7cm.		
	S1					FILL / FILL	**Poorly-graded GRAVEL with Silt and Sand**: grayish brown; moist; about 70% subangular fine to coarse gravel (max.5cm); about 20% subangular fine to coarse Sand (max.4.8mm); about 10% Fines; fill material (GP-GM).	%Recovery = 100 PID = 1.6ppm FC = F3	
49 — 1	S2						**SILTY SAND**: brown; moist; about 10% subangular fine to coarse gravel (max.3cm); about 65% subangular fine to coarse Sand (max.4.8mm); about 25% Fines; no plasticity; fill material (SM).	%Recovery = 93 PID = 1.0 - 10.3ppm	
48 — 2									
							With scrap of asphalt at 3m.	%Recovery = 96 PID = 2.9 - 4.3ppm	
47 — 3	S3					FILL	**CLAYEY SAND**: reddish brown to gray; moist; about 5% subangular fine gravel (max.2cm); about 60% subangular fine to coarse Sand (max.4.8mm); about 35% Fines; medium plasticity; fill material (SC).		
46 — 4							About 3% subangular fine gravel (max.1cm); about 67% subangular fine to coarse Sand; about 30% Fines.		
45 — 5						SC	**CLAYEY SAND**: reddish brown; moist; about 70% subangular fine to coarse Sand (max.4.8mm); about 30% Fines; medium plasticity; residual soil.	%Recovery = 90 PID = 0.5 - 2.0ppm	
44 — 6									
43 — 7	S4					SM	**SILTY SAND**: brown; moist; about 70% subangular fine to coarse Sand (max.4.8mm); about 30% Fines; no plasticity; residual soil.		
42 — 8							Light brown.		
41 — 9									
— 10							Penetration finish depth = 10.0m (Penetration speed = 10cm / 20sce).		

ENVIRO-EXPLORATION LOG 11-032E.GPJ USACE SKOREA.GDT 7/22/11

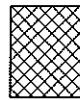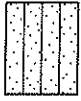# SOIL DESCRIPTIONS

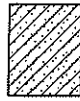|			
■ Asphalt	▨ Sandy Lean Clay	▦ Fill material	▥ Silt
Sandy Silt	Portland Cement Concrete	Clayey Sand	Silty Sand

ROCK DESCRIPTIONS

Granite

GROUNDWATER

▽ Groundwater 1st reading
(While drilling or at completion)

▼ Groundwater 2nd reading
(After Drilling or over 12 hours later after drilling)

SOIL SAMPLERS

◣ Direct Push Soil Sampler

FIELD / LAB TEST DATA

Fines = %Passing #200 Sieve
FC = Frost Classification
PID = Photoionization detector
Petro FLAG = Petroleum Hydrocarbons detected
LL = Liquid Limit
PI = Plasticity Index
MC = %Moisture Content
Cc = Compression Index
OCR = Overconsolidation Ratio
Tor = Torvane
PP = Pocket Penetrometer
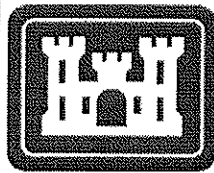
**US Army Corps
of Engineers
Far East District**
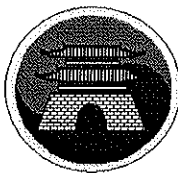
Key to Symbols

Project Name: Phase I Site Soil Sampling
Location: Camp Carroll
G&EE Number: 11-032E

S902

1. The dates of drilling/penetration and type of equipment used are shown on the logs. All soils were classified in accordance with ASTM D 2488. Results of tests conducted on recovered samples are shown on the logs.
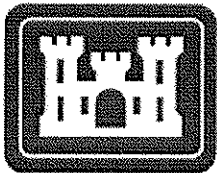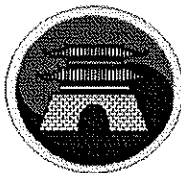
2. Borehole locations and elevations were determined using GPS RTK and/or Traverse methods. Equipments used are Trimble GPS RTK and/or Sokkia Total Stations. Survey Datum is WGS84, UTM Zone 52 and Elevations are Mean Sea Level (MSL).

3. The groundwater table is representative of boring location and time of drilling, and may change according to seasonal precipitation.

4. The exploration logs are subject to the limitations, conclusions, and recommendations provided in the report. Some variation in the subsurface conditions and depth to bedrock between boring locations can be expected.

5. Soil and rock conditions and associated stratigraphic features as depicted in the boring logs are specific for the particular drilling location, and may vary between boreholes.

6. Penetration refusal depth on the logs is based on achieving an penetration speed at least 1 minutes for 2 cm penetration (<2cm/1min) within very dense residual soil or decomposed bedrock.

7. When direct push sampling system used, some gravelly soils may have the potential to provide poor sample recovery or erroneous penetration speed due to the coarse size of the particles, as compared to the size of the sampler (35mm ID).

5903

PROJECT: **Phase II Site Soil Sampling**
LOCATION: **Camp Carroll**   G&EE NO.: **11-032E**   INSPECTOR: ▇▇▇▇
DATE STARTED: **11 Aug 11**   FINISHED: **11 Aug 11**   DRILLER: ▇▇▇▇
DRILLING METHOD/EQUIPMENT: **BEC50PM-1**
DRILLING AGENCY: **BEC**   HOLE DIAMETER: **5.5 cm**   TOTAL DEPTH: **2.3 m**
OVERBURDEN THICKNESS: _____   DEPTH DRILLED: **2.3 m**   WATER DEPTH: **No water; AD**
COORDINATES: N: **3,983,502.5** E: **447,696.6**   GROUND ELEV.: **52.29 m**   DATUM: **MSL**
GROUND COVER: **Grass**   CONTAMINATION: _____
TYPE OF HOLE: ☐ Piezometer   ☐ Monitoring Well   ☐ Test Pit   ☐ Auger Hole   ☒ other **Direct push sampling hole**

ELEVATION / DEPTH (meters)	SAMPLE TYPE / NUMBER	GRAPHIC LOG	CONTAMINATED	BLOW COUNT	SPT N-VALUE	USCS / STRATA	DESCRIPTION OF MATERIALS	FIELD DATA	LAB DATA
0 — 52	S1					FILL	**SILTY SAND**: brown; moist; about 10% subangular fine to coarse gravel (max.3cm); about 60% subangular fine to coarse Sand (max.4.8mm); about 30% Fines; no plasticity; fill material (SM).	%Recovery = 100 PID = 1,5ppm FC = F3	
							About 5% subangular fine to coarse gravel (max.3cm); about 65% subangular fine to coarse Sand (max.4.8mm); about 30% Fines.	%Recovery = 100 PID = 0.6 - 2.0ppm	
51	S2					SM	**SILTY SAND**: light brown; moist; about 80% subangular fine to coarse Sand (max.4.8mm); about 20% Fines; residual soil; granite texture.		
2 — 50							Hard pushing of sampler at 2.1-2.3m; HDP (Hydraulic Down Pressure) = 1000 psi.		
							Penetration refusal depth = 2.3m (Penetration speed = 1cm / 1min).		

ENVIRO-EXPLORATION LOG 11-032E-PHASE2-FINAL.GPJ USACE SKOREA.GDT 8/22/11

PROJECT: **Phase II Site Soil Sampling**

LOCATION: **Camp Carroll** G&EE NO.: **11-032E** INSPECTOR: ▓▓▓▓ 66

DATE STARTED: **11 Aug 11** FINISHED: **11 Aug 11** DRILLER: ▓▓▓▓ 66

DRILLING METHOD/EQUIPMENT: **BEC50PM-1**

DRILLING AGENCY: **BEC** HOLE DIAMETER: **5.5 cm** TOTAL DEPTH: **1.8 m**

OVERBURDEN THICKNESS: _____ DEPTH DRILLED: **1.8 m** WATER DEPTH: **No water; AD**

COORDINATES: N: **3,983,488.8** E: **447,677.1** GROUND ELEV.: **51.51 m** DATUM: **MSL**

GROUND COVER: **Grass** CONTAMINATION: _____

TYPE OF HOLE: ☐ Piezometer ☐ Monitoring Well ☐ Test Pit ☐ Auger Hole ☒ other **Direct push sampling hole**

ELEVATION / DEPTH (meters)	SAMPLE TYPE / NUMBER	GRAPHIC LOG	CONTAMINATED	BLOW COUNT	SPT N-VALUE	USCS / STRATA	DESCRIPTION OF MATERIALS	FIELD DATA	LAB DATA
0	S1					FILL	**SILTY SAND**: brown; moist; about 10% subangular fine to coarse gravel (max.3cm); about 65% subangular fine to coarse Sand (max.4.8mm); about 25% Fines; no plasticity; fill material (SM).	%Recovery = 100 PID = 2.1ppm FC = F3	
51								%Recovery = 100 PID = 4.2 - 5.2ppm	
1	S2								
50						SM	**SILTY SAND**: brown; moist; about 80% subangular fine to coarse Sand (max.4.8mm); about 20% Fines; residual soil; granite texture. Hard pushing of sampler at 1.6-1.8m; HDP (Hydraulic Down Pressure) = 1000 psi.		

Penetration refusal depth = 1.8m (Penetration speed = 2cm / 1min).

ENVIRO-EXPLORATION LOG 11-032E-PHASE2-FINAL.GPJ USACE SKOREA.GDT 8/22/11

PROJECT: **Phase II Site Soil Sampling**
LOCATION: **Camp Carroll**   G&EE NO.: **11-032E**   INSPECTOR: _____ bb / bb
DATE STARTED: **05 Aug 11**   FINISHED: **05 Aug 11**   DRILLER: _____
DRILLING METHOD/EQUIPMENT: **BEC50PM-2**
DRILLING AGENCY: **BEC**   HOLE DIAMETER: **5.5 cm**   TOTAL DEPTH: **6.45 m**
OVERBURDEN THICKNESS: _____   DEPTH DRILLED: **6.45 m**   WATER DEPTH: **0.73 m; AD**
COORDINATES: N: **3,983,460.1** E: **447,679.5**   GROUND ELEV.: **51.40 m**   DATUM: **MSL**
GROUND COVER: **Grass**   CONTAMINATION: _____
TYPE OF HOLE: ☐ Piezometer   ☐ Monitoring Well   ☐ Test Pit   ☐ Auger Hole   ☒ other **Direct push sampling hole**

ELEVATION / DEPTH (meters)	SAMPLE TYPE / NUMBER	GRAPHIC LOG	CONTAMINATED	BLOW COUNT	SPT N-VALUE	USCS / STRATA	DESCRIPTION OF MATERIALS	FIELD DATA	LAB DATA
0	S1					FILL / FILL	**Poorly-graded GRAVEL with Silt and Sand**: brown; moist; about 60% angular to subangular fine to coarse gravel (max.2.5cm); about 30% subangular fine to coarse Sand; about 10% Fines; fill material (GP-GM); grass roots at 0-0.15m.	%Recovery = 90 PID = 1.7ppm FC = F1 FC = F3	
51							**SILTY SAND**: brown; moist; about 15% subangular fine to coarse gravel (max.3.3cm); about 70% subangular fine to coarse Sand; about 15% Fines; no plasticity; fill material (SM).	%Recovery = 100 PID = 0.5 - 2.5ppm	
1	S2					FILL	**CLAYEY SAND**: dark brown; moist; about 5% subangular fine gravel (max.2cm); about 55% fine to medium Sand; about 40% Fines; medium plasticity; fill material (SC).	FC = F3	
50						CH	**FAT CLAY with Sand**: dark brown; moist; about 2% subangular fine gravel (max.2.5cm); about 20% subangular fine Sand; about 78% Fines; high plasticity; alluvial soil.		
2						SC	**CLAYEY SAND**: brown; moist; about 60% fine to medium Sand; about 40% Fines; medium plasticity; alluvial soil.	%Recovery = 99 PID = 2.4 - 4.8ppm	
49									
3						SM	**SILTY SAND**: light brown; moist; about 60% fine to medium Sand; about 40% Fines; no plasticity; residual soil; Granite texture.		
48									
4	S3						About 70% fine to coarse Sand; about 30% Fines; w/ rock fragments at 4.0 - 6.0m.		
47									
5							Fine to medium sand size.		
46									
6							Dense.		
45							Hard pushing of sampler at 6.1-6.4m; HDP (Hydraulic Down Pressure) = 1300 psi.		
							Penetration refusal depth = 6.45m (Penetration speed = 3cm / 2min).		

ENVIRO-EXPLORATION LOG 11-032E-PHASE2-FINAL.GPJ USACE SKOREA.GDT 8/22.11

PROJECT: **Phase II Site Soil Sampling**
LOCATION: **Camp Carroll**   G&EE NO.: **11-032E**   INSPECTOR:
DATE STARTED: **11 Aug 11**   FINISHED: **11 Aug 11**   DRILLER:
DRILLING METHOD/EQUIPMENT: **BEC50PM-1**
DRILLING AGENCY: **BEC**   HOLE DIAMETER: **5.5 cm**   TOTAL DEPTH: **4.5 m**
OVERBURDEN THICKNESS: DEPTH DRILLED: **4.5 m**   WATER DEPTH: **No water; AD**
COORDINATES: N: **3,983,438.1** E: **447,655.6**   GROUND ELEV.: **50.76 m**   DATUM: **MSL**
GROUND COVER: **Grass**   CONTAMINATION:
TYPE OF HOLE: ☐ Piezometer   ☐ Monitoring Well   ☐ Test Pit   ☐ Auger Hole   ☒ other **Direct push sampling hole**

ELEVATION / DEPTH (meters)	SAMPLE TYPE / NUMBER	GRAPHIC LOG	CONTAMINATED	BLOW COUNT	SPT N-VALUE	USCS / STRATA	DESCRIPTION OF MATERIALS	FIELD DATA	LAB DATA
0	S1					FILL	**SILTY SAND**: brown; moist; about 5% subangular fine gravel (max.1cm); about 60% subangular fine to coarse Sand (max.4.8mm); about 35% Fines; no plasticity; fill material (SM).	%Recovery = 100 PID = 5.2ppm FC = F3	
50							About 10% subangular fine to coarse gravel (max.3cm); about 60% subangular fine to coarse Sand (max.4.8mm); about 30% Fines.	%Recovery = 97 PID = 7.8 - 11.2ppm	
1	S2						About 3% subangular fine gravel (max.1cm); about 62% subangular fine to coarse Sand (max.4.8mm); about 35% Fines; encountered clayey sand layer at 1.6m to 1.7m.		
49						SM	**SILTY SAND**: light brown; moist; about 80% subangular fine to coarse Sand (max.4.8mm); about 20% Fines; no plasticity; residual soil.		
2								%Recovery = 96 PID = 2.1 - 8.9ppm	
48									
3	S3								
47									
4							Hard pushing of sampler at 4.3-4.5m; HDP (Hydraulic Down Pressure) = 1000 psi.		
							Penetration refusal depth = 4.5m (Penetration speed = 1.5cm / 1min).		

PROJECT: **Phase II Site Soil Sampling**
LOCATION: **Camp Carroll**   G&EE NO.: **11-032E**   INSPECTOR: _____
DATE STARTED: **12 Aug 11**   FINISHED: **12 Aug 11**   DRILLER: _____
DRILLING METHOD/EQUIPMENT: **BEC50PM-2**
DRILLING AGENCY: **BEC**   HOLE DIAMETER: **5.5 cm**   TOTAL DEPTH: **8.5 m**
OVERBURDEN THICKNESS: _____   DEPTH DRILLED: **8.5 m**   WATER DEPTH: **8.22 m; AD**
COORDINATES: N: **3,983,435.9** E: **447,697.4**   GROUND ELEV.: **51.31 m**   DATUM: **MSL**
GROUND COVER: **Grass**   CONTAMINATION: _____
TYPE OF HOLE: ☐ Piezometer   ☐ Monitoring Well   ☐ Test Pit   ☐ Auger Hole   ☒ other **Direct push sampling hole**

ELEVATION / DEPTH (meters)	SAMPLE TYPE / NUMBER	GRAPHIC LOG	CONTAMINATED	BLOW COUNT	SPT N-VALUE	USCS / STRATA	DESCRIPTION OF MATERIALS	FIELD DATA	LAB DATA
0 51	S1					FILL	**SILTY SAND**: brown; moist; about 5% subangular to angular fine to coarse gravel (max.2.5cm); about 75% subangular fine to coarse Sand; about 20% Fines; no plasticity; fill material (SM); Grass roots at 0-0.05m.	%Recovery = 100 PID = 1.8ppm FC = F3	
1 50	S2						Grayish brown.	%Recovery = 98 PID = 2.9 - 3.7ppm	
2 49						FILL	**CLAYEY SAND**: brown; moist; about 5% angular to subangular fine gravel (max.1.5cm); about 55% subangular fine to coarse Sand; about 40% Fines; low plasticity; fill material (SC). Reddish brown.	%Recovery = 80 PID = 1.9 - 2.3ppm	
3 48	S3						Brown.		
4 47						SM	**SILTY SAND**: yellowish brown; about 65% subangular fine to coarse Sand; about 35% Fines; low plasticity; residual soil.		
5 46								%Recovery = 94 PID = 0.9 - 1.9ppm	
6 45									
7 44	S4						Light brown to brown; about 70% subangular fine to coarse Sand; about 30% Fines; no plasticity; sampler penetration speed= 7cm/1min at 7.9m.		
8 43	▼								

Hard pushing of sampler at 8.3-8.5m; HDP (Hydraulic Down Pressure) = 1500 psi.
Penetration refusal depth = 8.5m (Penetration speed = 5cm / 1min).

ENVIRO-EXPLORATION LOG 11-032E-PHASE2-FINAL.GPJ USACE SKOREA.GDT 8/22/11

PROJECT: Phase II Site Soil Sampling
LOCATION: Camp Carroll | **G&EE NO.:** 11-032E | **INSPECTOR:** bc bc
DATE STARTED: 12 Aug 11 | **FINISHED:** 12 Aug 11 | **DRILLER:**
DRILLING METHOD/EQUIPMENT: BEC50PM-2
DRILLING AGENCY: BEC | **HOLE DIAMETER:** 5.5 cm | **TOTAL DEPTH:** 12.0 m
OVERBURDEN THICKNESS: | **DEPTH DRILLED:** 12.0 m | **WATER DEPTH:** No water; AD
COORDINATES: N: 3,983,424.1 E: 447,689.8 | **GROUND ELEV.:** 50.83 m | **DATUM:** MSL
GROUND COVER: Grass | **CONTAMINATION:**
TYPE OF HOLE: ☐ Piezometer ☐ Monitoring Well ☐ Test Pit ☐ Auger Hole ☒ other Direct push sampling hole

ELEVATION / DEPTH (meters)	SAMPLE TYPE / NUMBER	GRAPHIC LOG	CONTAMINATED	BLOW COUNT	SPT N-VALUE	USCS / STRATA	DESCRIPTION OF MATERIALS	FIELD DATA	LAB DATA
0	S1					FILL	**SILTY SAND**: brown to grayish brown; moist; about 10% subangular fine gravel (max.2cm); about 70% subangular fine to coarse Sand; about 20% Fines; no plasticity; fill material (SM); Grass roots at 0-0.05m.	%Recovery = 100 PID = 10.6ppm FC = F3	
50	S2						Subangular fine to coarse gravel (max.3cm).	%Recovery = 100 PID = 10.9 - 14.7ppm	
2						FILL	**CLAYEY SAND**: brown to reddish brown; moist; about 55% fine to medium Sand; about 45% Fines; low plasticity; fill material (SC).	%Recovery = 87 PID = 11.4 - 12.2ppm	
48						FILL	**SILTY SAND**: brown; moist; about 70% subangular fine to coarse Sand; about 30% Fines; no plasticity; fill material (SM).		
	S3					FILL	**CLAYEY SAND**: reddish brown; moist; about 55% fine to medium Sand; about 45% Fines; low plasticity; fill material (SC).		
4							Medium to high plasticity; at 4.3-5.0m.		
46								%Recovery = 91 PID = 1.3 - 3.3ppm	
6						CH	**FAT CLAY with Sand**: reddish brown; moist; about 15% fine Sand; about 85% Fines; high plasticity; residual soil; granite texture.		
44									
	S4					ML	**SILT with Sand**: brown; moist; about 25% fine Sand; about 75% Fines; low plasticity; residual soil.		
8						SC	**CLAYEY SAND**: reddish brown; moist; about 55% fine Sand; about 45% Fines; residual soil.		
42							Grayish brown silty sand soil at 8.8-9.0m.		
						ML	**SILT with Sand**: brown; moist; about 20% fine to medium Sand; about 80% Fines; medium plasticity; residual soil; granite texture. Brown silty sand soil at 9.7-10.0m.		
10						SC	**CLAYEY SAND**: brown; moist; about 55% subangular fine to coarse Sand; about 45% Fines; medium plasticity; residual soil; granite texture.		
40									
12						SM	**SILTY SAND**: grayish brown; moist; about 70% subangular fine to coarse Sand; about 30% Fines; no plasticity; residual soil; granite texture.		

HDP (Hydraulic Down Pressure) = 1500 psi at 11.5-12.0m.
Penetration refusal depth = 12.0m (Penetration speed = 12cm / 1min at 11.9-12.0m).

ENVIRO-EXPLORATION LOG 11-032E-PHASE2-FINAL.GPJ USACE SKOREA.GDT 8/22/11

CEPOF-ED-G

PROJECT: **Phase II Site Soil Sampling**
LOCATION: **Camp Carroll**　　G&EE NO.: **11-032E**　INSPECTOR: _____
DATE STARTED: **12 Aug 11**　FINISHED: **12 Aug 11**　DRILLER: _____
DRILLING METHOD/EQUIPMENT: **BEC50PM-1**
DRILLING AGENCY: **BEC**　　HOLE DIAMETER: **5.5 cm**　TOTAL DEPTH: **3.4 m**
OVERBURDEN THICKNESS: _____　DEPTH DRILLED: **3.4 m**　WATER DEPTH: **No water; AD**
COORDINATES: N: **3,983,429.5** E: **447,733.2**　GROUND ELEV.: **51.93 m**　DATUM: **MSL**
GROUND COVER: **Grass**　　CONTAMINATION: _____
TYPE OF HOLE: ☐ Piezometer　☐ Monitoring Well　☐ Test Pit　☐ Auger Hole　☒ other **Direct push sampling hole**

ELEVATION / DEPTH (meters)	SAMPLE TYPE / NUMBER	GRAPHIC LOG	CONTAMINATED	BLOW COUNT	SPT N-VALUE	USCS / STRATA	DESCRIPTION OF MATERIALS	FIELD DATA	LAB DATA
0	S1					SM	**SILTY SAND**: brown; moist; about 75% subangular fine to coarse Sand (max.4.8mm); about 25% Fines; no plasticity; residual soil; granite texture.	%Recovery = 100 PID = 4.6ppm FC = F3	
51 — 1	S2							%Recovery = 97 PID = 4.9 - 6.6ppm	
50 — 2	S3							%Recovery = 36 PID = 3.6 - 5.4ppm	
49 — 3							Hard pushing of sampler at 3.2-3.4m; HDP (Hydraulic Down Pressure) = 1000 psi. Penetration refusal depth = 3.4m (Penetration speed = 2cm / 1min).		

ENVIRO-EXPLORATION LOG 11-032E-PHASE2-FINAL.GPJ USACE SKOREA.GDT 8/22/11

EXPLORATION LOG

US Army Corps Of Engineers

HOLE NO. **E11-161**

Far East District

PROJECT: **Phase II Site Soil Sampling**
LOCATION: **Camp Carroll**   G&EE NO.: **11-032E**   INSPECTOR: ~~[redacted]~~
DATE STARTED: **05 Aug 11**   FINISHED: **05 Aug 11**   DRILLER: ~~[redacted]~~
DRILLING METHOD/EQUIPMENT: **BEC50PM-2**
DRILLING AGENCY: **BEC**   HOLE DIAMETER: **5.5 cm**   TOTAL DEPTH: **7.9 m**
OVERBURDEN THICKNESS: _____   DEPTH DRILLED: **7.9 m**   WATER DEPTH: **2.0 m; AD**
COORDINATES: N: **3,983,404.3** E: **447,702.2**   GROUND ELEV.: **50.51 m**   DATUM: **MSL**
GROUND COVER: **Grass**   CONTAMINATION: _____
TYPE OF HOLE: ☐ Piezometer   ☐ Monitoring Well   ☐ Test Pit   ☐ Auger Hole   ☒ other **Direct push sampling hole**

ELEVATION / DEPTH (meters)	SAMPLE TYPE / NUMBER	GRAPHIC LOG	CONTAMINATED	BLOW COUNT	SPT N-VALUE	USCS / STRATA	DESCRIPTION OF MATERIALS	FIELD DATA	LAB DATA
0 / 50	S1					FILL	**SILTY SAND**: brown; moist; about 10% subangular fine to coarse gravel (max.3.5cm); about 65% angular to subangular fine to coarse Sand; about 25% Fines; no plasticity; fill material (SM); grass roots at 0-0.1m.	%Recovery = 96 PID = 1.2ppm FC = F3	
1 / 49	S2						Subangular fine gravel (max.1.5cm).	%Recovery = 100 PID = 1.2 - 1.6ppm	
2 / 48						CH	**FAT CLAY**: reddish brown; moist; about 10% fine Sand; about 90% Fines; medium plasticity; alluvial soil.	%Recovery = 100 PID = 2.8 - 3.4ppm	
3 / 47	S3					CH	**SANDY FAT CLAY**: reddish brown; moist; about 30% fine Sand; about 70% Fines; medium plasticity; alluvial soil.		
4 / 46						ML	**SILT with Sand**: yellowish red; moist; about 25% fine Sand; about 75% Fines; no to low plasticity; residual soil; granite texture.		
5 / 45						SM	**SILTY SAND**: brown; moist; about 60% fine to medium Sand; about 40% Fines; residual soil; granite texture.	%Recovery = 100 PID = 1.2 - 5.3ppm	
6 / 44	S4								
7 / 43							Hard pushing of sampler at 7.7-7.9m; HDP (Hydraulic Down Pressure) = 1300 psi.		

Penetration refusal depth = 7.9m (Penetration speed = 2cm / 5min).

CEPOF-ED-G

5911   PAGE 1 of 1

ENVIRO-EXPLORATION LOG 11-032E-PHASE2-FINAL.GPJ USACE SKOREA.GDT 8/22/11

PROJECT: **Phase II Site Soil Sampling**

LOCATION: **Camp Carroll**   G&EE NO.: **11-032E**   INSPECTOR: ~~[redacted]~~

DATE STARTED: **05 Aug 11**   FINISHED: **05 Aug 11**   DRILLER: ~~[redacted]~~

DRILLING METHOD/EQUIPMENT: **BEC50PM-2**

DRILLING AGENCY: **BEC**   HOLE DIAMETER: **5.5 cm**   TOTAL DEPTH: **1.52 m**

OVERBURDEN THICKNESS: _____   DEPTH DRILLED: **1.52 m**   WATER DEPTH: **No water; AD**

COORDINATES: N: **3,983,412.4** E: **447,742.7**   GROUND ELEV.: **52.02 m**   DATUM: **MSL**

GROUND COVER: **Grass**   CONTAMINATION: _____

TYPE OF HOLE: ☐ Piezometer   ☐ Monitoring Well   ☐ Test Pit   ☐ Auger Hole   ☒ other **Direct push sampling hole**

ELEVATION / DEPTH (meters)	SAMPLE TYPE / NUMBER	GRAPHIC LOG	CONTAMINATED	BLOW COUNT	SPT N-VALUE	USCS / STRATA	DESCRIPTION OF MATERIALS	FIELD DATA	LAB DATA
52 — 0	S1					FILL	**SILTY SAND with Gravel**: brown; moist; about 15% subangular fine to coarse gravel (max.3.3cm); about 65% subangular to angular fine to coarse Sand; about 20% Fines; no plasticity; fill material (SM); grass roots at 0-0.05m.	%Recovery = 100 PID = 1.8ppm FC = F3	
								%Recovery = 100 PID = 2.6 - 4.2ppm	
51 — 1	S2					SM	**SILTY SAND**: light brown; moist to dry; about 80% angular fine to coarse Sand; about 20% Fines; residual soil; granite texture. Hard pushing of sampler at 1.2-1.5m; HDP (Hydraulic Down Pressure) = 1300 psi.		

Penetration refusal depth = 1.52m (Penetration speed = 1cm / 2.5min).

ENVIRO-EXPLORATION LOG 11-032E-PHASE2-FINAL.GPJ USACE SKOREA.GDT 8/22/11

CEPOF-ED-G

US Army Corps Of Engineers

EXPLORATION LOG
HOLE NO. E11-163

Far East District

PROJECT: Phase II Site Soil Sampling
LOCATION: Camp Carroll **G&EE NO.:** 11-032E **INSPECTOR:** ▮▮▮▮ bb
DATE STARTED: 10 Aug 11 **FINISHED:** 10 Aug 11 **DRILLER:** ▮▮▮▮
DRILLING METHOD/EQUIPMENT: BEC50PM-2
DRILLING AGENCY: BEC **HOLE DIAMETER:** 5.5 cm **TOTAL DEPTH:** 10.95 m
OVERBURDEN THICKNESS: _____ **DEPTH DRILLED:** 10.95 m **WATER DEPTH:** 8.25 m; AD
COORDINATES: N: 3,983,373.3 **E:** 447,724.0 **GROUND ELEV.:** 50.76 m **DATUM:** MSL
GROUND COVER: Grass **CONTAMINATION:** _____
TYPE OF HOLE: ☐ Piezometer ☐ Monitoring Well ☐ Test Pit ☐ Auger Hole ☒ other Direct push sampling hole

ELEVATION / DEPTH (meters)	SAMPLE TYPE / NUMBER	GRAPHIC LOG	CONTAMINATED	BLOW COUNT	SPT N-VALUE	USCS / STRATA	DESCRIPTION OF MATERIALS	FIELD DATA	LAB DATA
0 / 50	S1					FILL	**SILTY SAND with Gravel:** brown; dry to moist; about 30% subangular fine to coarse gravel (max.3.5cm); about 55% angular to subangular fine to coarse Sand; about 15% Fines; no plasticity; fill material (SM).	%Recovery = 100 PID = 8.3ppm FC = F3	
	S2					FILL	**SILTY SAND:** light brown; moist; about 80% subangular fine to coarse Sand; about 20% Fines; no plasticity; fill material (SM).	%Recovery = 100 PID = 5.1 - 13.7ppm FC = F3	
2 / 48	S3					FILL / FILL / SC	Grayish brown.	%Recovery = 100 PID = 5.7 - 13.8ppm	
							CLAYEY SAND: brown; moist; about 55% subangular fine to medium Sand; about 45% Fines; medium plasticity; fill material (SC); at 2.7-2.8m.		
							SILTY SAND: light brown; about 80% fine to coarse Sand; about 20% Fines; fill material (SM); at 2.8-3.1m.		
4 / 46							**CLAYEY SAND:** reddish brown; moist; about 65% fine Sand; about 35% Fines; low to medium plasticity; residual soil; granite texture.		
6 / 44							Brown to grayish brown; subangular fine to medium Sand; low plasticity.	%Recovery = 94 PID = 8.2 - 17.4ppm	
	S4					SM	**SILTY SAND:** brown; moist; about 70% fine to medium Sand; about 30% Fines; no plasticity; residual soil; w/rock fragments (5mm), granite texture. Light brown.		
8 / 42							Granite texture.		
							More silty soil at 9-10m.		
10 / 40						SC	**CLAYEY SAND:** brown; wet to moist; about 65% subangular fine to coarse Sand; about 35% Fines; low plasticity; residual soil.		
						SM	**SILTY SAND:** light brown; about 55% fine to coarse Sand; about 45% Fines; residual soil; dense.		

End of direct push sampling at 10.95m.
Hard pushing of sampler at 10.7-10.95m; HDP (Hydraulic Down Pressure) = 1500 psi; Penetration refusal depth = 10.95m (Penetration speed = 5cm / 1min).

FOR OFFICIAL USE ONLY 59/3

ENVIRO-EXPLORATION LOG 11-032E-PHASE2-FINAL.GPJ USACE SKOREA.GDT 8/22/11

PROJECT: Phase II Site Soil Sampling

LOCATION: Camp Carroll   **G&EE NO.:** 11-032E   **INSPECTOR:** ▮▮▮ *bb bb*

DATE STARTED: 11 Aug 11   **FINISHED:** 11 Aug 11   **DRILLER:** ▮▮▮

DRILLING METHOD/EQUIPMENT: BEC50PM-2

DRILLING AGENCY: BEC   **HOLE DIAMETER:** 5.5 cm   **TOTAL DEPTH:** 11.0 m

OVERBURDEN THICKNESS: _____   **DEPTH DRILLED:** 11.0 m   **WATER DEPTH:** Caved (8.2m); AD

COORDINATES: N: 3,983,348.6 E: 447,726.8   **GROUND ELEV.:** 50.63 m   **DATUM:** MSL

GROUND COVER: Grass   **CONTAMINATION:** Yes

TYPE OF HOLE: ☐ Piezometer ☐ Monitoring Well ☐ Test Pit ☐ Auger Hole ☒ other Direct push sampling hole

ELEVATION / DEPTH (meters)	SAMPLE TYPE / NUMBER	GRAPHIC LOG	CONTAMINATED	BLOW COUNT	SPT N-VALUE	USCS / STRATA	DESCRIPTION OF MATERIALS	FIELD DATA	LAB DATA
0 / 50	S1					FILL	**SILTY SAND**: brown; moist; about 10% subangular fine to coarse gravel (max.3.5cm); about 70% subangular fine to coarse Sand; about 20% Fines; no plasticity; fill material (SM); Grass roots at 0-0.05m.	%Recovery = 100 PID = 2ppm FC = F3	
	S2						**SILTY SAND with Gravel**: about 15% subangular fine to coarse gravel (max.2.5cm); about 65% subangular fine to coarse Sand; about 20% Fines.	%Recovery = 87 PID = 0.6 - 0.9ppm	
2 / 48						FILL	**SILTY SAND**: about 5% subangular fine to coarse gravel; about 70% subangular fine to coarse Sand; about 25% Fines.	%Recovery = 95 PID = 0 - 0.9ppm	
						FILL	**CLAYEY SAND**: reddish brown; moist; about 65% fine to medium Sand; about 35% Fines; low plasticity; fill material (SC).		
	S3						**SILTY SAND**: grayish brown; moist; about 75% subangular fine to coarse Sand; about 25% Fines; no plasticity; fill material (SM). **CLAYEY SAND**: reddish brown; about 65% fine to medium Sand; about 35% Fines. **SILTY SAND**: grayish brown; about 75% subangular fine to coarse Sand; about 25% Fines.		
4 / 46									
						SW	Brownish gray. **Well-graded SAND**: bluish gray; moist to wet; about 95% subangular fine to coarse Sand; about 5% Fines; no plasticity; alluvial soil; weak solvent odor. 5.0 to 5.6m; PID = 50.8 ppm.	%Recovery = 79 PID = 4.2 - 50.8ppm	
6 / 44						SC	**CLAYEY SAND**: brown; moist; about 10% subangular fine to coarse gravel; about 60% subangular to angular fine to coarse Sand; about 30% Fines; low plasticity; alluvial soil.		
						SM	**SILTY SAND**: dark brown to brown; moist; about 75% subangular fine to coarse Sand; about 25% Fines; no plasticity; alluvial soil.		
8 / 42	S4					SC	**CLAYEY SAND**: brown to reddish brown; moist; about 5% subrounded fine gravel; about 50% fine Sand; about 45% Fines; medium plasticity; alluvial soil.		
						ML	**SANDY SILT**: brown mottled with white; about 40% angular to subangular fine Sand; about 60% Fines; low plasticity; residual soil; granite texture.		
10 / 40						SM	**SILTY SAND**: yellowish brown to brown; moist; about 65% angular to subangular fine Sand; about 35% Fines; residual soil; granite texture.		
						ML	**SANDY SILT**: brown mottled with white; about 40%; about 60% Fines; residual soil; End of direct push sampling at 11.0m. Confirmed depths of FILL MATERIAL = 0 -5 m, ALLUVIAL SOILS = 5 - 8.4m, and RESIDUAL SOIL =8.4 - 11.0m.		

ENVIRO-EXPLORATION LOG 11-032E-PHASE2-FINAL.GPJ USACE SKOREA.GDT 8/22/11

PROJECT: **Phase II Site Soil Sampling**
LOCATION: **Camp Carroll**   G&EE NO.: **11-032E**   INSPECTOR: ___
DATE STARTED: **06 Aug 11**   FINISHED: **06 Aug 11**   DRILLER: ___
DRILLING METHOD/EQUIPMENT: **BEC50PM-2**
DRILLING AGENCY: **BEC**   HOLE DIAMETER: **5.5 cm**   TOTAL DEPTH: **11.0 m**
OVERBURDEN THICKNESS: ___   DEPTH DRILLED: **11.0 m**   WATER DEPTH: **Caved (3.4m); AD**
COORDINATES: N: **3,983,323.6** E: **447,705.6**   GROUND ELEV.: **49.64 m**   DATUM: **MSL**
GROUND COVER: **Grass**   CONTAMINATION: ___
TYPE OF HOLE: ☐ Piezometer ☐ Monitoring Well ☐ Test Pit ☐ Auger Hole ☒ other **Direct push sampling hole**

ELEVATION / DEPTH (meters)	SAMPLE TYPE / NUMBER	GRAPHIC LOG	CONTAMINATED	BLOW COUNT	SPT N-VALUE	USCS / STRATA	DESCRIPTION OF MATERIALS	FIELD DATA	LAB DATA
0	S1					FILL	**SILTY SAND with Gravel**: brown to light brown; moist; about 20% subangular fine to coarse gravel (max.3cm); about 60% subangular fine to coarse Sand (max.4.8mm); about 20% Fines; no plasticity; fill material (SM). More gravels at 0.5-1m ≈ gravel (35%), sand(45%), fine(20%).	%Recovery = 100 PID = 4.2ppm FC = F3 %Recovery = 93 PID = 2.3 - 5.8ppm FC = F3	
48	S2								
2	S3						Brown; about 15% fine to coarse gravel (max.4cm); about 60% fine to coarse Sand; about 25% Fines; asphalt pavement scrap at 2.3m and 2.7m; PID =17.2 ppm at 2-3m.	%Recovery = 96 PID = 8.0 - 17.2ppm	
46									
4									
44						SC / SM	About 20% subangular fine to coarse gravel; about 60% subangular fine to coarse Sand; about 20% Fines. **CLAYEY SAND**: brown; moist; about 55% fine Sand; about 45% Fines; low plasticity; alluvial soil.	%Recovery = 86 PID = 5.6 - 10.6ppm	
6						SC	**SILTY SAND with Gravel**: brown; moist; about 20% subangular to subrounded fine to coarse gravel (max.3.5cm); about 60% angular fine to coarse Sand; about 20% Fines; no plasticity; alluvial soil; PID =10.6 ppm at 6-7m. **CLAYEY SAND**: brown; moist; about 55% fine Sand; about 45% Fines; low plasticity; alluvial soil.		
42	S4								
8						CH	**FAT CLAY**: dark greenish gray grades to brown; moist; about 5% subangular to subrounded fine gravel (max.2cm); about 5% fine Sand; about 90% Fines; high plasticity; alluvial soil; PID in hole ≈ 3.7m.		
40						ML	**SILT with Sand**: brown; moist; about 20% fine Sand; about 80% Fines; low plasticity; residual soil; granite texture.		
10									
						SM	**SILTY SAND**: brown; moist; about 70% fine to coarse Sand; about 30% Fines; no plasticity; residual soil; granite texture.		

End of direct push sampling at 11.0m after residual soils encountered at 9.4-11.0m.

ENVIRO-EXPLORATION LOG 11-032E-PHASE2-FINAL.GPJ USACE SKOREA.GDT 8/22/11

US Army Corps Of Engineers

EXPLORATION LOG
HOLE NO. E11-166

Far East District

PROJECT: Phase II Site Soil Sampling
LOCATION: Camp Carroll   **G&EE NO.:** 11-032E   **INSPECTOR:** ▮▮▮▮
DATE STARTED: 08 Aug 11   **FINISHED:** 08 Aug 11   **DRILLER:** ▮▮▮▮
DRILLING METHOD/EQUIPMENT: BEC50PM-1
DRILLING AGENCY: BEC   **HOLE DIAMETER:** 5.5 cm   **TOTAL DEPTH:** 2.7 m
OVERBURDEN THICKNESS: ___   **DEPTH DRILLED:** 2.7 m   **WATER DEPTH:** No water; AD
COORDINATES: N: 3,983,422.0 E: 447,813.7   **GROUND ELEV.:** 55.49 m   **DATUM:** MSL
GROUND COVER: Portland cement concrete   **CONTAMINATION:** ___
TYPE OF HOLE: ☐ Piezometer   ☐ Monitoring Well   ☐ Test Pit   ☐ Auger Hole   ☒ other Direct push sampling hole

ELEVATION / DEPTH (meters)	SAMPLE TYPE / NUMBER	GRAPHIC LOG	CONTAMINATED	BLOW COUNT	SPT N-VALUE	USCS / STRATA	DESCRIPTION OF MATERIALS	FIELD DATA	LAB DATA
0						PCC	Portland cement concrete pavement thickness = 15cm.		
						FILL	Poorly-graded GRAVEL with Sand: fill material (GP); base course material.		
55	S1					SM	SILTY SAND: brown; moist; about 75% subangular fine to coarse Sand (max.4.8mm); about 25% Fines; no plasticity; residual soil; granite texture.	%Recovery = 100 PID = 5.2ppm FC = F3	
1								%Recovery = 92 PID = 3.2 - 4.2ppm	
54	S2								
2									
53							Hard pushing of sampler at 2.4-2.7m; HDP (Hydraulic Down Pressure) = 1000 psi.		
							Penetration refusal depth = 2.7m (Penetration speed = 2cm / 1min).		

PROJECT: **Phase II Site Soil Sampling**
LOCATION: **Camp Carroll** G&EE NO.: **11-032E** INSPECTOR: ▓▓▓▓▓▓
DATE STARTED: **07 Aug 11** FINISHED: **07 Aug 11** DRILLER: ▓▓▓▓▓▓
DRILLING METHOD/EQUIPMENT: **BEC50PM-1**
DRILLING AGENCY: **BEC** HOLE DIAMETER: **5.5 cm** TOTAL DEPTH: **5.55 m**
OVERBURDEN THICKNESS: _____ DEPTH DRILLED: **5.55 m** WATER DEPTH: **5.03 m; AD**
COORDINATES: N: **3,983,414.3** E: **447,845.9** GROUND ELEV.: **55.98 m** DATUM: **MSL**
GROUND COVER: **Dirt** CONTAMINATION: _____
TYPE OF HOLE: ☐ Piezometer ☐ Monitoring Well ☐ Test Pit ☐ Auger Hole ☒ other **Direct push sampling hole**

ELEVATION / DEPTH (meters)	SAMPLE TYPE / NUMBER	GRAPHIC LOG	CONTAMINATED	BLOW COUNT	SPT N-VALUE	USCS / STRATA	DESCRIPTION OF MATERIALS	FIELD DATA	LAB DATA
0	S1					FILL	**CLAYEY SAND**: reddish brown; moist; about 5% subangular fine gravel (max.2cm); about 65% subangular fine to coarse Sand (max.4.8mm); about 30% Fines; medium plasticity; fill material (SC).	%Recovery = 100 PID = 2.5ppm FC = F3	
55 — 1	S2					FILL	**SILTY SAND**: brown; moist; about 5% subangular fine gravel (max.2cm); about 65% subangular fine to coarse Sand (max.4.8mm); about 30% Fines; no plasticity; fill material (SM).	%Recovery = 100 PID = 3.5 - 4.0ppm FC = F3	
54 — 2						CH	**SANDY FAT CLAY**: dark brown; moist; about 40% subangular fine to medium Sand (max.2mm); about 60% Fines; high plasticity; alluvial soil.		
						CH	**FAT CLAY with Sand**: brown; moist; about 20% subangular fine to medium Sand (max.2mm); about 80% Fines; high plasticity; alluvial soil.	%Recovery = 93 PID = 4.1 - 9.8ppm	
53 — 3	S3					SC	**CLAYEY SAND**: dark brown; moist; about 2% subangular fine gravel (max.1cm); about 63% subangular fine to medium Sand (max.2mm); about 35% Fines; medium plasticity; alluvial soil. Brown.		
52 — 4						SM	**SILTY SAND**: brown; moist; about 75% subangular fine to coarse Sand (max.4.8mm); about 25% Fines; no plasticity; residual soil; granite texture.		
51 — 5							Hard pushing of sampler at 5.3-5.55m; HDP (Hydraulic Down Pressure) = 1000 psi.		
							Penetration refusal depth = 5.55m (Penetration speed = 2cm / 1min).		

ENVIRO-EXPLORATION LOG 11-032E-PHASE2-FINAL.GPJ USACE SKOREA.GDT 8/22/11

EXPLORATION LOG

US Army Corps Of Engineers

HOLE NO. **E11-168**

Far East District

PROJECT: **Phase II Site Soil Sampling**
LOCATION: **Camp Carroll**   G&EE NO.: **11-032E**   INSPECTOR: ▓▓▓▓▓
DATE STARTED: **09 Aug 11**   FINISHED: **09 Aug 11**   DRILLER: ▓▓▓▓▓
DRILLING METHOD/EQUIPMENT: **BEC50PM-1**
DRILLING AGENCY: **BEC**   HOLE DIAMETER: **5.5 cm**   TOTAL DEPTH: **3.0 m**
OVERBURDEN THICKNESS: _____   DEPTH DRILLED: **3.0 m**   WATER DEPTH: **0.27 m; AD**
COORDINATES: N: **3,983,414.1** E: **447,771.8**   GROUND ELEV.: **52.19 m**   DATUM: **MSL**
GROUND COVER: **Dirt**   CONTAMINATION: _____
TYPE OF HOLE: ☐ Piezometer   ☐ Monitoring Well   ☐ Test Pit   ☐ Auger Hole   ☒ other **Direct push sampling hole**

ELEVATION / DEPTH (meters)	SAMPLE TYPE / NUMBER	GRAPHIC LOG	CONTAMINATED	BLOW COUNT	SPT N-VALUE	USCS / STRATA	DESCRIPTION OF MATERIALS	FIELD DATA	LAB DATA
52 — 0	S1 ▽					FILL	**SILTY SAND**: grayish brown; moist; about 10% subangular fine gravel (max.2cm); about 65% subangular fine to coarse Sand (max.4.8mm); about 25% Fines; no plasticity; fill material (SM).	%Recovery = 100 PID = 1.8ppm FC = F3	
51 — 1	S2					SM	**SILTY SAND**: brown; moist; about 75% subangular fine to coarse Sand (max.4.8mm); about 25% Fines; no plasticity; residual soil; granite texture.	%Recovery = 97 PID = 2.9 - 3.8ppm FC = F3	
50 — 2									
— 3							Hard pushing of sampler at 2.8-3.0m; HDP (Hydraulic Down Pressure) = 1000 psi.		

Penetration refusal depth = 3.0m (Penetration speed = 1cm / 1min).

ENVIRO-EXPLORATION LOG 11-032E-PHASE2-FINAL.GPJ USACE SKOREA.GDT 8/22/11

CEPOF-ED-G

FOR OFFICIAL USE ONLY   59/8   PAGE 1 of 1

PROJECT: **Phase II Site Soil Sampling**

LOCATION: **Camp Carroll**　　G&EE NO.: **11-032E**　　INSPECTOR: ▮▮▮▮

DATE STARTED: **09 Aug 11**　　FINISHED: **09 Aug 11**　　DRILLER: ▮▮▮▮

DRILLING METHOD/EQUIPMENT: **BEC50PM-1**

DRILLING AGENCY: **BEC**　　HOLE DIAMETER: **5.5 cm**　　TOTAL DEPTH: **1.8 m**

OVERBURDEN THICKNESS: ＿＿＿　DEPTH DRILLED: **1.8 m**　　WATER DEPTH: **NA**

COORDINATES: N: **3,983,405.3** E: **447,789.7**　GROUND ELEV.: **52.63 m**　DATUM: **MSL**

GROUND COVER: **Dirt**　　CONTAMINATION: ＿＿＿

TYPE OF HOLE: ☐ Piezometer　☐ Monitoring Well　☐ Test Pit　☐ Auger Hole　☒ other **Direct push sampling hole**

ELEVATION / DEPTH (meters)	SAMPLE TYPE / NUMBER	GRAPHIC LOG	CONTAMINATED	BLOW COUNT	SPT N-VALUE	USCS / STRATA	DESCRIPTION OF MATERIALS	FIELD DATA	LAB DATA
0	S1					FILL	SILTY SAND: brown; moist; about 10% subangular fine to coarse gravel (max.5cm); about 65% subangular fine to coarse Sand (max.4.8mm); about 25% Fines; no plasticity; fill material (SM).	%Recovery = 100 PID = 2.3ppm FC = F3	
52							About 10% subangular fine gravel (max.2cm); about 65% subangular fine to coarse Sand (max.4.8mm); about 25% Fines.	%Recovery = 100 PID = 2.4 - 3.0ppm	
1	S2					SM	SILTY SAND: brown; moist; about 75% subangular fine to coarse Sand (max.4.8mm); about 25% Fines; no plasticity; residual soil; granite texture.	FC = F3	
51							Hard pushing of sampler at 1.7-1.8m; HDP (Hydraulic Down Pressure) = 1000 psi.		

Penetration refusal depth = 1.8m (Penetration speed = 1cm / 1min).

ENVIRO-EXPLORATION LOG 11-032E-PHASE2-FINAL.GPJ USACE SKOREA.GDT 8/22/11

US Army Corps Of Engineers

EXPLORATION LOG
HOLE NO. E11-170

Far East District

PROJECT: **Phase II Site Soil Sampling**		
LOCATION: **Camp Carroll**	G&EE NO.: **11-032E**	INSPECTOR:
DATE STARTED: **07 Aug 11**	FINISHED: **07 Aug 11**	DRILLER:
DRILLING METHOD/EQUIPMENT: **BEC50PM-1**		
DRILLING AGENCY: **BEC**	HOLE DIAMETER: **5.5 cm**	TOTAL DEPTH: **7.5 m**
OVERBURDEN THICKNESS:	DEPTH DRILLED: **7.5 m**	WATER DEPTH: **1.8 m; AD**
COORDINATES: N: **3,983,393.3** E: **447,808.9**	GROUND ELEV.: **53.73 m**	DATUM: **MSL**
GROUND COVER: **Dirt (Inside land farm)**	CONTAMINATION:	

TYPE OF HOLE: ☐ Piezometer   ☐ Monitoring Well   ☐ Test Pit   ☐ Auger Hole   ☒ other **Direct push sampling hole**

ELEVATION / DEPTH (meters)	SAMPLE TYPE / NUMBER	GRAPHIC LOG	CONTAMINATED	BLOW COUNT	SPT N-VALUE	USCS / STRATA	DESCRIPTION OF MATERIALS	FIELD DATA	LAB DATA
0	S1					FILL	**SILTY SAND**: brown; moist; about 70% subangular fine to coarse Sand (max.4.8mm); about 30% Fines; no plasticity; fill material (SM).	%Recovery = 90 PID = 18.5ppm FC = F3 FC = NFS	
53						FILL FILL FILL	**Poorly-graded SAND**: yellowish brown; moist; about 95% subangular fine to medium Sand (max.2mm); about 5% Fines; no plasticity; fill material (SP).	%Recovery = 77 PID = 24.7 - 46.7ppm FC = NFS FC = F3	
1	S2						**Poorly-graded GRAVEL with Sand**: gray; wet; about 70% rounded fine to coarse gravel (max.3cm); about 25% subangular coarse Sand (max.4.8mm); about 5% Fines; no plasticity; fill material (GP).		
52						FILL	**FAT CLAY**: reddish brown; moist; about 10% fine Sand (max.0.43mm); about 90% Fines; high plasticity; fill material (CH).	FC = F3	
2							**CLAYEY SAND**: brown to reddish brown; moist; subangular fine gravel (max.1cm); about 70% subangular fine to coarse Sand (max.4.8mm); about 30% Fines; medium plasticity; fill material (SC); PID = 46.7 ppm at 1-1.3m.	%Recovery = 86 PID = 31.2 - 36.8ppm	
51						SC	**CLAYEY SAND**: gray; moist; about 65% subangular fine to coarse Sand (max.4.8mm); about 35% Fines; medium plasticity; alluvial soil; with organics.		
3	S3					CL	**SANDY LEAN CLAY**: dark brown; moist; about 35% subangular fine to medium Sand (max.2mm); about 65% Fines; medium plasticity; alluvial soil.		
50						SM	**SILTY SAND**: brown; moist; about 70% subangular fine to coarse Sand (max.4.8mm); about 30% Fines; no plasticity; residual soil; granite texture.		
4									
49									
5								%Recovery = 72 PID = 18.6 - 25.9ppm	
48									
6	S4								
47							Hard pushing of sampler at 7.0-7.5m; HDP (Hydraulic Down Pressure) = 1000 psi.		
7									
							Penetration refusal depth = 7.5m (Penetration speed = 2cm / 1min).		

FOR OFFICIAL USE ONLY

PROJECT: **Phase II Site Soil Sampling**
LOCATION: **Camp Carroll**　　G&EE NO.: **11-032E**　　INSPECTOR: ▓▓▓▓▓
DATE STARTED: **09 Aug 11**　　FINISHED: **09 Aug 11**　　DRILLER: ▓▓▓▓▓
DRILLING METHOD/EQUIPMENT: **BEC50PM-1**
DRILLING AGENCY: **BEC**　　HOLE DIAMETER: **5.5 cm**　　TOTAL DEPTH: **6.5 m**
OVERBURDEN THICKNESS: _____　　DEPTH DRILLED: **6.5 m**　　WATER DEPTH: **No water; AD**
COORDINATES: N: **3,983,381.7** E: **447,777.2**　　GROUND ELEV.: **52.11 m**　　DATUM: **MSL**
GROUND COVER: **Dirt**　　CONTAMINATION: _____
TYPE OF HOLE: ☐ Piezometer　☐ Monitoring Well　☐ Test Pit　☐ Auger Hole　☒ other **Direct push sampling hole**

ELEVATION / DEPTH (meters)	SAMPLE TYPE / NUMBER	GRAPHIC LOG	CONTAMINATED	BLOW COUNT	SPT N-VALUE	USCS / STRATA	DESCRIPTION OF MATERIALS	FIELD DATA	LAB DATA
52 — 0	S1					FILL	**CLAYEY SAND**: dark brown; wet; about 10% subangular fine to coarse gravel (max.3cm); about 60% subangular fine to coarse Sand (max.4.8mm); about 30% Fines; medium plasticity; fill material (SC).	%Recovery = 30 PID = 1.8ppm FC = F3	
							Greenish gray to brown; moist.	%Recovery = 45 PID = 2.5 - 3.9ppm	
51 — 1	S2						Brown; about 70% subangular fine to coarse Sand (max.4.8mm); about 30% Fines; no gravels.		
50 — 2						FILL	**SILTY SAND with Gravel**: grayish brown; moist; about 20% subangular fine gravel (max.2cm); about 55% subangular fine to coarse Sand (max.4.8mm); about 25% Fines; no plasticity; fill material (SM); with waste materials (plywood, scraps of porcelain).	%Recovery = 52 PID = 1.4 - 6.5ppm	
49 — 3						FILL	**CLAYEY SAND with Gravel**: gray to brown; moist; about 25% subangular fine to coarse gravel (max.5cm); about 50% subangular fine to coarse Sand (max.4.8mm); about 25% Fines; medium plasticity; fill material (SC); with waste materials (scraps of sand bag).		
48 — 4	S3					SM	**SILTY SAND**: brown; moist; about 70% subangular fine to coarse Sand (max.4.8mm); about 30% Fines; no plasticity; residual soil; disturbed granite texture at 4.2m to 4.7m.		
47 — 5									
46 — 6							Hard pushing of sampler at 6.3-6.5m; HDP (Hydraulic Down Pressure) = 1000 psi.		
							Penetration refusal depth = 6.5m (Penetration speed = 2cm / 1min).		

ENVIRO-EXPLORATION LOG 11-032E-PHASE2-FINAL.GPJ USACE SKOREA.GDT 8/22/11

PROJECT: **Phase II Site Soil Sampling**
LOCATION: **Camp Carroll**   G&EE NO.: **11-032E**   INSPECTOR:
DATE STARTED: **09 Aug 11**   FINISHED: **09 Aug 11**   DRILLER:
DRILLING METHOD/EQUIPMENT: **BEC50PM-1**
DRILLING AGENCY: **BEC**   HOLE DIAMETER: **5.5 cm**   TOTAL DEPTH: **8.7 m**
OVERBURDEN THICKNESS: DEPTH DRILLED: **8.7 m**   WATER DEPTH: **2.97 m; AD**
COORDINATES: N: **3,983,357.0** E: **447,767.7**   GROUND ELEV.: **51.11 m**   DATUM: **MSL**
GROUND COVER: **Dirt**   CONTAMINATION:
TYPE OF HOLE: ☐ Piezometer   ☐ Monitoring Well   ☐ Test Pit   ☐ Auger Hole   ☒ other **Direct push sampling hole**

ELEVATION / DEPTH (meters)	SAMPLE TYPE / NUMBER	GRAPHIC LOG	CONTAMINATED	BLOW COUNT	SPT N-VALUE	USCS / STRATA	DESCRIPTION OF MATERIALS	FIELD DATA	LAB DATA
51 — 0	S1					FILL FILL FILL	**SILTY SAND with Gravel**: grayish brown; moist; about 30% subangular fine to coarse gravel (max.3cm); about 50% subangular fine to coarse Sand (max.4.8mm); about 20% Fines; no plasticity; fill material (SM).	%Recovery = 100 PID = 2.5ppm FC = F3 FC = NFS FC = F3	
50 — 1	S2						**Poorly-graded SAND with Silt**: brown; moist; about 90% subangular fine to medium Sand (max.2mm); about 10% Fines; no plasticity; fill material (SP-SM). **CLAYEY SAND**: reddish brown; moist; about 70% subangular fine to coarse Sand (max.4.8mm); about 30% Fines; medium plasticity; fill material (SC). Encountered silty sand layer at 0.5m to 0.7m.	%Recovery = 92 PID = 1.0 - 2.6ppm	
49 — 2						FILL	**SILTY SAND**: brown; moist; about 70% subangular fine to coarse Sand (max.4.8mm); about 30% Fines; no plasticity; fill material (SM).	%Recovery = 86 PID = 5.1 - 8.2ppm	
48 — 3	S3					FILL	About 10% subangular fine to coarse gravel (max.3cm); about 60% subangular fine to coarse Sand (max.4.8mm); about 30% Fines.		
47 — 4							**CLAYEY SAND**: brown; moist; about 5% subangular fine gravel (max.2cm); about 65% subangular fine to coarse Sand (max.4.8mm); about 30% Fines; medium plasticity; fill material (SC).		
46 — 5						CH ML	**SANDY FAT CLAY**: gray to brown; moist; about 3% subangular fine gravel (max.1cm); about 37% subangular fine to coarse Sand (max.4.8mm); about 60% Fines; high plasticity; alluvial soil; with organics. **SANDY SILT**: reddish brown; moist; about 40% subangular fine to medium Sand (max.2mm); about 60% Fines; medium plasticity; residual soil.	%Recovery = 90 PID = 0.3 - 5.0ppm	
45 — 6						SM	**SILTY SAND**: brown; moist; about 60% subangular fine to medium Sand (max.2mm); about 40% Fines; no to medium plasticity; residual soil; granite texture.		
44 — 7	S4						About 70% subangular fine to coarse Sand (max.4.8mm); about 30% Fines; no plasticity.		
43 — 8							Hard pushing of sampler at 8.5-8.7m; HDP (Hydraulic Down Pressure) = 1000 psi. Penetration refusal depth = 8.7m (Penetration speed = 5cm / 1min).		

ENVIRO-EXPLORATION LOG 11-032E-PHASE2-FINAL.GPJ USACE SKOREA.GDT 8/22/11

CEPOF-ED-G

PROJECT: Phase II Site Soil Sampling

LOCATION: **Camp Carroll**	G&EE NO.: **11-032E**
DATE STARTED: **10 Aug 11**	FINISHED: **10 Aug 11**

INSPECTOR: ~~bb~~
DRILLER: ~~bb~~

DRILLING METHOD/EQUIPMENT: **BEC50PM-1**

DRILLING AGENCY: **BEC**	HOLE DIAMETER: **5.5 cm**	TOTAL DEPTH: **10.0 m**
OVERBURDEN THICKNESS:	DEPTH DRILLED: **10.0 m**	WATER DEPTH: **NA**
COORDINATES: N: **3,983,363.9** E: **447,811.9**	GROUND ELEV.: **53.53 m**	DATUM: **MSL**

GROUND COVER: **Dirt (Inside land farm)** CONTAMINATION:

TYPE OF HOLE: ☐ Piezometer ☐ Monitoring Well ☐ Test Pit ☐ Auger Hole ☒ other **Direct push sampling hole**

ELEVATION / DEPTH (meters)	SAMPLE TYPE / NUMBER	GRAPHIC LOG	CONTAMINATED	BLOW COUNT	SPT N-VALUE	USCS / STRATA	DESCRIPTION OF MATERIALS	FIELD DATA	LAB DATA
0	S1					FILL	**SANDY LEAN CLAY**: gray; wet; about 5% subangular fine gravel (max.2cm); about 30% subangular fine to coarse Sand (max.4.8mm); about 65% Fines; medium plasticity; fill material (CL).	%Recovery = 100 PID = 7.4ppm FC = F3 FC = NFS	
						FILL		FC = NFS	
53						FILL	**Poorly-graded SAND**: brown; wet; about 95% subangular fine to coarse Sand (max.4.8mm); about 5% Fines; no plasticity; fill material (SP).	%Recovery = 93 PID = 3.2 - 4.2ppm FC = F3	
						FILL	**Poorly-graded GRAVEL with Sand**: grayish brown; wet; about 70% subangular fine to coarse gravel (max.3cm); about 25% subangular fine to coarse Sand (max.4.8mm); about 5% Fines; no plasticity; fill material (GP).		
1	S2						**FAT CLAY**: reddish brown; moist; about 3% subangular fine gravel (max.2cm); about 7% subangular fine to medium Sand (max.2mm); about 90% Fines; high plasticity; fill material (CH). About 10% subangular fine to medium Sand (max.2mm); about 90% Fines; no gravels.		
52						FILL	**SILTY SAND**: brown; moist; about 70% subangular fine to coarse Sand (max.4.8mm); about 30% Fines; no plasticity; fill material (SM).		
2						FILL	**CLAYEY SAND**: reddish brown; moist; about 65% subangular fine to coarse Sand (max.4.8mm); about 35% Fines; medium plasticity; fill material (SC).	%Recovery = 88 PID = 4.8 - 5.6ppm	
51						FILL	**SILTY SAND**: brown; moist; about 70% subangular fine to coarse Sand (max.4.8mm); about 30% Fines; no plasticity; fill material (SM).		
3							About 5% subangular fine to coarse gravel (max.3cm); about 65% subangular fine to coarse Sand (max.4.8mm); about 30% Fines.		
50	S3					FILL	**CLAYEY SAND**: brown; moist; about 5% subangular fine gravel (max.2cm); about 65% subangular fine to coarse Sand (max.4.8mm); about 30% Fines; medium plasticity; fill material (SC).		
4							Wet zone (4.3m).		
49									
5						CL	**SANDY LEAN CLAY**: grayish brown; moist to wet; about 40% subangular fine to medium Sand (max.2mm); about 60% Fines; medium plasticity; alluvial soil.	%Recovery = 81 PID = 4.7 - 15.3ppm	
48						SP-SM	**Poorly-graded SAND with Silt**: grayish brown; wet; about 90% subangular fine to coarse Sand (max.4.8mm); about 10% Fines; no plasticity; alluvial soil.		
						SC			

ENVIRO-EXPLORATION LOG 11-032E-PHASE2-FINAL.GPJ USACE SKOREA.GDT 8/22/11

PROJECT: **Phase II Site Soil Sampling**

LOCATION: **Camp Carroll** G&EE NO.: **11-032E** INSPECTOR: ~~____~~ *bb*

DATE STARTED: **10 Aug 11** FINISHED: **10 Aug 11** DRILLER: ~~____~~ *bb*

DRILLING METHOD/EQUIPMENT: **BEC50PM-1**

DRILLING AGENCY: **BEC** HOLE DIAMETER: **5.5 cm** TOTAL DEPTH: **10.0 m**

OVERBURDEN THICKNESS: ____ DEPTH DRILLED: **10.0 m** WATER DEPTH: **NA**

COORDINATES: N: **3,983,363.9** E: **447,811.9** GROUND ELEV.: **53.53 m** DATUM: **MSL**

GROUND COVER: **Dirt (Inside land farm)** CONTAMINATION: ____

TYPE OF HOLE: ☐ Piezometer ☐ Monitoring Well ☐ Test Pit ☐ Auger Hole ☒ other **Direct push sampling hole**

ELEVATION / DEPTH (meters)	SAMPLE TYPE / NUMBER	GRAPHIC LOG	CONTAMINATED	BLOW COUNT	SPT N-VALUE	USCS / STRATA	DESCRIPTION OF MATERIALS	FIELD DATA	LAB DATA
6							**CLAYEY SAND**: dark brown; wet; about 60% subangular fine to coarse Sand (max.4.8mm); about 40% Fines; medium plasticity; alluvial soil. Brown; about 3% subangular fine gravel (max.1cm); about 67% subangular fine to coarse Sand (max.4.8mm); about 30% Fines.		
47									
7							Light gray to brown; moist; about 60% subangular fine to medium Sand (max.2mm); about 40% Fines; high plasticity.		
46	S4								
8						CH	**FAT CLAY**: grayish brown; moist; about 5% fine Sand (max.0.43mm); about 95% Fines; high plasticity; alluvial soil.		
						SC	**CLAYEY SAND**: brown to grayish brown; moist; about 5% subangular fine gravel (max.2cm); about 60% subangular fine to coarse Sand (max.4.8mm); about 35% Fines; high plasticity; alluvial soil.		
45									
9							Light gray to brown; moist; about 2% subangular fine gravel (max.1cm); about 63% subangular fine to coarse Sand (max.4.8mm); about 35% Fines; high plasticity.		
44									
10						SM	**SILTY SAND**: brown; moist; about 75% subangular fine to coarse Sand (max.4.8mm); about 25% Fines; no plasticity; residual soil; granite texture. Hard pushing of sampler at 9.9-10.0m; HDP (Hydraulic Down Pressure) = 1000 psi. Penetration refusal depth = 10.0m (Penetration speed = 1.5cm / 1min).		

ENVIRO-EXPLORATION LOG 11-032E-PHASE2-FINAL.GPJ USACE SKOREA.GDT 8/22/11

PROJECT: **Phase II Site Soil Sampling**

LOCATION: **Camp Carroll** G&EE NO.: **11-032E** INSPECTOR: _____ bb bb

DATE STARTED: **08 Aug 11** FINISHED: **08 Aug 11** DRILLER: _____

DRILLING METHOD/EQUIPMENT: **BEC50PM-1**

DRILLING AGENCY: **BEC** HOLE DIAMETER: **5.5 cm** TOTAL DEPTH: **8.9 m**

OVERBURDEN THICKNESS: _____ DEPTH DRILLED: **8.9 m** WATER DEPTH: **1.92 m; AD**

COORDINATES: N: **3,983,366.3** E: **447,839.1** GROUND ELEV.: **54.98 m** DATUM: **MSL**

GROUND COVER: **Portland cement concrete (20cm)** CONTAMINATION: _____

TYPE OF HOLE: ☐ Piezometer ☐ Monitoring Well ☐ Test Pit ☐ Auger Hole ☒ other **Direct push sampling hole**

ELEVATION / DEPTH (meters)	SAMPLE TYPE / NUMBER	GRAPHIC LOG	CONTAMINATED	BLOW COUNT	SPT N-VALUE	USCS / STRATA	DESCRIPTION OF MATERIALS	FIELD DATA	LAB DATA
0						PCC	Portland cement concrete pavement thickness = 20cm.		
						FILL	Poorly-graded GRAVEL with Sand: fill material (GP); base course material.	%Recovery = 80 PID = 11.6ppm FC = F3	
	S1					FILL	CLAYEY SAND: grayish brown to reddish brown; moist; about 10% subangular fine to coarse gravel (max.4cm); about 60% subangular fine to coarse Sand (max.4.8mm); about 30% Fines; medium plasticity; fill material (SC).		
54 — 1						FILL	SILTY SAND: brown; moist; about 10% subangular fine to coarse gravel (max.3cm); about 60% subangular fine to coarse Sand (max.4.8mm); about 30% Fines; no plasticity; fill material (SM).	%Recovery = 90 PID = 3.6 - 11.7ppm FC = F3	
	S2						About 5% subangular fine gravel (max.2cm); about 65% subangular fine to coarse Sand (max.4.8mm); about 30% Fines; encountered clayey sand layer at 1.7m to 1.8m.		
53 — 2									
						FILL	CLAYEY SAND: brown; moist to wet; about 70% subangular fine to coarse Sand (max.4.8mm); about 30% Fines; medium plasticity; fill material (SC); wet zone = 2.8m.	%Recovery = 85 PID = 2.4 - 3.5ppm	
52 — 3						FILL	SILTY SAND: brown; moist; about 5% subangular fine gravel (max.2cm); about 70% subangular fine to coarse Sand (max.4.8mm); about 25% Fines; no plasticity; fill material (SM).		
	S3						About 5% subangular fine gravel (max.1cm); about 70% subangular fine to coarse Sand (max.4.8mm); about 25% Fines; encountered clayey sand layer at 3.9m to 4.0m.		
51 — 4									
						FILL	CLAYEY SAND: greenish gray to brown; moist; about 3% subangular fine gravel (max.1cm); about 62% subangular fine to coarse Sand (max.4.8mm); about 35% Fines; medium plasticity; fill material (SC).		
50 — 5						SC CH	CLAYEY SAND: greenish gray; moist; about 70% subangular fine to coarse Sand (max.4.8mm); about 30% Fines; medium plasticity; alluvial soil.		
						SC	SANDY FAT CLAY: dark brown; moist; about 30% subangular fine to medium Sand (max.2mm); about 70% Fines; high plasticity; alluvial soil.	%Recovery = 42 PID = 3.7 - 6.2ppm	
49 — 6							CLAYEY SAND: dark brown; moist; about 65% subangular fine to coarse Sand (max.4.8mm); about 35% Fines; medium plasticity; alluvial soil.		
48 — 7	S4								
						CL	SANDY LEAN CLAY: brown; moist; about 30% subangular fine to medium Sand (max.2mm); about 70% Fines; medium plasticity; alluvial soil.		
47 — 8						SM	SILTY SAND: brown; moist; about 70% subangular fine to coarse Sand (max.4.8mm); about 30% Fines; no plasticity; residual soil; granite texture.		
							Hard pushing of sampler at 8.7-8.9m; HDP (Hydraulic Down Pressure) = 1000 psi.		
							Penetration refusal depth = 8.9m (Penetration speed = 2cm / 1min).		

ENVIRO-EXPLORATION LOG 11-032E-PHASE2-FINAL.GPJ USACE SKOREA.GDT 8/22/11

EXPLORATION LOG

US Army Corps Of Engineers

HOLE NO. **E11-175**

Far East District

PROJECT: **Phase II Site Soil Sampling**
LOCATION: **Camp Carroll**   G&EE NO.: **11-032E**   INSPECTOR: ▮▮▮
DATE STARTED: **10 Aug 11**   FINISHED: **10 Aug 11**   DRILLER: ▮▮▮
DRILLING METHOD/EQUIPMENT: **BEC50PM-2**
DRILLING AGENCY: **BEC**   HOLE DIAMETER: **5.5 cm**   TOTAL DEPTH: **7.25 m**
OVERBURDEN THICKNESS: ___   DEPTH DRILLED: **7.25 m**   WATER DEPTH: **1.55 m; AD**
COORDINATES: N: **3,983,346.8** E: **447,784.2**   GROUND ELEV.: **51.07 m**   DATUM: **MSL**
GROUND COVER: **Grass**   CONTAMINATION: ___
TYPE OF HOLE: ☐ Piezometer   ☐ Monitoring Well   ☐ Test Pit   ☐ Auger Hole   ☒ other **Direct push sampling hole**

ELEVATION / DEPTH (meters)	SAMPLE TYPE / NUMBER	GRAPHIC LOG	CONTAMINATED	BLOW COUNT	SPT N-VALUE	USCS / STRATA	DESCRIPTION OF MATERIALS	FIELD DATA	LAB DATA
51 — 0	S1					FILL	**SILTY SAND**: brown grades to brownish gray; moist; about 5% subangular to subrounded fine gravel (max.2cm); about 75% subangular fine to coarse Sand; about 20% Fines; no plasticity; fill material (SM).	%Recovery = 100 PID = 6.0ppm FC = F3	
50 — 1	S2							%Recovery = 85 PID = 8.4 - 10.0ppm	
49 — 2							More gravels at 2.0-2.4m.	%Recovery = 89 PID = 6.3 - 12.6ppm	
						FILL	**CLAYEY SAND**: brown to reddish brown; moist; about 60% subangular fine to coarse Sand; about 40% Fines; medium plasticity; fill material (SC).		
48 — 3	S3					FILL	**SILTY SAND**: brownish gray; moist to wet; about 80% subangular to angular fine to coarse Sand; about 20% Fines; no plasticity; fill material (SM).		
47 — 4						FILL	**CLAYEY SAND**: brown; moist; about 65% angular to subangular fine to coarse Sand; about 35% Fines; low to medium plasticity; fill material (SC).		
46 — 5						CH	**SANDY FAT CLAY**: dark greenish gray; moist; about 30% fine to medium Sand; about 70% Fines; medium to high plasticity; alluvial soil.		
							Brownish gray grades to light gray; moist; angular to subangular fine to coarse Sand.	%Recovery = 76 PID = 6.6 - 9.4ppm	
45 — 6	S4					SC	**CLAYEY SAND**: yellowish brown; moist; about 60% subangular fine to coarse Sand; about 40% Fines; low plasticity; alluvial soil.		
44 — 7						SM	**SILTY SAND**: light brown to brown; moist; about 70% angular fine to coarse Sand; about 30% Fines; no plasticity; residual soil; granite texture.		

Hard pushing of sampler at 7.1-7.25m; HDP (Hydraulic Down Pressure) = 1500 psi.
Penetration refusal depth = 7.25m (Penetration speed = 1.2cm / 1min).

FOR OFFICIAL USE ONLY   5926

ENVIRO-EXPLORATION LOG 11-032E-PHASE2-FINAL.GPJ USACE SKOREA.GDT 8/22/11

PROJECT: **Phase II Site Soil Sampling**
LOCATION: **Camp Carroll**   G&EE NO.: **11-032E**   INSPECTOR: _____
DATE STARTED: **10 Aug 11**   FINISHED: **10 Aug 11**   DRILLER: _____
DRILLING METHOD/EQUIPMENT: **BEC50PM-1**
DRILLING AGENCY: **BEC**   HOLE DIAMETER: **5.5 cm**   TOTAL DEPTH: **10.0 m**
OVERBURDEN THICKNESS: _____   DEPTH DRILLED: **10.0 m**   WATER DEPTH: **NA**
COORDINATES: N: **3,983,341.6** E: **447,801.8**   GROUND ELEV.: **53.36 m**   DATUM: **MSL**
GROUND COVER: **Dirt (Inside land farm)**   CONTAMINATION: _____
TYPE OF HOLE: ☐ Piezometer   ☐ Monitoring Well   ☐ Test Pit   ☐ Auger Hole   ☒ other **Direct push sampling hole**

ELEVATION / DEPTH (meters)	SAMPLE TYPE / NUMBER	GRAPHIC LOG	CONTAMINATED	BLOW COUNT	SPT N-VALUE	USCS / STRATA	DESCRIPTION OF MATERIALS	FIELD DATA	LAB DATA
0	S1					FILL	**CLAYEY SAND**: gray; wet; about 10% subangular fine gravel (max.2cm); about 55% subangular fine to coarse Sand (max.4.8mm); about 35% Fines; medium plasticity; fill material (SC).	%Recovery = 90 PID = 4ppm FC = F3 FC = NFS	
53						FILL	**Poorly-graded SAND**: brown; wet; about 95% subangular fine to coarse Sand (max.4.8mm); about 5% Fines; no plasticity; fill material (SP).	%Recovery = 80 PID = 2.9 - 3.2ppm FC = NFS FC = F3	
1	S2					FILL / FILL	**Poorly-graded GRAVEL with Sand**: grayish brown; wet; about 70% subangular fine to coarse gravel (max.3cm); about 25% subangular fine to coarse Sand (max.4.8mm); about 5% Fines; no plasticity; fill material (GP).		
52							**FAT CLAY**: reddish brown; moist; about 10% subangular fine to medium Sand (max.2mm); about 90% Fines; high plasticity; fill material (CH).		
2						FILL	**SILTY SAND**: brown; moist; about 5% subangular fine gravel (max.2cm); about 65% subangular fine to coarse Sand (max.4.8mm); about 30% Fines; no plasticity; fill material (SM).	%Recovery = 59 PID = 4.6 - 10.1ppm	
51									
3	S3					FILL / FILL	**FAT CLAY with Sand**: reddish brown; moist; about 20% subangular fine to medium Sand (max.2mm); about 80% Fines; high plasticity; fill material (CH).		
50							**SILTY SAND**: brown; moist; about 70% subangular fine to coarse Sand (max.4.8mm); about 30% Fines; no plasticity; fill material (SM); encountered clayey layer(2cm).		
4							About 10% subangular fine to coarse gravel (max.3cm); about 65% subangular fine to coarse Sand (max.4.8mm); about 25% Fines.		
49									
5						FILL	**CLAYEY SAND**: brown; moist; about 10% subangular fine gravel (max.2cm); about 65% subangular fine to coarse Sand (max.4.8mm); about 25% Fines; medium plasticity; fill material (SC).	%Recovery = 70 PID = 3.3 - 6.2ppm	
48									

ENVIRO-EXPLORATION LOG 11-032E-PHASE2-FINAL.GPJ USACE SKOREA.GDT 8/22/11

US Army Corps
Of Engineers

EXPLORATION LOG
HOLE NO. **E11-176**

Far East
District

PROJECT: **Phase II Site Soil Sampling**
LOCATION: **Camp Carroll**   G&EE NO.: **11-032E**   INSPECTOR: ___
DATE STARTED: **10 Aug 11**   FINISHED: **10 Aug 11**   DRILLER: ___
DRILLING METHOD/EQUIPMENT: **BEC50PM-1**
DRILLING AGENCY: **BEC**   HOLE DIAMETER: **5.5 cm**   TOTAL DEPTH: **10.0 m**
OVERBURDEN THICKNESS: ___   DEPTH DRILLED: **10.0 m**   WATER DEPTH: **NA**
COORDINATES: N: **3,983,341.6** E: **447,801.8**   GROUND ELEV.: **53.36 m**   DATUM: **MSL**
GROUND COVER: **Dirt (Inside land farm)**   CONTAMINATION: ___
TYPE OF HOLE: ☐ Piezometer   ☐ Monitoring Well   ☐ Test Pit   ☐ Auger Hole   ☒ other **Direct push sampling hole**

ELEVATION / DEPTH (meters)	SAMPLE TYPE / NUMBER	GRAPHIC LOG	CONTAMINATED	BLOW COUNT	SPT N-VALUE	USCS / STRATA	DESCRIPTION OF MATERIALS	FIELD DATA	LAB DATA
47— —6						SC	**CLAYEY SAND**: gray; moist; about 65% subangular fine to coarse Sand (max.4.8mm); about 35% Fines; medium		
						CL	plasticity; alluvial soil.		
						SC	**LEAN CLAY**: grayish brown; moist; about 5% fine Sand (max.0.43mm); about 95% Fines; medium plasticity; alluvial soil.		
—7						CH	**CLAYEY SAND**: dark brown; moist to wet; about 65% subangular fine to medium Sand (max.2mm); about 35% Fines; medium plasticity; alluvial soil.		
46—	S4						**FAT CLAY**: dark brown; moist; about 5% fine Sand (max.0.43mm); about 95% Fines; high plasticity; alluvial soil. Gray.		
—8							About 10% fine Sand (max.0.43mm); about 90% Fines.		
45—									
—9						SC	**CLAYEY SAND**: light gray; moist; subangular fine to coarse gravel (max.3cm); about 60% subangular fine to coarse Sand (max.4.8mm); about 40% Fines; high plasticity; alluvial soil.		
44—						CH	**SANDY FAT CLAY**: gray; moist to wet; about 30% subangular fine to medium Sand (max.2mm); about 70% Fines; high plasticity; alluvial soil.		
—10						SM	**SILTY SAND**: light gray to brown; moist; about 5% subangular fine gravel (max.2cm); about 75% subangular fine to coarse Sand (max.4.8mm); about 20% Fines; no plasticity; alluvial soil. Hard pushing of sampler at 9.9-10.0m; HDP (Hydraulic Down Pressure) = 1000 psi. Penetration refusal depth = 10.0m (Penetration speed = 8cm / 1min).		

ENVIRO-EXPLORATION LOG 11-032E-PHASE2-FINAL.GPJ USACE SKOREA.GDT 8/22/11

US Army Corps Of Engineers

EXPLORATION LOG
HOLE NO. E11-177

Far East District

PROJECT: **Phase II Site Soil Sampling**

LOCATION: **Camp Carroll**   G&EE NO.: **11-032E**   INSPECTOR: ▮▮▮▮ *bb* / *bb*

DATE STARTED: **08 Aug 11**   FINISHED: **08 Aug 11**   DRILLER: ▮▮▮▮

DRILLING METHOD/EQUIPMENT: **BEC50PM-1**

DRILLING AGENCY: **BEC**   HOLE DIAMETER: **5.5 cm**   TOTAL DEPTH: **9.0 m**

OVERBURDEN THICKNESS: ___   DEPTH DRILLED: **9.0 m**   WATER DEPTH: **0.2 m; AD**

COORDINATES: N: **3,983,340.9** E: **447,834.7**   GROUND ELEV.: **54.71 m**   DATUM: **MSL**

GROUND COVER: **Portland cement concrete (0.2m thick)**   CONTAMINATION: ___

TYPE OF HOLE: ☐ Piezometer   ☐ Monitoring Well   ☐ Test Pit   ☐ Auger Hole   ☒ other **Direct push sampling hole**

ELEVATION / DEPTH (meters)	SAMPLE TYPE / NUMBER	GRAPHIC LOG	CONTAMINATED	BLOW COUNT	SPT N-VALUE	USCS / STRATA	DESCRIPTION OF MATERIALS	FIELD DATA	LAB DATA
0						PCC	Portland cement concrete pavement thickness = 20cm.		
						FILL	**Poorly-graded GRAVEL with Sand**: fill material (GP); base course material.		
54	S1					FILL	**CLAYEY SAND**: greenish gray; moist; about 5% subangular fine to coarse gravel (max.3cm); about 70% subangular fine to coarse Sand (max.4.8mm); about 25% Fines; medium plasticity; fill material (SC).	%Recovery = 70, PID = 4.1ppm, FC = F3	
53	S2					FILL	**SILTY SAND**: brown; moist; about 5% subangular fine gravel (max.2cm); about 70% subangular fine to coarse Sand (max.4.8mm); about 25% Fines; no plasticity; fill material (SM). About 5% subangular fine gravel (max.1cm); about 70% subangular fine to coarse Sand (max.4.8mm); about 25% Fines; no plasticity; encountered clayey sand layer at 2.2m to 2.3m. About 75% subangular fine to coarse Sand (max.4.8mm); about 25% Fines; no gravels.	%Recovery = 98, PID = 5.1 - 7.2ppm, FC = F3 / %Recovery = 87, PID = 4.5 - 6.5ppm	
52									
51	S3					FILL	**CLAYEY SAND**: reddish brown to brown; moist; about 10% subangular fine gravel (max.2cm); about 60% subangular fine to coarse Sand (max.4.8mm); about 30% Fines; medium plasticity; fill material (SC); encountered silty sand layer at 3.7m to 3.8m. Brown; moist to wet; about 10% subangular fine to coarse gravel (max.3cm); about 60% subangular fine to coarse Sand (max.4.8mm); about 30% Fines.		
50									
49						SC	**CLAYEY SAND**: dark brown; moist; about 60% subangular fine to medium Sand (max.2mm); about 40% Fines; medium plasticity; alluvial soil.	%Recovery = 74, PID = 2.7 - 5.2ppm	
48	S4					CH	**SANDY FAT CLAY**: light grayish brown; moist; about 40% subangular fine to medium Sand (max.2mm); about 60% Fines; high plasticity; alluvial soil.		
47						SM	**SILTY SAND**: brown; moist; about 70% subangular fine to coarse Sand (max.4.8mm); about 30% Fines; no plasticity; residual soil; granite texture.		
46							Hard pushing of sampler at 8.7-9.0m; HDP (Hydraulic Down Pressure) = 1000 psi.		
9							Penetration refusal depth = 9.0m (Penetration speed = 2cm / 1min).		

US Army Corps Of Engineers

EXPLORATION LOG
HOLE NO. E11-178

Far East District

PROJECT: **Phase II Site Soil Sampling**
LOCATION: **Camp Carroll**   G&EE NO.: **11-032E**   INSPECTOR: ▮▮▮▮▮▮
DATE STARTED: **06 Aug 11**   FINISHED: **06 Aug 11**   DRILLER: _____
DRILLING METHOD/EQUIPMENT: **BEC50PM-2**
DRILLING AGENCY: **BEC**   HOLE DIAMETER: **5.5 cm**   TOTAL DEPTH: **10.0 m**
OVERBURDEN THICKNESS: _____   DEPTH DRILLED: **10.0 m**   WATER DEPTH: **3.35 m; AD**
COORDINATES: N: **3,983,357.5** E: **447,752.1**   GROUND ELEV.: **50.99 m**   DATUM: **MSL**
GROUND COVER: **Grass**   CONTAMINATION: _____
TYPE OF HOLE: ☐ Piezometer   ☐ Monitoring Well   ☐ Test Pit   ☐ Auger Hole   ☒ other **Direct push sampling hole**

ELEVATION / DEPTH (meters)	SAMPLE TYPE / NUMBER	GRAPHIC LOG	CONTAMINATED	BLOW COUNT	SPT N-VALUE	USCS / STRATA	DESCRIPTION OF MATERIALS	FIELD DATA	LAB DATA
0	S1					FILL	**SILTY SAND**: brown grades to light brown; moist; about 10% subangular to subrounded fine to coarse gravel (max.3.5cm); about 70% subangular fine to coarse Sand; about 20% Fines; no plasticity; fill material (SM).	%Recovery = 100 PID = 3.3ppm FC = F3	
50 / 1	S2							%Recovery = 100 PID = 2.0 - 6.3ppm	
49 / 2							**CLAYEY SAND**: brown; moist; about 55% fine Sand; about 45% Fines; medium plasticity; at 1.3-1.5m. **SILTY SAND**: brown; moist; about 5% subangular fine to coarse gravel (max.3.2cm); about 70% subangular fine to coarse Sand; about 25% Fines; no plasticity; at 1.5-5.0m.	FC = F3 %Recovery = 95 PID = 7.2 - 8.0ppm	
48 / 3							No gravels below 3.0m.		
47 / 4	S3						Clayey sand layers encountered at 3.3-3.6m and 4.0-5.0m.		
46 / 5						SC	**CLAYEY SAND**: grayish brown; moist to wet; about 60% fine to medium Sand; about 40% Fines; medium plasticity, alluvial soil.	%Recovery = 71 PID = 4.4 - 8.5ppm	
45 / 6							Dark greenish gray; groundwater encountered at 6.0m while sampling.		
44 / 7	S4						Easy sampler penetration at 7 - 8m; PID in hole = 3.0 ppm.		
43 / 8						SM	**SILTY SAND**: grayish brown to brown; moist to wet; about 70% subangular fine to coarse Sand; about 30% Fines; no plasticity; residual soil; greenish-gray mottled with white; granite texture.		
42 / 9									
41 / 10							End of direct push sampling at 10.0m after residual soils encountered at 8.0-10.0m.		

PROJECT: **Phase II Site Soil Sampling**
LOCATION: **Camp Carroll**   G&EE NO.: **11-032E**   INSPECTOR:
DATE STARTED: **10 Aug 11**   FINISHED: **10 Aug 11**   DRILLER:
DRILLING METHOD/EQUIPMENT: **BEC50PM-2**
DRILLING AGENCY: **BEC**   HOLE DIAMETER: **5.5 cm**   TOTAL DEPTH: **10.0 m**
OVERBURDEN THICKNESS: DEPTH DRILLED: **10.0 m**   WATER DEPTH: **1.96 m; AD**
COORDINATES: N: **3,983,337.7** E: **447,767.8**   GROUND ELEV.: **50.60 m**   DATUM: **MSL**
GROUND COVER: **Grass**   CONTAMINATION:
TYPE OF HOLE: ☐ Piezometer   ☐ Monitoring Well   ☐ Test Pit   ☐ Auger Hole   ☒ other **Direct push sampling hole**

ELEVATION / DEPTH (meters)	SAMPLE TYPE / NUMBER	GRAPHIC LOG	CONTAMINATED	BLOW COUNT	SPT N-VALUE	USCS / STRATA	DESCRIPTION OF MATERIALS	FIELD DATA	LAB DATA
0 / 50	S1					PCC / FILL / FILL	Portland cement concrete pavement thickness = 10cm.	FC = F1	
							Poorly-graded GRAVEL with Silt and Sand: gray; wet; about 75% angular to subangular fine to coarse gravel (max.3cm); about 15% fine to medium Sand; about 10% Fines; fill material (GP-GM).	%Recovery = 97 PID = 22.5ppm	
	S2					FILL	**SILTY SAND with Gravel**: brown; moist; about 15% subangular fine to coarse gravel (max.4cm); about 65% subangular fine to coarse Sand (max.4.8mm); about 20% Fines; no plasticity; fill material (SM).	FC = F3 / FC = F3 / %Recovery = 68 PID = 3.2ppm	
2 / 48	S3					FILL	**CLAYEY SAND**: brown to reddish brown; moist; about 5% fine gravel (max.1cm); about 55% subangular fine to coarse Sand; about 40% Fines; low plasticity; fill material (SC).	%Recovery = 60 PID = 3.0 - 5.4ppm	
							SILTY SAND: brown; moist; about 70% subangular fine to coarse Sand; about 30% Fines; fill material (SM). Subangular to subrounded coarse gravel (max. 4cm) at 2.0-2.7m.		
							CLAYEY SAND: brown; moist; about 65% fine to coarse Sand; about 35% Fines; low plasticity; at 2.7-2.85m and 3.6-3.75m.		
4 / 46							Brown to grayish brown; fine gravel.		
6 / 44						CH / SC	**FAT CLAY with Sand**: grayish brown to brownish gray; moist; fine gravel; about 85%; about 15% Fines; high plasticity; alluvial soil.	%Recovery = 60 PID = 1.2 - 14.5ppm	
							CLAYEY SAND: brownish gray to brown; moist to wet; about 70% subrounded fine to coarse Sand; about 30% Fines; low to medium plasticity; alluvial soil.		
8 / 42	S4					SC	**CLAYEY SAND**: reddish brown; moist; about 60% fine Sand; about 40% Fines; low plasticity; residual soil; granite texture.		
							More silty.		
10						ML	**SILT with Sand**: reddish brown; moist; about 25% fine Sand; about 75% Fines; low plasticity; residual soil; granite texture.		
						SM	**SILTY SAND**: brown to light brown; moist; about 70% fine to coarse Sand; about 30% Fines; residual soil; granite texture.		

End of direct push sampling at 10.0m.
Confirmed depths of FILL MATERIAL = 0 -5.55 m, ALLUVIAL
SOILS = 5.55 - 7.4m, and RESIDUAL SOIL = 7.4-10.0m.

ENVIRO-EXPLORATION LOG 11-032E-PHASE2-FINAL.GPJ USACE SKOREA.GDT 8/22/11

US Army Corps Of Engineers

EXPLORATION LOG

HOLE NO. **E11-180**

Far East District

PROJECT: **Phase II Site Soil Sampling**

LOCATION: **Camp Carroll** G&EE NO.: **11-032E** INSPECTOR:

DATE STARTED: **09 Aug 11** FINISHED: **09 Aug 11** DRILLER:

DRILLING METHOD/EQUIPMENT: **BEC50PM-2**

DRILLING AGENCY: **BEC** HOLE DIAMETER: **5.5 cm** TOTAL DEPTH: **10.0 m**

OVERBURDEN THICKNESS: DEPTH DRILLED: **10.0 m** WATER DEPTH: **6.59 m; AD**

COORDINATES: N: **3,983,323.0** E: **447,748.9** GROUND ELEV.: **50.14 m** DATUM: **MSL**

GROUND COVER: **Grass** CONTAMINATION: **Yes**

TYPE OF HOLE: ☐ Piezometer ☐ Monitoring Well ☐ Test Pit ☐ Auger Hole ☒ other **Direct push sampling hole**

ELEVATION / DEPTH (meters)	SAMPLE TYPE / NUMBER	GRAPHIC LOG	CONTAMINATED	BLOW COUNT	SPT N-VALUE	USCS / STRATA	DESCRIPTION OF MATERIALS	FIELD DATA	LAB DATA
50 — 0	S1					FILL	<u>SILTY SAND</u>: brown; moist; about 5% subrounded to subangular fine to coarse gravel (max.3.5cm); about 65% subangular fine to coarse Sand; about 30% Fines; no plasticity; fill material (SM); grass roots at 0-0.1m.	%Recovery = 100 PID = 2.5ppm FC = F3	
	S2						Brown to light brown; about 15% subangular fine to coarse gravel (max.3cm); about 60% subangular fine to coarse Sand; about 25% Fines; no plasticity; at 1.0-4.0m.	%Recovery = 87 PID = 3.1 - 6.2ppm	
48 — 2							2.0 to 3.0m; PID = 279 ppm.	%Recovery = 85 PID = 11 - 366ppm	
	S3						3.0 to 4.0m; PID = 366 ppm.		
46 — 4							Dark bluish gray to grayish brown; wet to moist; about 10% subangular fine gravel (max.1cm); about 65% fine to coarse Sand; about 25% Fines; wet sample at 4.3m; more clayey soils.		
						FILL	<u>SILTY SAND</u>: gray to dark bluish gray; wet to moist; about 80% subangular fine to coarse Sand; about 20% Fines; medium plasticity; fill material (SM). 5.0 to 6.0m; PID = 314 ppm. <u>CLAYEY SAND</u>: reddish brown; about 60%; about 40% Fines; at 5.65-6.0m.	%Recovery = 71 PID = 7.9 - 314ppm	
44 — 6									
	S4					CL	<u>LEAN CLAY with Sand</u>: brown to grayish brown; moist; about 25% fine Sand; about 75% Fines; medium plasticity; alluvial soil.		
						SC	<u>CLAYEY SAND</u>: dark greenish gray; moist to wet; about 60% subangular fine to coarse Sand; about 40% Fines; alluvial soil.		
						CH	<u>FAT CLAY with Sand</u>: dark brownish gray; moist; about 20% fine Sand; about 80% Fines; high plasticity; alluvial soil.		
42 — 8									
						SC	<u>CLAYEY SAND</u>: brown; moist; about 55% fine Sand; about 45% Fines; medium plasticity; alluvial soil.		
— 10						SC	<u>CLAYEY SAND</u>: yellowish brown; moist; about 60% subangular fine to coarse Sand; about 40% Fines; residual soil; granite texture.		

End of direct push sampling at 10.0m.
Confirmed depths of FILL MATERIAL = 0 - 6.65 m, ALLUVIAL SOILS = 6.65 - 9.8m, and RESIDUAL SOIL = 9.8- 10.0m.

FOR OFFICIAL USE ONLY

PROJECT: **Phase II Site Soil Sampling**
LOCATION: **Camp Carroll**   G&EE NO.: **11-032E**   INSPECTOR: ▮▮▮ bb / bb
DATE STARTED: **08 Aug 11**   FINISHED: **08 Aug 11**   DRILLER:
DRILLING METHOD/EQUIPMENT: **BEC50PM-2**
DRILLING AGENCY: **BEC**   HOLE DIAMETER: **5.5 cm**   TOTAL DEPTH: **7.0 m**
OVERBURDEN THICKNESS: DEPTH DRILLED: **7.0 m**   WATER DEPTH: **Caved (0.3m); AD**
COORDINATES: N: **3,983,318.1** E: **447,762.6**   GROUND ELEV.: **49.93 m**   DATUM: **MSL**
GROUND COVER: **Grass**   CONTAMINATION:
TYPE OF HOLE: ☐ Piezometer   ☐ Monitoring Well   ☐ Test Pit   ☐ Auger Hole   ☒ other **Direct push sampling hole**

ELEVATION / DEPTH (meters)	SAMPLE TYPE / NUMBER	GRAPHIC LOG	CONTAMINATED	BLOW COUNT	SPT N-VALUE	USCS / STRATA	DESCRIPTION OF MATERIALS	FIELD DATA	LAB DATA
0	S1					FILL	**SILTY SAND**: brown to light brown; moist; about 5% subangular to subrounded fine to coarse gravel (max.4.5cm); about 70% subangular fine to coarse Sand; about 25% Fines; no plasticity; fill material (SM).	%Recovery = 100 PID = 0.6ppm FC = F3	
49 -1	S2							%Recovery = 93 PID = 2.8 - 3.8ppm	
48 -2						FILL FILL	**CLAYEY SAND**: reddish brown; about 60% fine Sand; about 40% Fines; medium plasticity; fill material (SC); at 1.4-1.6m. **SILTY SAND**: brown to light brown; moist; about 5% subangular to subrounded fine to coarse gravel (max.4.5cm); about 70% subangular fine to coarse Sand; about 25% Fines; no plasticity; fill material (SM).	FC = F3 %Recovery = 57 PID = 1.6 - 3.5ppm	
47 -3	S3					FILL FILL	**SILTY SAND with Gravel**: brown; moist to wet; about 15% subangular fine gravel (max.2cm); about 65% subangular fine to coarse Sand; about 20% Fines; no plasticity; fill material (SM). **CLAYEY SAND**: reddish brown; wet to moist; about 10% subrounded fine gravel; about 60% fine to medium Sand; about 30% Fines; low plasticity; fill material (SC). Wet sample at 3.6m.		
46 -4									
45 -5						FILL	**SILTY SAND**: brown; moist; about 10% subangular fine gravel; about 60% fine to coarse Sand; about 30% Fines; fill material (SM). Water encountered at 5.5m.		
44 -6						CH	**FAT CLAY with Sand**: dark greenish gray to brownish gray; moist; about 20% fine Sand; about 80% Fines; high plasticity; alluvial soil.		
43 -7									

End of direct push sampling at 7.0m; Confirmed depths of
FILL MATERIAL = 0-5.9m and ALLUVIAL SOILS = 5.9 - 7m.

ENVIRO-EXPLORATION LOG 11-032E-PHASE2-FINAL.GPJ USACE SKOREA.GDT 8/22/11

US Army Corps Of Engineers

EXPLORATION LOG
HOLE NO. E11-182

Far East District

PROJECT: **Phase II Site Soil Sampling**		
LOCATION: **Camp Carroll**	G&EE NO.: **11-032E**	INSPECTOR:
DATE STARTED: **07 Aug 11**	FINISHED: **07 Aug 11**	DRILLER:
DRILLING METHOD/EQUIPMENT: **BEC50PM-2**		
DRILLING AGENCY: **BEC**	HOLE DIAMETER: **5.5 cm**	TOTAL DEPTH: **10.0 m**
OVERBURDEN THICKNESS:	DEPTH DRILLED: **10.0 m**	WATER DEPTH: **2.53 m; AD**
COORDINATES: N: **3,983,301.8** E: **447,747.3**	GROUND ELEV.: **49.73 m**	DATUM: **MSL**
GROUND COVER: **Grass**	CONTAMINATION:	

TYPE OF HOLE: ☐ Piezometer ☐ Monitoring Well ☐ Test Pit ☐ Auger Hole ☒ other **Direct push sampling hole**

ELEVATION / DEPTH (meters)	SAMPLE TYPE / NUMBER	GRAPHIC LOG	CONTAMINATED	BLOW COUNT	SPT N-VALUE	USCS / STRATA	DESCRIPTION OF MATERIALS	FIELD DATA	LAB DATA
0	S1					FILL	**SILTY SAND**: brown; moist; about 10% subangular fine to coarse gravel (max.5cm); about 70% subangular fine to coarse Sand; about 20% Fines; no plasticity; fill material (SM).	%Recovery = 100 PID = 0.8ppm FC = F3	
	S2						Grayish brown.	%Recovery = 92 PID = 1.1 - 2.1ppm	
48									
2						FILL	**CLAYEY SAND**: brown; moist; about 5% subangular fine to coarse gravel (max.4cm); about 55% subangular fine to coarse Sand; about 40% Fines; low plasticity; fill material (SC).	%Recovery = 86 PID = 1.7 - 2.9ppm	
	S3					FILL	**SILTY SAND**: brown to reddish brown; moist; about 10% subangular fine to coarse gravel (max.3cm); about 60% fine to medium Sand; about 30% Fines; no plasticity; fill material (SM).		
46							Fine gravel (max.1.5cm).		
4									
						FILL	**CLAYEY SAND**: brown; moist; about 55% subangular fine to coarse Sand; about 45% Fines; low plasticity; fill material (SC).	%Recovery = 90 PID = 1.9 - 7.5ppm	
44						FILL	**SILTY SAND**: brown; moist; about 5% subangular fine gravel; about 70% fine to coarse Sand; about 25% Fines; no plasticity; fill material (SM).		
6						SC	**CLAYEY SAND with Gravel**: brownish gray; moist; about 25% subrounded fine to coarse gravel (max.4cm); about 40% subangular fine to coarse Sand; about 35% Fines; alluvial soil.		
						CH	**SANDY FAT CLAY**: dark brownish gray; wet; about 30% fine to medium Sand; about 70% Fines; medium to high plasticity; alluvial soil; A coarse gravel (3cm) encountered at 8.7m.		
42	S4								
8									
						SC	**CLAYEY SAND with Gravel**: grayish brown; moist; about 20% subrounded fine to coarse gravel; about 65% subangular fine to coarse Sand; about 15% Fines; alluvial soil.		
						CH	**FAT CLAY with Sand**: brown; moist; about 15% fine Sand; about 85% Fines; high plasticity; alluvial soil.		
40						SC	**CLAYEY SAND**: reddish brown to black; moist; about 60% subangular fine to coarse Sand; about 40% Fines; medium plasticity; alluvial soil.		
10							End of direct push sampling at 10.0m; Confirmed depths of FILL MATERIAL = 0-5.8m and ALLUVIAL SOILS = 5.8-10m.		

ENVIRO-EXPLORATION LOG 11-032E-PHASE2-FINAL.GPJ USACE SKOREA.GDT 8/22/11

US Army Corps Of Engineers

EXPLORATION LOG
HOLE NO. E11-183

Far East District

PROJECT: **Phase II Site Soil Sampling**
LOCATION: **Camp Carroll**   G&EE NO.: **11-032E**   INSPECTOR: ▓▓▓▓▓▓
DATE STARTED: **07 Aug 11**   FINISHED: **07 Aug 11**   DRILLER: ▓▓▓▓▓▓
DRILLING METHOD/EQUIPMENT: **BEC50PM-2**
DRILLING AGENCY: **BEC**   HOLE DIAMETER: **5.5 cm**   TOTAL DEPTH: **12.0 m**
OVERBURDEN THICKNESS: DEPTH DRILLED: **12.0 m**   WATER DEPTH: **2.07 m; AD**
COORDINATES: N: **3,983,288.9** E: **447,718.0**   GROUND ELEV.: **49.38 m**   DATUM: **MSL**
GROUND COVER: **Grass**   CONTAMINATION:
TYPE OF HOLE: ☐ Piezometer   ☐ Monitoring Well   ☐ Test Pit   ☐ Auger Hole   ☒ other **Direct push sampling hole**

ELEVATION / DEPTH (meters)	SAMPLE TYPE / NUMBER	GRAPHIC LOG	CONTAMINATED	BLOW COUNT	SPT N-VALUE	USCS / STRATA	DESCRIPTION OF MATERIALS	FIELD DATA	LAB DATA
0	S1					FILL	**SILTY SAND with Gravel**: brown; moist; about 15% subangular fine to coarse gravel (max.4cm); about 65% subangular fine to coarse Sand; about 20% Fines; no plasticity; fill material (SM); grass roots at 0-0.05m.	%Recovery = 100 PID = 3.5ppm FC = F3	
48	S2						Light brown; more gravels at 1.2-1.5m.	%Recovery = 97 PID = 4.4 - 5.0ppm	
2		▼					Brown; PID in hole (0-3m open hole) = 1.4 ppm.	%Recovery = 100 PID = 2.1 - 7.3ppm	
46	S3					FILL	**CLAYEY SAND**: reddish brown; moist; about 5% subangular fine gravel (max.1cm); about 55% fine to medium Sand; about 40% Fines; medium plasticity; fill material (SC).		
4									
44						FILL	**SILTY SAND**: grayish brown; moist; about 5% subangular fine gravel (max.2cm); about 65% fine to coarse Sand; about 30% Fines; no plasticity; fill material (SM); PID in hole (0-5m open hole) = 0 ppm.	%Recovery = 85 PID = 1.7 - 5.9ppm	
6		▽							
42	S4					FILL	**CLAYEY SAND**: brown; moist to wet; about 60% fine to medium Sand; about 40% Fines; low plasticity; fill material (SC); Wet sample at 6.8m.		
8						FILL / FILL	**LEAN CLAY with Sand**: yellowish brown; moist; about 20% fine Sand; about 80% Fines; low plasticity; fill material (CL).		
							CLAYEY SAND: brown; moist to wet; about 60% fine to medium Sand; about 40% Fines; low plasticity; fill material (SC).		
						CL	**LEAN CLAY**: greenish black to dark reddish brown; moist; fine to coarse Sand; about 100% Fines; medium plasticity; alluvial soil; 2.5cm subrounded gravel at 9.7m.		
40									
10						SC	**CLAYEY SAND**: dark brown to grayish brown; moist to wet; about 60% fine to coarse Sand; about 40% Fines; low plasticity; alluvial soil.		
						CL	**LEAN CLAY**: brown; moist; about 10% fine Sand; about 90% Fines; medium plasticity; alluvial soil; black hard clay (mud crack).		
						SC	**CLAYEY SAND**: brown; wet; about 60% subangular fine to coarse Sand; about 40% Fines; low plasticity; alluvial soil.		
38									
12									

End of direct push sampling at 12.0m.

Confirmed depths of FILL MATERIAL = 0-8.8m and ALLUVIAL SOILS = 8.8-11m.

CEPOF-ED-G

5935   PAGE 1 of 1

ENVIRO-EXPLORATION LOG 11-032E-PHASE2-FINAL.GPJ USACE SKOREA.GDT 8/22/11

		EXPLORATION LOG	Far East
US Army Corps Of Engineers		HOLE NO. **E11-184**	District

PROJECT: **Phase II Site Soil Sampling**

LOCATION: **Camp Carroll**	G&EE NO.: **11-032E**	INSPECTOR:
DATE STARTED: **06 Aug 11**	FINISHED: **07 Aug 11**	DRILLER:

DRILLING METHOD/EQUIPMENT: **BEC50PM-1**

| DRILLING AGENCY: **BEC**	HOLE DIAMETER: **5.5 cm**	TOTAL DEPTH: **8.75 m**
OVERBURDEN THICKNESS:	DEPTH DRILLED: **8.75 m**	WATER DEPTH: **1.84 m; AD**
COORDINATES: N:**3,983,296.4** E: **447,800.2**	GROUND ELEV.: **50.16 m**	DATUM: **MSL**
GROUND COVER: **Weed**	CONTAMINATION:	

TYPE OF HOLE: ☐ Piezometer   ☐ Monitoring Well   ☐ Test Pit   ☐ Auger Hole   ☒ other **Direct push sampling hole**

ELEVATION / DEPTH (meters)	SAMPLE TYPE / NUMBER	GRAPHIC LOG	CONTAMINATED	BLOW COUNT	SPT N-VALUE	USCS / STRATA	DESCRIPTION OF MATERIALS	FIELD DATA	LAB DATA
50 — 0	S1					FILL	**SILTY SAND**: brown; moist; about 5% subangular fine gravel (max.2cm); about 70% subangular fine to coarse Sand (max.4.8mm); about 25% Fines; no plasticity; fill material (SM).	%Recovery = 100 PID = 1.8ppm FC = F3	
49 — 1	S2							%Recovery = 100 PID = 2.6 - 2.8ppm	
48 — 2							About 70% subangular fine to coarse Sand (max.4.8mm); about 30% Fines; no gravels.	%Recovery = 77 PID = 4.8 - 14.0ppm	
						FILL	**SANDY LEAN CLAY**: reddish brown; moist; about 35% subangular fine to medium Sand (max.2mm); about 65% Fines; medium plasticity; fill material (CL).		
						FILL	**SILTY SAND**: brown; moist; about 70% subangular fine to coarse Sand (max.4.8mm); about 30% Fines; no plasticity; fill material (SM).		
47 — 3	S3						Moist to wet; about 3% subrounded fine to coarse gravel (max.3cm); about 72% subangular fine to coarse Sand (max.4.8mm); about 25% Fines.		
46 — 4							About 75%; about 25% Fines; no gravels.		
						SC	**CLAYEY SAND**: reddish brown to grayish brown; moist; about 10% subangular fine gravel (max.2cm); about 60% subangular fine to coarse Sand (max.4.8mm); about 30% Fines; medium plasticity; alluvial soil; no gravels at 4.6m to 5.0m.		
45 — 5						CL	**SANDY LEAN CLAY**: grayish brown; wet; about 40% subangular fine to medium Sand (max.2mm); about 60% Fines; medium plasticity; alluvial soil.	%Recovery = 70 PID = 2.7 - 12.3ppm	
44 — 6						SC	**CLAYEY SAND**: grayish brown; moist; about 60% subangular fine to coarse Sand (max.4.8mm); about 40% Fines; medium plasticity; alluvial soil.		
43 — 7	S4					SM	**SILTY SAND**: brown; moist; about 70% subangular fine to coarse Sand (max.4.8mm); about 30% Fines; no plasticity; residual soil. Granite texture.		
42 — 8							Hard pushing of sampler at 8.5-8.75m; HDP (Hydraulic Down Pressure) = 1000 psi.		
							Penetration refusal depth = 8.75m (Penetration speed = 2cm / 1min).		

ENVIRO-EXPLORATION LOG 11-032E-PHASE2-FINAL.GPJ USACE SKOREA.GDT 8/22/11

EXPLORATION LOG

US Army Corps Of Engineers

HOLE NO. **E11-185**

Far East District

PROJECT: **Phase II Site Soil Sampling**
LOCATION: **Camp Carroll**   G&EE NO.: **11-032E**   INSPECTOR: ▮▮▮▮▮
DATE STARTED: **06 Aug 11**   FINISHED: **06 Aug 11**   DRILLER: ▮▮▮▮▮
DRILLING METHOD/EQUIPMENT: **BEC50PM-1**
DRILLING AGENCY: **BEC**   HOLE DIAMETER: **5.5 cm**   TOTAL DEPTH: **8.8 m**
OVERBURDEN THICKNESS: _____   DEPTH DRILLED: **8.8 m**   WATER DEPTH: **2.0 m; AD**
COORDINATES: N: **3,983,304.7** E: **447,806.0**   GROUND ELEV.: **50.97 m**   DATUM: **MSL**
GROUND COVER: **Grass**   CONTAMINATION: _____
TYPE OF HOLE: ☐ Piezometer   ☐ Monitoring Well   ☐ Test Pit   ☐ Auger Hole   ☒ other **Direct push sampling hole**

ELEVATION / DEPTH (meters)	SAMPLE TYPE / NUMBER	GRAPHIC LOG	CONTAMINATED	BLOW COUNT	SPT N-VALUE	USCS / STRATA	DESCRIPTION OF MATERIALS	FIELD DATA	LAB DATA
0	S1					FILL	**CLAYEY SAND**: brown; moist; about 10% subangular fine to coarse gravel (max.3cm); about 65% subangular fine to coarse Sand (max.4.8mm); about 25% Fines; medium plasticity; fill material (SC).	%Recovery = 100 PID = 2.4ppm FC = F3	
50 / 1	S2					FILL	**SILTY SAND**: brown; moist; about 5% subangular fine gravel (max.1cm); about 70% subangular fine to coarse Sand (max.4.8mm); about 25% Fines; no plasticity; fill material (SM). About 75% subangular fine to coarse Sand (max.4.8mm); about 25% Fines; no gravels; encountered clayey sand layer at 1.8m to 1.9m.	%Recovery = 93 PID = 2.8 - 2.9ppm FC = F3	
49 / 2						FILL	**CLAYEY SAND**: brown; moist; about 5% subangular fine gravel (max.2cm); about 70% subangular fine to coarse Sand (max.4.8mm); about 25% Fines; medium plasticity; fill material (SC).	%Recovery = 87 PID = 2.6 - 3.5ppm	
48 / 3	S3						Wet soil at 3.0m to 3.2m.		
47 / 4						FILL	**SILTY SAND**: brown; moist; about 5% subangular fine gravel (max.2cm); about 70% subangular fine to coarse Sand (max.4.8mm); about 25% Fines; no plasticity; fill material (SM). Wet.		
46 / 5						CL	**SANDY LEAN CLAY**: grayish brown; moist; about 40% subangular fine to medium Sand (max.2mm); about 60% Fines; medium plasticity; alluvial soil.		
						SC	**CLAYEY SAND**: grayish brown; moist; about 60% subangular fine to medium Sand (max.2mm); about 40% Fines; medium plasticity; alluvial soil.	%Recovery = 63 PID = 0.6 - 4.2ppm	
45 / 6						CH	**FAT CLAY with Sand**: grayish brown; moist; about 20% subangular fine Sand (max.0.43mm); about 80% Fines; high plasticity; alluvial soil. Grayish brown to gray; about 20% subangular fine to medium Sand (max.2mm); about 80% Fines.		
44 / 7	S4						Encountered clayey sand layer (5cm).		
43 / 8						SC	**CLAYEY SAND**: brown; moist; about 70% subangular fine to coarse Sand (max.4.8mm); about 30% Fines; medium plasticity; residual soil; disturbed granite texture.		
						SM	**SILTY SAND**: brown; moist; about 70% subangular fine to coarse Sand (max.4.8mm); about 30% Fines; no plasticity; residual soil; granite texture;. Hard pushing of sampler at 8.55-8.8m; HDP (Hydraulic Down Pressure) = 1000 psi;. Penetration refusal depth = 8.8m (Penetration speed = 1cm / 1min).		

CEPOF-ED-G

59 37 PAGE 1 of 1

ENVIRO-EXPLORATION LOG 11-032E-PHASE2-FINAL.GPJ USACE SKOREA.GDT 8/22/11

EXPLORATION LOG

US Army Corps Of Engineers

HOLE NO. **E11-186**

Far East District

PROJECT: Phase II Site Soil Sampling
LOCATION: Camp Carroll
G&EE NO.: 11-032E
INSPECTOR:
DATE STARTED: 06 Aug 11   **FINISHED:** 06 Aug 11   **DRILLER:**
DRILLING METHOD/EQUIPMENT: BEC50PM-1
DRILLING AGENCY: BEC   **HOLE DIAMETER:** 5.5 cm   **TOTAL DEPTH:** 8.0 m
OVERBURDEN THICKNESS: ___   **DEPTH DRILLED:** 8.0 m   **WATER DEPTH:** 3.4 m; AD
COORDINATES: N: 3,983,296.6 E: 447,822.8   **GROUND ELEV.:** 52.43 m   **DATUM:** MSL
GROUND COVER: Weed   **CONTAMINATION:**
TYPE OF HOLE: ☐ Piezometer   ☐ Monitoring Well   ☐ Test Pit   ☐ Auger Hole   ☒ other Direct push sampling hole

ELEVATION / DEPTH (meters)	SAMPLE TYPE / NUMBER	GRAPHIC LOG	CONTAMINATED	BLOW COUNT	SPT N-VALUE	USCS / STRATA	DESCRIPTION OF MATERIALS	FIELD DATA	LAB DATA
0 / 52	S1					FILL	**SILTY SAND**: brown; moist; about 10% subangular fine to coarse gravel (max.3cm); about 65% subangular fine to coarse Sand (max.4.8mm); about 25% Fines; no plasticity; fill material (SM); encountered clayey sand layer.	%Recovery = 100 PID = 3.6ppm FC = F3	
1 / 51	S2							%Recovery = 88 PID = 1.1 - 1.5ppm	
2 / 50						FILL	**CLAYEY SAND**: reddish brown; moist to wet; about 5% subangular fine gravel (max.2cm); about 60% subangular fine to coarse Sand (max.4.8mm); about 35% Fines; medium plasticity; fill material (SC). Brown; moist; about 5% subangular fine gravel (max.2cm); about 70% subangular fine to coarse Sand (max.4.8mm); about 25% Fines; encountered silty sand layer at 2.5m to 2.6m.	%Recovery = 90 PID = 2.3 - 4.2ppm	
3 / 49	S3						Brown to reddish brown; about 75% subangular fine to coarse Sand (max.4.8mm); about 25% Fines; encountered silty sand layer at 3.3m to 3.5m.		
4 / 48							Moist to wet.		
5 / 47						CL / SC	**SANDY LEAN CLAY**: grayish brown; moist; about 40% subangular fine to coarse Sand (max.4.8mm); about 60% Fines; medium plasticity; alluvial soil; with organics. **CLAYEY SAND**: dark brown; moist; about 65% subangular fine to coarse Sand (max.4.8mm); about 35% Fines; high plasticity; alluvial soil.	%Recovery = 62 PID = 2.6 - 3.5ppm	
6 / 46	S4					CH	**SANDY FAT CLAY**: dark brown; moist; about 30% subangular fine to coarse Sand (max.4.8mm); about 70% Fines; high plasticity; alluvial soil.		
7 / 45						SC	**CLAYEY SAND**: brown; moist; about 70% subangular fine to coarse Sand (max.4.8mm); about 30% Fines; medium plasticity; residual soil; disturbed granite texture. Hard pushing of sampler at 7.7-8.0m; HDP (Hydraulic Down Pressure) = 1000 psi.		
8							Penetration refusal depth = 8.0m (Penetration speed = 5cm / 1min).		

ENVIRO-EXPLORATION LOG 11-032E-PHASE2-FINAL.GPJ USACE SKOREA.GDT 8/22/11

PROJECT: **Phase II Site Soil Sampling**
LOCATION: **Camp Carroll**   G&EE NO.: **11-032E**   INSPECTOR: _____ *bb*
DATE STARTED: **05 Aug 11**   FINISHED: **05 Aug 11**   DRILLER: _____ *bb*
DRILLING METHOD/EQUIPMENT: **BEC50PM-1**
DRILLING AGENCY: **BEC**   HOLE DIAMETER: **5.5 cm**   TOTAL DEPTH: **10.0 m**
OVERBURDEN THICKNESS: _____   DEPTH DRILLED: **10.0 m**   WATER DEPTH: **5.27 m; AD**
COORDINATES: N: **3,983,323.6** E: **447,829.9**   GROUND ELEV.: **54.91 m**   DATUM: **MSL**
GROUND COVER: **Grass**   CONTAMINATION: _____
TYPE OF HOLE: ☐ Piezometer   ☐ Monitoring Well   ☐ Test Pit   ☐ Auger Hole   ☒ other **Direct push sampling hole**

ELEVATION / DEPTH (meters)	SAMPLE TYPE / NUMBER	GRAPHIC LOG	CONTAMINATED	BLOW COUNT	SPT N-VALUE	USCS / STRATA	DESCRIPTION OF MATERIALS	FIELD DATA	LAB DATA
0	S1					FILL	**SILTY SAND**: brown; moist; about 10% subangular fine gravel (max.2cm); about 65% subangular fine to coarse Sand (max.4.8mm); about 25% Fines; no plasticity; fill material (SM).	%Recovery = 100 / PID = 1.2ppm / FC = F3	
54 / 1	S2							%Recovery = 97 / PID = 1.1 - 1.8ppm	
							About 5% subangular fine gravel (max.2cm); about 70% subangular fine to coarse Sand (max.4.8mm); about 25% Fines; encountered clayey sand layer.		
53 / 2								%Recovery = 93 / PID = 0.8 - 2.0ppm	
52 / 3									
51 / 4	S3					FILL	**CLAYEY SAND**: reddish brown; moist; about 70% subangular fine to coarse Sand (max.4.8mm); about 30% Fines; medium plasticity; fill material (SC).		
						FILL	**SILTY SAND**: dark brown; moist; about 5% subangular fine to coarse gravel (max.3cm); about 70% subangular fine to coarse Sand (max.4.8mm); about 25% Fines; no plasticity; fill material (SM).		
50 / 5							Brown; moist to wet; about 3% subangular fine gravel (max.1cm); about 72% subangular fine to coarse Sand (max.4.8mm); about 25% Fines; encountered fat clay with sand layer at 5.8m to 5.9m.	%Recovery = 88 / PID = 0.3 - 2.3ppm	
49 / 6							Moist to wet; about 3% subangular fine gravel (max.2cm); about 72% subangular fine to coarse Sand (max.4.8mm); about 25% Fines; encountered clayey sand layer.		
48 / 7	S4					SC	**CLAYEY SAND**: dark brown; moist to wet; about 70% subangular fine to medium Sand (max.2mm); about 30% Fines; alluvial soil; encountered fat clay layer at 7.0m to 7.1m.		
47 / 8						CH	**FAT CLAY**: dark gray; moist; about 10% fine Sand (max.0.43mm); about 90% Fines; high plasticity; alluvial soil.		
46 / 9						SC	**CLAYEY SAND**: brown; moist to wet; about 80% subangular fine to coarse Sand (max.4.8mm); about 20% Fines; medium plasticity; alluvial soil. Wet. Easy pushing of sampler at 9.0-10.0m; HDP (Hydraulic Down Pressure) = 100 psi.		
45 / 10							Penetration refusal depth = 10.0m (Penetration speed = 10cm / 10sec).		

ENVIRO-EXPLORATION LOG 11-032E-PHASE2-FINAL.GPJ USACE SKOREA.GDT 8/22/11

CEPOF-ED-G

PROJECT: Phase II Site Soil Sampling
LOCATION: Camp Carroll
G&EE NO.: 11-032E
INSPECTOR: (redacted)
DATE STARTED: 05 Aug 11 **FINISHED:** 05 Aug 11
DRILLER: (redacted)
DRILLING METHOD/EQUIPMENT: BEC50PM-1
DRILLING AGENCY: BEC **HOLE DIAMETER:** 5.5 cm **TOTAL DEPTH:** 9.58 m
OVERBURDEN THICKNESS: **DEPTH DRILLED:** 9.58 m **WATER DEPTH:** Caved (0.5m); AD
COORDINATES: N: 3,983,322.2 E: 447,841.8 **GROUND ELEV.:** 55.03 m **DATUM:** MSL
GROUND COVER: Weed **CONTAMINATION:**
TYPE OF HOLE: ☐ Piezometer ☐ Monitoring Well ☐ Test Pit ☐ Auger Hole ☒ other Direct push sampling hole

ELEVATION / DEPTH (meters)	SAMPLE TYPE / NUMBER	GRAPHIC LOG	CONTAMINATED	BLOW COUNT	SPT N-VALUE	USCS / STRATA	DESCRIPTION OF MATERIALS	FIELD DATA	LAB DATA
55 — 0	S1					FILL	**SILTY SAND:** brown; moist; about 10% subangular fine to coarse gravel (max.3cm); about 65% subangular fine to coarse Sand (max.4.8mm); about 25% Fines; no plasticity; fill material (SM).	%Recovery = 100 PID = 2.5ppm FC = F3	
54 — 1	S2						About 5% subangular fine gravel (max.2cm); about 70% subangular fine to coarse Sand (max.4.8mm); about 25% Fines.	%Recovery = 100 PID = 3.8 - 4.2ppm	
						FILL	**CLAYEY SAND:** reddish brown; moist; about 5%; about 65% subangular fine to coarse Sand (max.4.8mm); about 30% Fines; medium plasticity; fill material (SC).	FC = F3	
53 — 2						FILL	**SILTY SAND:** brown; moist; about 5% subangular fine gravel (max.2cm); about 70% subangular fine to coarse Sand (max.4.8mm); about 25% Fines; no plasticity; fill material (SM).	%Recovery = 94 PID = 1.4 - 3.9ppm	
52 — 3	S3					FILL	**CLAYEY SAND:** brown to reddish brown; moist to wet; about 5% subangular fine gravel (max.2cm); about 70% subangular fine to coarse Sand (max.4.8mm); about 25% Fines; medium plasticity; fill material (SC); encountered silty sand layer.		
51 — 4						FILL	**SILTY SAND:** brown; moist; about 5% subangular fine gravel (max.2cm); about 70% subangular fine to coarse Sand (max.4.8mm); about 25% Fines; no plasticity; fill material (SM).		
50 — 5						FILL	**CLAYEY SAND:** reddish brown; moist; about 70% subangular fine to coarse Sand (max.4.8mm); about 30% Fines; medium plasticity; fill material (SC).	%Recovery = 76 PID = 0.9 - 3.2ppm	
49 — 6						SC	**CLAYEY SAND:** gray; moist; about 60% subangular fine to coarse Sand (max.4.8mm); about 40% Fines; medium plasticity; alluvial soil; with organics.		
						CL	**LEAN CLAY with Sand:** gray; moist; about 25% subangular fine to medium Sand (max.2mm); about 75% Fines; medium plasticity; alluvial soil.		
						SM	**SILTY SAND:** grayish brown; wet; about 80% subangular fine to medium Sand (max.2mm); about 20% Fines; no plasticity; alluvial soil.		
48 — 7	S4					SC	**CLAYEY SAND:** dark brown; moist; about 70% subangular fine to coarse Sand (max.4.8mm); about 30% Fines; medium plasticity; alluvial soil; encountered fat clay layer at 7.7m to 7.8m.		
47 — 8									
46 — 9						SM	**SILTY SAND:** brown; moist; about 70% subangular fine to coarse Sand (max.4.8mm); about 30% Fines; no plasticity; residual soil; granite texture. Hard pushing of sampler at 9.3-9.58m; HDP (Hydraulic Down Pressure) = 1000 psi.		
							Penetration refusal depth = 9.58m (Penetration speed = 5cm / 2min).		

ENVIRO-EXPLORATION LOG 11-032E-PHASE2-FINAL.GPJ USACE SKOREA.GDT 8/22/11

PROJECT: Phase II Site Soil Sampling

LOCATION: Camp Carroll	**G&EE NO.:** 11-032E	**INSPECTOR:**
DATE STARTED: 05 Aug 11	**FINISHED:** 05 Aug 11	**DRILLER:**

DRILLING METHOD/EQUIPMENT: BEC50PM-1

DRILLING AGENCY: BEC	**HOLE DIAMETER:** 5.5 cm	**TOTAL DEPTH:** 10.0 m
OVERBURDEN THICKNESS:	**DEPTH DRILLED:** 10.0 m	**WATER DEPTH:** 5.36 m; AD
COORDINATES: N: 3,983,311.0 **E:** 447,835.5	**GROUND ELEV.:** 54.81 m	**DATUM:** MSL
GROUND COVER: Weed	**CONTAMINATION:**	

TYPE OF HOLE: ☐ Piezometer ☐ Monitoring Well ☐ Test Pit ☐ Auger Hole ☒ other Direct push sampling hole

ELEVATION / DEPTH (meters)	SAMPLE TYPE / NUMBER	GRAPHIC LOG	CONTAMINATED	BLOW COUNT	SPT N-VALUE	USCS / STRATA	DESCRIPTION OF MATERIALS	FIELD DATA	LAB DATA
0	S1					FILL	**SILTY SAND:** brown; moist; about 3% subangular fine gravel (max.1cm); about 72% subangular fine to coarse Sand (max.4.8mm); about 25% Fines; no plasticity; fill material (SM).	%Recovery = 100 PID = 1.8ppm FC = F3	
54	S2						About 10% subangular fine to coarse gravel (max.3cm); about 65% subangular fine to coarse Sand (max.4.8mm); about 25% Fines; encountered clayey sand layer. No clayey sand layer.	%Recovery = 93 PID = 2.6 - 2.8ppm	
-2								%Recovery = 90 PID = 4.8 - 14.0ppm	
52	S3						About 5% subangular fine to coarse gravel (max.5cm); about 70% subangular fine to coarse Sand (max.4.8mm); about 25% Fines.		
-4							About 5% subangular fine gravel (max.1cm); about 70% subangular fine to coarse Sand (max.4.8mm); about 25% Fines; encountered clayey sand layer at 4.8m to 5.0m.		
50							Moist to wet; about 75%; about 25% Fines; no gravels; encountered clayey sand layer at 5.3m to 5.4m.	%Recovery = 90 PID = 2.7 - 12.3ppm	
-6							Moist to wet; encountered clayey sand layer.		
48	S4					CL CH	**SANDY LEAN CLAY:** gray to brown; moist; about 30% subangular fine to coarse Sand (max.4.8mm); about 70% Fines; medium plasticity; alluvial soil; with organics. **FAT CLAY:** dark brown; moist; about 10% subangular fine to medium Sand (max.2mm); about 90% Fines; high plasticity; alluvial soil.		
-8									
46						CH SM	**FAT CLAY with Sand:** brown to light gray; moist; about 5% subangular fine gravel (max.2cm); about 15% subangular fine to coarse Sand (max.4.8mm); about 80% Fines; high plasticity; alluvial soil. About 25% fine Sand (max.0.43mm); about 75% Fines; no gravels.		
-10							**SILTY SAND:** light brown; moist; about 75% subangular fine to coarse Sand (max.4.8mm); about 25% Fines; no plasticity; residual soil; granite texture. Hard pushing of sampler at 9.7-10.0m; HDP (Hydraulic Down Pressure) = 800 psi. Penetration refusal depth =10.0m (Penetration speed = 5cm / 1min).		

ENVIRO-EXPLORATION LOG 11-032E-PHASE2-FINAL.GPJ USACE SKOREA.GDT 8/22/11

CEPOF-ED-G

PROJECT: Phase II Site Soil Sampling
LOCATION: Camp Carroll   **G&EE NO.:** 11-032E   **INSPECTOR:** ⬛⬛
DATE STARTED: 08 Aug 11   **FINISHED:** 08 Aug 11   **DRILLER:** ⬛⬛
DRILLING METHOD/EQUIPMENT: BEC50PM-2
DRILLING AGENCY: BEC   **HOLE DIAMETER:** 5.5 cm   **TOTAL DEPTH:** 10.0 m
OVERBURDEN THICKNESS: _____   **DEPTH DRILLED:** 10.0 m   **WATER DEPTH:** Caved (4.8m); AD
COORDINATES: N: 3,983,371.5 E: 447,663.9   **GROUND ELEV.:** 49.61 m   **DATUM:** MSL
GROUND COVER: Grass   **CONTAMINATION:** _____
TYPE OF HOLE: ☐ Piezometer   ☐ Monitoring Well   ☐ Test Pit   ☐ Auger Hole   ☒ other Direct push sampling hole

ELEVATION / DEPTH (meters)	SAMPLE TYPE / NUMBER	GRAPHIC LOG	CONTAMINATED	BLOW COUNT	SPT N-VALUE	USCS / STRATA	DESCRIPTION OF MATERIALS	FIELD DATA	LAB DATA
0	S1					FILL	**SILTY SAND with Gravel**: brown; moist; about 25% subangular fine to coarse gravel (max.3cm); about 55% subangular fine to coarse Sand; about 20% Fines; no plasticity; fill material (SM).	%Recovery = 100 PID = 0.6ppm FC = F3	
	S2							%Recovery = 93 PID = 2.8 - 3.8ppm	
48									
2							**SILTY SAND**: moist; about 20% subrounded fine to coarse gravel (max.3cm); about 60% subangular fine to coarse Sand; about 20% Fines; no plasticity.	%Recovery = 57 PID = 1.6 - 3.5ppm	
46	S3								
4						FILL	**CLAYEY SAND**: reddish brown; moist to wet; about 60% fine to medium Sand; about 40% Fines; low plasticity; fill material (SC).		
							Water encountered at 4.8m.		
						FILL	**SILTY SAND**: brown; wet; about 70% subangular fine to coarse Sand; about 30% Fines; fill material (SM).	%Recovery = 53 PID = 1.9 - 2.7ppm	
44									
6									
						FILL	**CLAYEY SAND**: brown; moist; about 60% fine Sand; about 40% Fines; low to medium plasticity; fill material (SC); coarse angular gravel (4.5cm) encountered at 7.4m.		
42	S4					CH	**FAT CLAY with Sand**: dark brown to reddish brown; moist; about 20% fine Sand; about 80% Fines; high plasticity; residual soil.		
8									
						SC	**CLAYEY SAND**: reddish brown; moist; about 55% fine to medium Sand; about 45% Fines; residual soil; granite texture.		
40									
10									

End of direct push sampling at 10.0m; Confirmed depths of FILL MATERIAL = 0-7.4m, ALLUVIAL SOILS = 7.4-8.4m, and RESIDUAL SOIL = 8.4-10.0m.

ENVIRO-EXPLORATION LOG 11-032E-PHASE2-FINAL.GPJ USACE SKOREA.GDT 8/22/11

PROJECT: **Phase II Site Soil Sampling**
LOCATION: **Camp Carroll**　　G&EE NO.: **11-032E**　　INSPECTOR:
DATE STARTED: **09 Aug 11**　　FINISHED: **09 Aug 11**　　DRILLER:
DRILLING METHOD/EQUIPMENT: **BEC50PM-2**
DRILLING AGENCY: **BEC**　　HOLE DIAMETER: **5.5 cm**　　TOTAL DEPTH: **7.7 m**
OVERBURDEN THICKNESS: ___　　DEPTH DRILLED: **7.7 m**　　WATER DEPTH: **4.42 m; AD**
COORDINATES: N: **3,983,367.8** E: **447,600.8**　　GROUND ELEV.: **43.61 m**　　DATUM: **MSL**
GROUND COVER: **Grass**　　CONTAMINATION: ___
TYPE OF HOLE: ☐ Piezometer　☐ Monitoring Well　☐ Test Pit　☐ Auger Hole　☒ other **Direct push sampling hole**

ELEVATION / DEPTH (meters)	SAMPLE TYPE / NUMBER	GRAPHIC LOG	CONTAMINATED	BLOW COUNT	SPT N-VALUE	USCS / STRATA	DESCRIPTION OF MATERIALS	FIELD DATA	LAB DATA
0	S1					FILL	**SILTY SAND**: brown; moist; about 10% angular to subangular fine to coarse gravel (max.3cm); about 60% subangular fine to coarse Sand; about 30% Fines; no plasticity; fill material (SM).	%Recovery = 100 PID = 2.7ppm FC = F3	
43						FILL	**SILTY SAND with Gravel**: brown to dark gray; moist; about 20% subangular to angular fine to coarse gravel (max.4cm); about 55% subangular fine to coarse Sand; about 25% Fines; no plasticity; fill material (SM).	%Recovery = 100 PID = 1.2 - 3.3ppm FC = F3	
1	S2					SM	**SILTY SAND**: light brown; moist; about 60% fine to medium Sand (max.3mm); about 40% Fines; residual soil; Granite texture.	FC = F3	
42									
2								%Recovery = 100 PID = 2.3 - 4.5ppm	
41									
3							Light brown.		
40	S3								
4									
39									
5	▼							%Recovery = 100 PID = 2.3 - 4.6ppm	
38									
6							Brown; granite texture.		
37	S4 ▽						... water encountered at 6.4m while sampling; wet sample at 6.4-6.5m.		
7							Brown; wet; more silty; granite texture.		
36									

Hard pushing of sampler at 7.6-7.7m; HDP (Hydraulic Down Pressure) = 1500 psi.
Penetration refusal depth = 7.7m (Penetration speed = 2cm / 1min).

ENVIRO-EXPLORATION LOG 11-032E-PHASE2-FINAL.GPJ USACE SKOREA.GDT 8/22/11

PROJECT: **Phase II Site Soil Sampling**

LOCATION: **Camp Carroll** G&EE NO.: **11-032E** INSPECTOR: _____

DATE STARTED: **12 Aug 11** FINISHED: **12 Aug 11** DRILLER: _____

DRILLING METHOD/EQUIPMENT: **BEC50PM-2**

DRILLING AGENCY: **BEC** HOLE DIAMETER: **5.5 cm** TOTAL DEPTH: **12.0 m**

OVERBURDEN THICKNESS: _____ DEPTH DRILLED: **12.0 m** WATER DEPTH: **no water; AD**

COORDINATES: N: **3,983,360.1** E: **447,699.4** GROUND ELEV.: **49.96 m** DATUM: **MSL**

GROUND COVER: **Grass** CONTAMINATION: _____

TYPE OF HOLE: ☐ Piezometer ☐ Monitoring Well ☐ Test Pit ☐ Auger Hole ☒ other **Direct push sampling hole**

ELEVATION / DEPTH (meters)	SAMPLE TYPE / NUMBER	GRAPHIC LOG	CONTAMINATED	BLOW COUNT	SPT N-VALUE	USCS / STRATA	DESCRIPTION OF MATERIALS	FIELD DATA	LAB DATA
0	S1					FILL	**SILTY SAND**: brown; moist; about 10% angular to subangular fine to coarse gravel (max.3cm); about 70% subangular fine to coarse Sand; about 20% Fines; no plasticity; fill material (SM); grass roots at 0-0.05m.	%Recovery = 100 PID = 0.4ppm FC = F3	
	S2					FILL	**SILTY SAND with Gravel**: grayish brown to brown; moist to wet; about 35% subangular fine to coarse gravel (max.4.5cm); about 50% angular to subangular fine to coarse Sand; about 15% Fines; no plasticity; fill material (SM).	%Recovery = 77 PID = 4.4 - 8.0ppm FC = F3	
48 —2								%Recovery = 51 PID = 2.8 - 3.3ppm	
	S3						Subrounded to subangular fine to coarse gravels (max 3.5cm) at 3-4m.		
46 —4							Subangular fine gravels (max. 1cm) at 4-5m.		
44 —6						ML	**SANDY SILT**: reddish brown to brown; moist; about 40% fine to medium Sand; about 60% Fines; no plasticity; residual soil; granite texture.	%Recovery = 63 PID = 1.5 - 3.8ppm	
42 —8	S4					ML	**SILT**: red grades to reddish brown; moist; about 100% Fines; low plasticity; residual soil.		
						SM	**SILTY SAND**: grayish brown; moist; about 60% angular to subangular fine to coarse Sand; about 40% Fines; no to low plasticity; residual soil; granite texture.		
40 —10							Brown mottled with white; granite texture.		
							Light brown to brown; moist; about 70% angular to subangular fine to coarse Sand; about 30% Fines; no plasticity; granite texture.		
38 —12									

HDP (Hydraulic Down Pressure) = 1500 psi at 11.5-12.0m.

Penetration refusal depth =12.0m (Penetration speed = 25cm / 1min at 11.75-12.0m).

ENVIRO-EXPLORATION LOG 11-032E-PHASE2-FINAL.GPJ USACE SKOREA.GDT 8/22/11

PROJECT: Phase II Site Soil Sampling

LOCATION: Camp Carroll   **G&EE NO.:** 11-032E   **INSPECTOR:** ▮▮▮▮▮

DATE STARTED: 12 Aug 11   **FINISHED:** 12 Aug 11   **DRILLER:** ▮▮▮▮▮

DRILLING METHOD/EQUIPMENT: BEC50PM-1

DRILLING AGENCY: BEC   **HOLE DIAMETER:** 5.5 cm   **TOTAL DEPTH:** 8.6 m

OVERBURDEN THICKNESS: _____   **DEPTH DRILLED:** 8.6 m   **WATER DEPTH:** 0.28 m; AD

COORDINATES: N:3,983,345.7 E: 447,659.5   **GROUND ELEV.:** 43.32 m   **DATUM:** MSL

GROUND COVER: Grass   **CONTAMINATION:** _____

TYPE OF HOLE: ☐ Piezometer ☐ Monitoring Well ☐ Test Pit ☐ Auger Hole ☒ other Direct push sampling hole

ELEVATION / DEPTH (meters)	SAMPLE TYPE / NUMBER	GRAPHIC LOG	CONTAMINATED	BLOW COUNT	SPT N-VALUE	USCS / STRATA	DESCRIPTION OF MATERIALS	FIELD DATA	LAB DATA
43 — 0	S1 ▼					FILL	**SILTY SAND**: brown; moist; about 5% subangular fine to coarse gravel (max.3cm); about 70% subangular fine to coarse Sand (max.4.8mm); about 25% Fines; no plasticity; fill material (SM).	%Recovery = 60 PID = 2.5ppm FC = F3	
42 — 1	S2					FILL	Wet; about 75% subangular fine to coarse Sand (max.4.8mm); about 25% Fines.	%Recovery = 100 PID = 3.4 - 3.5ppm FC = F3	
						FILL	**CLAYEY SAND**: reddish brown; moist to wet; about 70% subangular fine to coarse Sand (max.4.8mm); about 30% Fines; medium plasticity; fill material (SC).	FC = F2	
						FILL	**SILTY SAND**: brown; wet; about 85% subangular fine to coarse Sand (max.4.8mm); about 15% Fines; no plasticity; fill material (SM).		
41 — 2						FILL	**CLAYEY SAND**: reddish brown to brown; moist; about 65% subangular fine to coarse Sand (max.4.8mm); about 35% Fines; medium plasticity; fill material (SC).	%Recovery = 69 PID = 1.5 - 2.6ppm FC = F2	
40 — 3	S3					SC	**SILTY SAND**: brown; wet; about 85% subangular fine to medium Sand (max.2mm); about 15% Fines; no plasticity; fill material (SM).		
							CLAYEY SAND: reddish brown; moist; about 65% subangular fine to medium Sand (max.2mm); about 35% Fines; medium plasticity; residual soil; granite texture.		
39 — 4									
38 — 5						SM	**SILTY SAND**: brown; moist; about 60% subangular fine to medium Sand (max.2mm); about 40% Fines; low plasticity; residual soil; granite texture.	%Recovery = 75 PID = 1.5 - 5.5ppm	
37 — 6							Reddish brown to yellowish brown; no to low plasticity; with blackish rock fragments.		
36 — 7	S4						Yellowish brown; low plasticity.		
35 — 8							About 70% subangular fine to medium Sand (max.2mm); about 30% Fines. Hard pushing of sampler at 8.4-8.6m; HDP (Hydraulic Down Pressure) = 1000 psi.		
							Penetration refusal depth = 8.6m (Penetration speed = 2cm / 1min).		

ENVIRO-EXPLORATION LOG 11-032E-PHASE2-FINAL.GPJ USACE SKOREA.GDT 8/22/11

PROJECT: **Phase II Site Soil Sampling**
LOCATION: **Camp Carroll**   G&EE NO.: ___**11-032E**___   INSPECTOR: [redacted]
DATE STARTED: ___**13 Aug 11**___   FINISHED: ___**13 Aug 11**___   DRILLER: [redacted]
DRILLING METHOD/EQUIPMENT: **BEC50PM-2**
DRILLING AGENCY: ___**BEC**___   HOLE DIAMETER: __**5.5 cm**__   TOTAL DEPTH: __**10.0 m**__
OVERBURDEN THICKNESS: ___   DEPTH DRILLED: __**10.0 m**__   WATER DEPTH: **No water; AD**
COORDINATES: N: **3,983,353.8** E: **447,607.8** GROUND ELEV.: __**42.98 m**__ DATUM: __**MSL**__
GROUND COVER: **Grass**   CONTAMINATION: ___
TYPE OF HOLE: ☐ Piezometer   ☐ Monitoring Well   ☐ Test Pit   ☐ Auger Hole   ☒ other **Direct push sampling hole**

ELEVATION / DEPTH (meters)	SAMPLE TYPE / NUMBER	GRAPHIC LOG	CONTAMINATED	BLOW COUNT	SPT N-VALUE	USCS / STRATA	DESCRIPTION OF MATERIALS	FIELD DATA	LAB DATA
0	S1					AC / FILL	Asphalt concrete pavement thickness = 10cm.	FC = F1	
						FILL	**Poorly-graded GRAVEL with Silt and Sand**: gray to dark gray; dry to moist; about 75% angular to subangular fine to coarse gravel (max.3.5cm); about 15% subangular fine Sand; about 10% Fines; fill material (GP-GM); Base course material.	FC = F3 %Recovery = 100 PID = 0ppm	
42	S2					SM	**SILTY SAND**: reddish brown to brown; moist; about 75% angular to subangular fine to coarse Sand; about 25% Fines; no plasticity; fill material (SM).	%Recovery = 100 PID = 5.4ppm	
2							**SILTY SAND**: reddish brown to brown; moist; about 65% angular to subangular fine to coarse Sand; about 35% Fines; no plasticity; residual soil; granite texture.	%Recovery = 66 PID = 4.9 - 8.4ppm	
40	S3						Light brown grades to brown; about 70% subangular fine to coarse Sand; about 30% Fines.		
4							Light brown; granite texture.		
38								%Recovery = 69 PID = 0.7 - 9.6ppm	
6							Brown; wet sample at 6.8m.		
36	S4						Light brown to pinkish brown; w/ rock fragments; dense at 7-7.4m (sampler penetration speed = 6cm/ 1min).		
8						ML	**SILT with Sand**: grayish brown; moist; about 25% fine Sand; about 75% Fines; low plasticity; residual soil; granite texture.		
						SM	**SILTY SAND**: grayish brown; moist; about 70% subangular fine to coarse Sand; about 30% Fines; no plasticity; residual soil; granite texture.		
34									
10							Hard pushing of sampler at 9.8-10.0m; HDP (Hydraulic Down Pressure) = 1500 psi. Penetration refusal depth = 10m (Penetration speed = 5cm / 1min).		

ENVIRO-EXPLORATION LOG 11-032E-PHASE2-FINAL.GPJ USACE SKOREA.GDT 8/22/11

EXPLORATION LOG

US Army Corps Of Engineers

HOLE NO. **E11-195**

Far East District

| PROJECT:	**Phase II Site Soil Sampling**			
LOCATION:	**Camp Carroll**	G&EE NO.: **11-032E**	INSPECTOR:	
DATE STARTED: **13 Aug 11**		FINISHED: **13 Aug 11**	DRILLER:	

DRILLING METHOD/EQUIPMENT: **BEC50PM-2**

DRILLING AGENCY: **BEC**	HOLE DIAMETER: **5.5 cm**	TOTAL DEPTH: **11.0 m**
OVERBURDEN THICKNESS:	DEPTH DRILLED: **11.0 m**	WATER DEPTH: **No water; AD**
COORDINATES: N: **3,983,347.7** E: **447,630.8**	GROUND ELEV.: **42.91 m**	DATUM: **MSL**
GROUND COVER: **Grass**	CONTAMINATION:	

TYPE OF HOLE: ☐ Piezometer ☐ Monitoring Well ☐ Test Pit ☐ Auger Hole ☒ other **Direct push sampling hole**

ELEVATION / DEPTH (meters)	SAMPLE TYPE / NUMBER	GRAPHIC LOG	CONTAMINATED	BLOW COUNT	SPT N-VALUE	USCS / STRATA	DESCRIPTION OF MATERIALS	FIELD DATA	LAB DATA
0						AC	Asphalt concrete pavement thickness = 7cm.	FC = F1	
	S1					FILL FILL	**Poorly-graded GRAVEL with Silt and Sand:** gray to dark gray; dry to moist; about 75% subangular to angular fine to coarse gravel (max.3cm); about 15% fine Sand; about 10% Fines; fill material (GP-GM); Base course material.	FC = F3 %Recovery = 100 PID = 3.2ppm	
42	S2						**SILTY SAND:** brown; moist; about 5% angular fine gravel (max.1.2cm); about 75% subangular fine to coarse Sand; about 20% Fines; no plasticity; fill material (SM). No gravels below 1m. Dark gray sands at 1.8-2.0m.	%Recovery = 100 PID = 4.5ppm	
2						FILL	**CLAYEY SAND:** reddish brown; moist; about 55% fine Sand; about 45% Fines; medium plasticity; fill material (SC).	%Recovery = 63 PID = 1.9 - 5.2ppm	
40	S3					SC	**CLAYEY SAND:** reddish brown; moist; about 55%; about 45% Fines; medium plasticity; residual soil; reddish brown mottled w/black at 3.8-4m.		
4						CH	**SANDY FAT CLAY:** reddish brown; moist; about 30% fine Sand; about 70% Fines; high plasticity; residual soil.		
38						ML SC	**SANDY SILT:** yellowish brown; moist; about 35% angular to subangular fine to coarse Sand; about 65% Fines; low plasticity; residual soil; granite texture.	%Recovery = 65 PID = 1.3 - 2.7ppm	
							CLAYEY SAND: light brown to yellowish brown; moist; about 65% angular to subangular fine to coarse Sand; about 35% Fines; low plasticity; residual soil; granite texture.		
6						SM	**SILTY SAND:** light brown; moist; about 55% fine to medium Sand; about 45% Fines; no to low plasticity; residual soil; granite texture.		
36	S4						Grayish brown; about 60% angular to subangular fine to coarse Sand; about 40% Fines.		
8							About 70% angular to subangular fine to coarse Sand; about 30% Fines; at 7-11m; granite texture.		
34									
10							Yellowish brown; granite texture.		
32									

Moderate sampler penetration speed (17cm / 1min) at 10.7-11m; HDP (Hydraulic Down Pressure) = 1500 psi. Penetration end depth = 11m.

FOR OFFICIAL USE ONLY 69 47

ENVIRO-EXPLORATION LOG 11-032E-PHASE2-FINAL.GPJ USACE SKOREA.GDT 8/22/11

US Army Corps Of Engineers

EXPLORATION LOG
HOLE NO. E11-196

Far East District

PROJECT: **Phase II Site Soil Sampling**
LOCATION: **Camp Carroll**   G&EE NO.: **11-032E**   INSPECTOR: ▓▓▓▓▓
DATE STARTED: **13 Aug 11**   FINISHED: **13 Aug 11**   DRILLER: ____
DRILLING METHOD/EQUIPMENT: **BEC50PM-1**
DRILLING AGENCY: **BEC**   HOLE DIAMETER: **5.5 cm**   TOTAL DEPTH: **10.3 m**
OVERBURDEN THICKNESS: ____   DEPTH DRILLED: **10.3 m**   WATER DEPTH: **1.77 m; AD**
COORDINATES: N: **3,983,340.5** E: **447,654.1**   GROUND ELEV.: **42.90 m**   DATUM: **MSL**
GROUND COVER: **Grass**   CONTAMINATION: ____
TYPE OF HOLE: ☐ Piezometer ☐ Monitoring Well ☐ Test Pit ☐ Auger Hole ☒ other **Direct push sampling hole**

ELEVATION / DEPTH (meters)	SAMPLE TYPE / NUMBER	GRAPHIC LOG	CONTAMINATED	BLOW COUNT	SPT N-VALUE	USCS / STRATA	DESCRIPTION OF MATERIALS	FIELD DATA	LAB DATA
0	S1					AC / FILL / FILL	Asphalt concrete pavement thickness = 5cm. **Poorly-graded GRAVEL with Sand**: about 70%; about 25%; about 5% Fines; fill material (GP); base course material.	%Recovery = 60 PID = 2.9ppm FC = F3	
42	S2 ▽						**CLAYEY SAND**: reddish brown; moist; about 70% subangular fine to coarse Sand (max.4.8mm); about 30% Fines; medium plasticity; fill material (SC). Moist to wet; about 3% subangular fine gravel (max.1cm); about 57% subangular fine to coarse Sand (max.4.8mm); about 40% Fines; encountered sandy clay layer at 1.1m to 1.2m; perched water at 0.8m to 1.0m. Moist.	%Recovery = 73 PID = 4.6 - 5.2ppm	
2							Brown; no gravels.	%Recovery = 78 PID = 4.2 - 5.8ppm	
40	S3					CH / SM	**FAT CLAY**: reddish brown; moist; about 5% fine Sand (max.0.43mm); about 95% Fines; high plasticity; residual soil; disturbed granite texture. **SILTY SAND**: reddish brown; moist; about 70% subangular fine to coarse Sand (max.4.8mm); about 30% Fines; low plasticity; residual soil; granite texture.		
4							Brown; no to low plasticity.		
38									
6							No plasticity.	%Recovery = 91 PID = 2.8 - 7.0ppm	
36							Light brown.		
8	S4								
34									
10							Hard pushing of sampler at 10.2-10.3m; HDP (Hydraulic Down Pressure) = 1000 psi. Penetration refusal depth = 8.75m (Penetration speed = 5cm / 1min).		

CEPOF-ED-G

FOR OFFICIAL USE ONLY

PAGE 1 of 1

ENVIRO-EXPLORATION LOG 11-032E-PHASE2-FINAL.GPJ USACE SKOREA.GDT 8/22/11

SOIL DESCRIPTIONS

⬛ Asphalt		Fat Clay		Fat Clay with Sand		Sandy Fat Clay	
Lean Clay		Lean Clay with Sand		Sandy Lean Clay		Fill material	
Silt		Silt with Sand		Sandy Silt		Portland Cement Concrete	
Clayey Sand		Clayey Sand with Gravel		Silty Sand		Silty Sand with gravel	

ROCK DESCRIPTIONS

GROUNDWATER

▽ Groundwater 1st reading
(While drilling or at completion)

▼ Groundwater 2nd reading
(After Drilling or over 12 hours later after drilling)

SOIL SAMPLERS

Direct Push Sampling Run
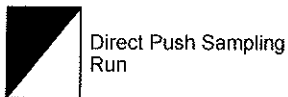
FIELD / LAB TEST DATA

LL = Liquid Limit
PI = Plasticity Index
MC = %Moisture Content
Fines = %Passing #200 Sieve
Cc = Compression Index
OCR = Overconsolidation Ratio
Tor = Torvane
PP = Pocket Penetrometer
PID = Photoionization detector
Petro FLAG = Petroleum Hydrocarbons detected
FC = Frost Classification
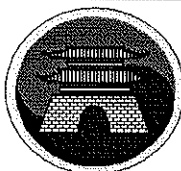
Key to Symbols

Project Name: Phase II Site Soil Sampling
Location: Camp Carroll
G&EE Number: 11-032E

5949

1. The dates of drilling/penetration and type of equipment used are shown on the logs. All soils were classified in accordance with ASTM D 2488. Results of tests conducted on recovered samples are shown on the logs.

2. Borehole locations and elevations were determined using GPS RTK and/or Traverse methods. Equipments used are Trimble GPS RTK and/or Sokkia Total Stations. Survey Datum is WGS84, UTM Zone 52 and Elevations are Mean Sea Level (MSL).

3. The groundwater table is representative of boring location and time of drilling/sampling , and may change according to seasonal precipitation.

4. The exploration logs are subject to the limitations, conclusions, and recommendations provided in the report. Some variation in the subsurface conditions and depth to specific soil strata between boring locations can be expected.

5. Soil and rock conditions and associated stratigraphic features as depicted in the boring logs are specific for the particular drilling/sampling location, and may vary between boreholes.

6. Penetration refusal depth on the logs is based on achieving an penetration speed within dense to very dense residual soil or decomposed bedrock above groundwater table or no water conditions.

7. When direct push sampling system used, some gravelly soils may have the potential to provide poor sample recovery or erroneous penetration speed due to the coarse size of the particles, as compared to the size of the sampler (35mm ID).
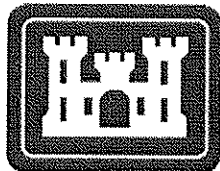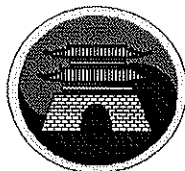
	Note
US Army Corps of Engineers Far East Distric	Project Name: Phase II Site Soil Sampling Location: Camp Carroll G&EE Number: 11-032E

FOR OFFICIAL USE ONLY

GRAPHIC SCALE (m)

0   20   40   60   80

1 : 2000

WGS 84

...11-032k_bor_16 Aug 11.dgn 8/16/2011 1:35:07 PM

FOR OFFICIAL USE ONLY
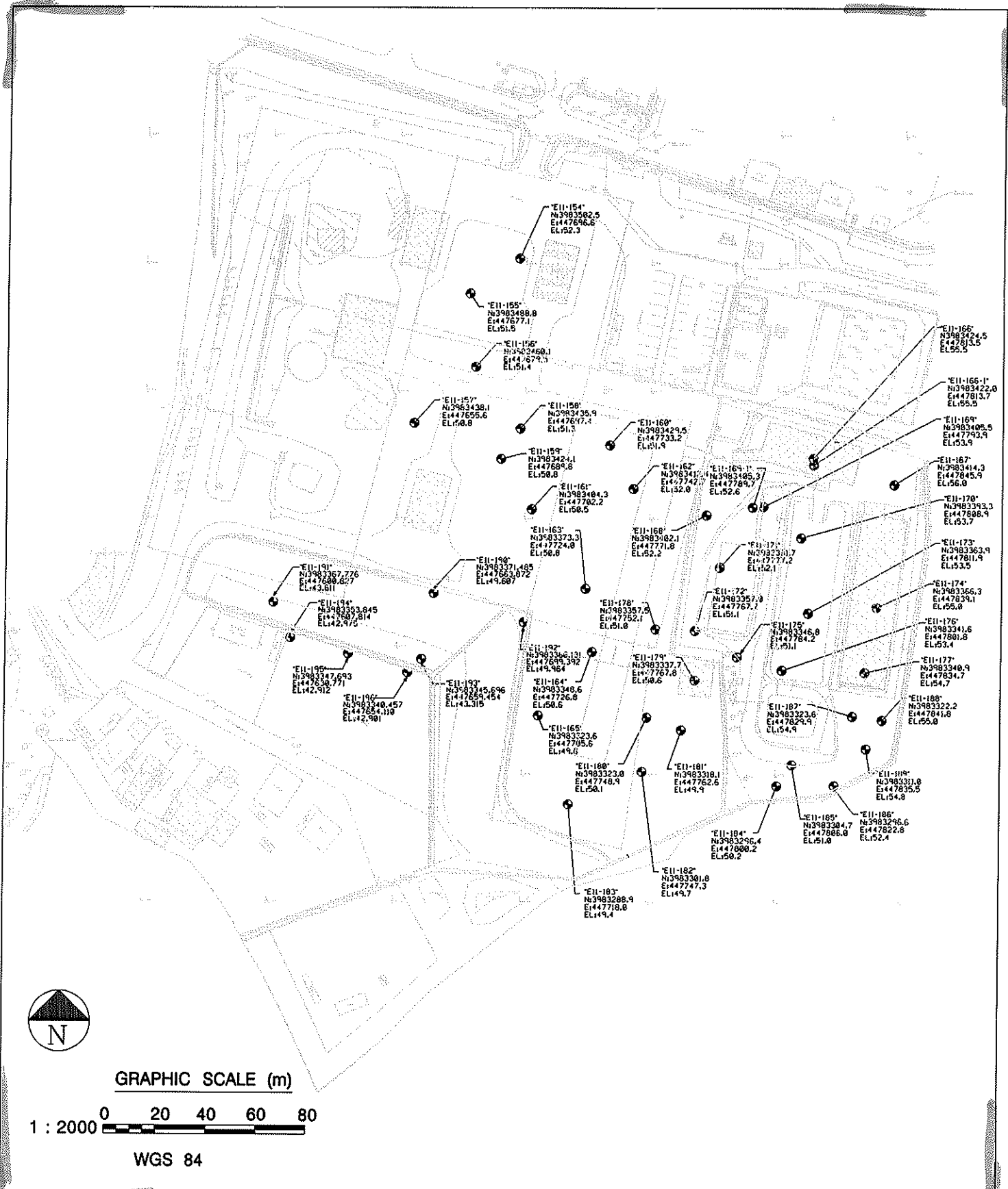
5951

APPENDIX G

RESULTS OF THE JOHNSON AND ETTINGER ONLINE MODEL RUNS

5952

⬥EPA United States
Environmental Protection
Agency

Ecosystems Research Division

EPA On-line Tools for Site Assessment Calculation

48 of 67

Screening Level Implementation of the Johnson and Ettinger Vapor Intrusion Model with two variable/uncertain parameters (source depth, moisture content)

Forward Calculation of Indoor Air Concentration

Backward Calculation full uncertainty analysis

Background

Migration of volatile chemicals from the subsurface into overlying buildings is called vapor intrusion (VI). Volatile organic chemicals in contaminated soils or groundwater can emit vapors, which may migrate through subsurface soils and may enter the indoor air of overlying buildings. Building depressurization may cause these vapors to enter the home through cracks in the foundation. Depressurization can be caused by a combination of wind effects and stack effects, which are the result of heating within the building and/or mechanical ventilation. In extreme cases, the vapors may accumulate in dwellings to levels that may pose near-term safety hazards, such as explosion. Typically, however, vapor concentrations are present at low levels, to which long-term exposure may pose increased risk for chronic health effects.

This on-line calculator implements the Johnson and Ettinger (J&E) (Johnson and Ettinger, 1991) simplified model to evaluate the vapor intrusion pathway into buildings. This J&E model replicates the implementation that the US EPA Office of Solid Waste and Emergency Response (OSWER) used in developing its draft vapor intrusion guidance, but includes a number of enhancements that are facilitated by web implementation: temperature dependence of Henry's Law Constants and gaseous diffusivities, automatic sensitivity analysis of certain parameters, and others described on the background page.

The results you obtain from this OnSite implementation of the Johnson and Ettinger model may differ from other versions of the Johnson & Ettinger Model. In addition to the OSWER implementation that was used for the draft vapor intrusion guidance, EPA Office of Emergency Response and Remediation (OERR) distributes a set of spreadsheet implementations of the model. The differences among these implementations is described in detail on the results page. Beyond these differences the on-line version includes a simplified uncertainty analysis the other implementations lack.

	Click For an Example	
Enter Site Name (optional):		Industrial Worker - Phase II

Enter sample concentration, units and media type	1.68	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)	7	meters	
This value can change by +/-	1	meters	

What is your contaminant of concern (COC)? Vinyl chloride (chloroethene)

What type of building are you investigating at your site? Slab-on-Grade

What type of soil is beneath the building? Loam

What is the average soil/ground water temperature? 55 Farenheit

Chemical Properties

CAS Number	75014		
Molecular Weight (MW)	62.5	[g/mole]	
Henry's Law Constant at ground water temperature (H)	0.8021316	[unitless]	
Free-Air Diffusion Coefficient (D_a)	0.1060	[cm2/s]	
Diffusivity in Water (D_w)	1.230e-5	[cm2/s]	
Unit Risk Factor (URF)	8.80e-6	[(µg/m3)-1]	
Reference Concentration (RfC)	0.100	[mg/m3]	

Soil Properties

Total Porosity (n)		0.399	[unitless]	
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]	
Height of Capillary Zone (CZ_h)		0.375	[m]	
Soil-gas Flow Rate Into the Building (Q_{soil})		5.00	[L/min]	

Building Properties

Air Exchange Rate (E_B)	0.250	[hr-1]
Building Mixing Height (H_B)	2.44	[m]
Building Footprint Area (F_B)	100.0	[m2]
Subsurface Foundation Area (A_B)	106.0	[m2]

Building Crack Ratio (η)	0.00038	[unitless]
Building Foundation Slab Thickness (L$_{crack}$)	0.100	[m]

Exposure Parameters

Exposure Duration for Carcinogens (ED$_c$)	25	[years]
Exposure Frequency for Carcinogens (EF$_c$)	250	[days/year]
Averaging Time for Carcinogens (AT$_c$)	70	[years]
Exposure Duration for Non-Carcinogens (ED$_{nc}$)	25	[years]
Exposure Frequency for Non-Carcinogens (EF$_{nc}$)	250	[days/year]
Averaging Time for Non-Carcinogens (AT$_{nc}$)	25	[years]

CALCULATE RESULTS

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (D$_{eff}$)	0.006672	[cm2/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (D^T$_{eff}$)	0.001289	[cm2/s]

"A" Parameter	1.152e-4	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.
"B" Parameter	310.1	
"C" Parameter	0.004918	

Johnson & Ettinger Attenuation Factor (α)   1.126e-4

	INDOOR AIR RESULTS FOR GROUND WATER		SAMPLE DATA					
	Low Prediction[1]			Best Estimate			High Prediction[2]	
Indoor Air Concentration	0.08613 [µg/m3]	0.03372 [ppbv]		0.1517 [µg/m3]	0.05939 [ppbv]		0.1729 [µg/m3]	0.06767 [ppbv]
Cancer Risk	1.854e-7			3.266e-7			3.721e-7	
Hazard Quotient	5.899e-4			0.001039			0.001184	

[1] "Low Prediction" concentration produced with HIGHEST   moisture content and DEEPEST   depth to contamination.

[2] "High Prediction" concentration produced with LOWEST   moisture content and SHALLOWEST   depth to contamination.

CLEAR ALL

FORMAT REPORT FOR PRINTER

What do these results mean?

Comments or suggestions

Top ^
Home | Glossary | Notation | Links | References | Calculators

WCMS
Last updated on Thursday, April 07, 2011

http://www.epa.gov/athens/learn2model/part-two/onsite/JnE_lite_forward.html

⚡EPA United States
Environmental Protection
Agency

Ecosystems Research Division

EPA On-line Tools for Site Assessment Calculation

48 of 67

Screening Level Implementation of the Johnson and Ettinger Vapor Intrusion Model with two variable/uncertain parameters (source depth, moisture content)

Forward Calculation of Indoor Air Concentration

Backward Calculation full uncertainty analysis

Background

Migration of volatile chemicals from the subsurface into overlying buildings is called vapor intrusion (VI). Volatile organic chemicals in contaminated soils or groundwater can emit vapors, which may migrate through subsurface soils and may enter the indoor air of overlying buildings. Building depressurization may cause these vapors to enter the home through cracks in the foundation. Depressurization can be caused by a combination of wind effects and stack effects, which are the result of heating within the building and/or mechanical ventilation. In extreme cases, the vapors may accumulate in dwellings to levels that may pose near-term safety hazards, such as explosion. Typically, however, vapor concentrations are present at low levels, to which long-term exposure may pose increased risk for chronic health effects.

This on-line calculator implements the Johnson and Ettinger (J&E) (Johnson and Ettinger, 1991) simplified model to evaluate the vapor intrusion pathway into buildings. This J&E model replicates the implementation that the US EPA Office of Solid Waste and Emergency Response (OSWER) used in developing its draft vapor intrusion guidance, but includes a number of enhancements that are facilitated by web implementation: temperature dependence of Henry's Law Constants and gaseous diffusivities, automatic sensitivity analysis of certain parameters, and others described on the background page.

The results you obtain from this OnSite Implementation of the Johnson and Ettinger model may differ from other versions of the Johnson & Ettinger Model. In addition to the OSWER implementation that was used for the draft vapor intrusion guidance, EPA Office of Emergency Response and Remediation (OERR) distributes a set of spreadsheet implementations of the model. The differences among these implementations is described in detail on the results page. Beyond these differences the on-line version includes a simplified uncertainty analysis the other implementations lack.

	Click For an Example	
Enter Site Name (optional):		Industrial Worker - phase II

Enter sample concentration, units and media type	1.01e-1	µg/L		Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)		7		meters
This value can change by +/-		1		meters
What is your contaminant of concern (COC)?	alpha-HCH (alpha-BHC)			
What type of building are you investigating at your site?			Slab-on-Grade	
What type of soil is beneath the building?			Loam	
What is the average soil/ground water temperature?		55	Farenheit	

Chemical Properties

CAS Number	319846		
Molecular Weight (MW)	290.83	[g/mole]	
Henry's Law Constant at ground water temperature (H)	0.00009886	[unitless]	
Free-Air Diffusion Coefficient (D_a)	1.420e-2	[cm2/s]	
Diffusivity in Water (D_w)	7.340e-6	[cm2/s]	
Unit Risk Factor (URF)	1.80e-3	[(µg/m3)-1]	
Reference Concentration (RfC)	0.	[mg/m3]	

Soil Properties

Total Porosity (n)		0.399	[unitless]	
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]	
Height of Capillary Zone (CZ_h)		0.375	[m]	
Soil-gas Flow Rate Into the Building (Q_{soil})		5.00	[L/min]	

Building Properties

Air Exchange Rate (E_B)	0.250	[hr-1]	
Building Mixing Height (H_B)	2.44	[m]	
Building Footprint Area (F_B)	100.0	[m2]	
Subsurface Foundation Area (A_B)	106.0	[m2]	

5955

	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (L_{crack})	0.100	[m]
Exposure Parameters			
	Exposure Duration for Carcinogens (ED_c)	25	[years]
	Exposure Frequency for Carcinogens (EF_c)	250	[days/year]
	Averaging Time for Carcinogens (AT_c)	70	[years]
	Exposure Duration for Non-Carcinogens (ED_{nc})	25	[years]
	Exposure Frequency for Non-Carcinogens (EF_{nc})	250	[days/year]
	Averaging Time for Non-Carcinogens (AT_{nc})	25	[years]

CALCULATE RESULTS

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (D_{eff})	0.001699	[cm²/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (D^T_{eff})	0.001780	[cm²/s]

"A" Parameter	1.591e-4	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.
"B" Parameter	1218.	
"C" Parameter	0.004918	

Johnson & Ettinger Attenuation Factor (α)   1.541e-4

INDOOR AIR RESULTS FOR GROUND WATER	SAMPLE DATA							
	Low Prediction1		Best Estimate			High Prediction2		
Indoor Air Concentration	1.344e-6 [µg/m3]	1.131e-7 [ppbv]	1.539e-6 [µg/m3]	1.295e-7 [ppbv]		4.188e-6 [µg/m3]	3.523e-7 [ppbv]	
Cancer Risk	5.918e-10		6.776e-10			1.844e-9		
Hazard Quotient	0.		0.			0.		

1 "Low Prediction" concentration produced with BEST ESTIMATE   moisture content and DEEPEST   depth to contamination.

2 "High Prediction" concentration produced with HIGHEST   moisture content and SHALLOWEST   depth to contamination.

CLEAR ALL

FORMAT REPORT FOR PRINTER

What do these results mean?

Comments or suggestions

Top ^
Home | Glossary | Notation | Links | References | Calculators

⬥EPA United States Environmental Protection Agency

Ecosystems Research Division

EPA On-line Tools for Site Assessment Calculation

Screening Level Implementation of the Johnson and Ettinger Vapor Intrusion Model with two variable/uncertain parameters (source depth, moisture content)

Forward Calculation of Indoor Air Concentration

Backward Calculation full uncertainty analysis

Background

Migration of volatile chemicals from the subsurface into overlying buildings is called vapor intrusion (VI). Volatile organic chemicals in contaminated soils or groundwater can emit vapors, which may migrate through subsurface soils and may enter the indoor air of overlying buildings. Building depressurization may cause these vapors to enter the home through cracks in the foundation. Depressurization can be caused by a combination of wind effects and stack effects, which are the result of heating within the building and/or mechanical ventilation. In extreme cases, the vapors may accumulate in dwellings to levels that may pose near-term safety hazards, such as explosion. Typically, however, vapor concentrations are present at low levels, to which long-term exposure may pose increased risk for chronic health effects.

This on-line calculator implements the Johnson and Ettinger (J&E) (Johnson and Ettinger, 1991) simplified model to evaluate the vapor intrusion pathway into buildings. This J&E model replicates the implementation that the US EPA Office of Solid Waste and Emergency Response (OSWER) used in developing its draft vapor intrusion guidance, but includes a number of enhancements that are facilitated by web implementation: temperature dependence of Henry's Law Constants and gaseous diffusivities, automatic sensitivity analysis of certain parameters, and others described on the background page.

The results you obtain from this OnSite implementation of the Johnson and Ettinger model may differ from other versions of the Johnson & Ettinger Model. In addition to the OSWER implementation that was used for the draft vapor intrusion guidance, EPA Office of Emergency Response and Remediation (OERR) distributes a set of spreadsheet implementations of the model. The differences among these implementations is described in detail on the results page. Beyond these differences the on-line version includes a simplified uncertainty analysis the other implementations lack.

Click For an Example	

Enter Site Name (optional):		Industrial Worker - phase II		
Enter sample concentration, units and media type	.835	µg/L		Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(Lт)		7		meters
This value can change by +/-		1		meters
What is your contaminant of concern (COC)?	gamma-HCH (Lindane)			
What type of building are you investigating at your site?			Slab-on-Grade	
What type of soil is beneath the building?			Loam	
What is the average soil/ground water temperature?			55	Farenheit

Chemical Properties

CAS Number	58899	
Molecular Weight (MW)	290.83	[g/mole]
Henry's Law Constant at ground water temperature (H)	0.00013057	[unitless]
Free-Air Diffusion Coefficient (Da)	1.420e-2	[cm^2/s]
Diffusivity in Water (Dw)	7.340e-6	[cm^2/s]
Unit Risk Factor (URF)	3.71e-4	[(µg/m^3)$^{-1}$]
Reference Concentration (RfC)	1.05e-3	[mg/m^3]

Soil Properties

Total Porosity (n)		0.399		[unitless]
Unsaturated Zone Moisture Content (θw)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure (θw,cap)		0.332		[unitless]
Height of Capillary Zone (CZh)		0.375		[m]
Soil-gas Flow Rate Into the Building (Qsoil)		5.00		[L/min]

Building Properties

Air Exchange Rate (EB)	0.250	[hr^{-1}]
Building Mixing Height (HB)	2.44	[m]
Building Footprint Area (FB)	100.0	[m^2]
Subsurface Foundation Area (AB)	106.0	[m^2]

Building Crack Ratio (η)   0.00038   [unitless]
Building Foundation Slab Thickness (L_crack)   0.100   [m]

Exposure Parameters

Exposure Duration for Carcinogens (ED_c)	25	[years]
Exposure Frequency for Carcinogens (EF_c)	250	[days/year]
Averaging Time for Carcinogens (AT_c)	70	[years]
Exposure Duration for Non-Carcinogens (ED_nc)	25	[years]
Exposure Frequency for Non-Carcinogens (EF_nc)	250	[days/year]
Averaging Time for Non-Carcinogens (AT_nc)	25	[years]

[CALCULATE RESULTS]

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (D_eff)	0.001503	[cm2/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (D^T_eff)	0.001573	[cm2/s]

"A" Parameter   1.406e-4

"B" Parameter   1376.

"C" Parameter   0.004918

Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.

Johnson & Ettinger Attenuation Factor (α)   1.367e-4

	INDOOR AIR RESULTS FOR GROUND WATER			SAMPLE DATA						
	Low Prediction[1]			Best Estimate			High Prediction[2]			
Indoor Air Concentration	1.301e-5	[µg/m3] 1.095e-6	[ppbv]	1.490e-5	[µg/m3] 1.254e-6	[ppbv]	3.584e-5	[µg/m3] 3.015e-6	[ppbv]	
Cancer Risk	1.181e-9			1.353e-9			3.252e-9			
Hazard Quotient	8.488e-6			9.722e-6			2.338e-5			

[1] "Low Prediction" concentration produced with BEST ESTIMATE moisture content and DEEPEST depth to contamination.

[2] "High Prediction" concentration produced with HIGHEST moisture content and SHALLOWEST depth to contamination.
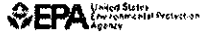
[CLEAR ALL]

[FORMAT REPORT FOR PRINTER]

What do these results mean?

Comments or suggestions

Top ^

Home | Glossary | Notation | Links | References | Calculators

5958

EPA United States Environmental Protection Agency

Ecosystems Research Division

EPA On-line Tools for Site Assessment Calculation

Screening Level Implementation of the Johnson and Ettinger Vapor Intrusion Model with two variable/uncertain parameters (source depth, moisture content)

Forward Calculation of Indoor Air Concentration

Backward Calculation full uncertainty analysis

Background

Migration of volatile chemicals from the subsurface into overlying buildings is called vapor intrusion (VI). Volatile organic chemicals in contaminated soils or groundwater can emit vapors, which may migrate through subsurface soils and may enter the indoor air of overlying buildings. Building depressurization may cause these vapors to enter the home through cracks in the foundation. Depressurization can be caused by a combination of wind effects and stack effects, which are the result of heating within the building and/or mechanical ventilation. In extreme cases, the vapors may accumulate in dwellings to levels that may pose near-term safety hazards, such as explosion. Typically, however, vapor concentrations are present at low levels, to which long-term exposure may pose increased risk for chronic health effects.

This on-line calculator implements the Johnson and Ettinger (J&E) (Johnson and Ettinger, 1991) simplified model to evaluate the vapor intrusion pathway into buildings. This J&E model replicates the implementation that the US EPA Office of Solid Waste and Emergency Response (OSWER) used in developing its draft vapor intrusion guidance, but includes a number of enhancements that are facilitated by web implementation: temperature dependence of Henry's Law Constants and gaseous diffusivities, automatic sensitivity analysis of certain parameters, and others described on the background page.

The results you obtain from this OnSite implementation of the Johnson and Ettinger model may differ from other versions of the Johnson & Ettinger Model. In addition to the OSWER implementation that was used for the draft vapor intrusion guidance, EPA Office of Emergency Response and Remediation (OERR) distributes a set of spreadsheet implementations of the model. The differences among these implementations is described in detail on the results page. Beyond these differences the on-line version includes a simplified uncertainty analysis the other implementations lack.

Click For an Example

Enter Site Name (optional):		Industrial Worker - phase II		
Enter sample concentration, units and media type	4.36e-3	µg/L		Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(LT)		7		meters
This value can change by +/-		1		meters
What is your contaminant of concern (COC)?	Heptachlor			
What type of building are you investigating at your site?			Slab-on-Grade	
What type of soil is beneath the building?			Loam	
What is the average soil/ground water temperature?			55	Farenheit

Chemical Properties

CAS Number	76448	
Molecular Weight (MW)	373.32	[g/mole]
Henry's Law Constant at ground water temperature (H)	16.77690	[unitless]
Free-Air Diffusion Coefficient (D_a)	1.120e-2	[cm2/s]
Diffusivity in Water (D_w)	5.690e-6	[cm2/s]
Unit Risk Factor (URF)	1.30e-3	[(µg/m3)-1]
Reference Concentration (RfC)	1.75e-3	[mg/m3]

Soil Properties

Total Porosity (n)		0.399	[unitless]	
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]	
Height of Capillary Zone (CZ_h)		0.375	[m]	
Soil-gas Flow Rate into the Building (Q_{soil})		5.00	[L/min]	

Building Properties

Air Exchange Rate (E_B)	0.250	[hr-1]
Building Mixing Height (H_B)	2.44	[m]
Building Footprint Area (F_B)	100.0	[m2]
Subsurface Foundation Area (A_B)	106.0	[m2]

5959

Building Crack Ratio (η)	0.00038	[unitless]
Building Foundation Slab Thickness (L_{crack})	0.100	[m]

Exposure Parameters

Exposure Duration for Carcinogens (ED_c)	25	[years]
Exposure Frequency for Carcinogens (EF_c)	250	[days/year]
Averaging Time for Carcinogens (AT_c)	70	[years]
Exposure Duration for Non-Carcinogens (ED_{nc})	25	[years]
Exposure Frequency for Non-Carcinogens (EF_{nc})	250	[days/year]
Averaging Time for Non-Carcinogens (AT_{nc})	25	[years]

[CALCULATE RESULTS]

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (D_{eff})	0.0007050	[cm2/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (D^T_{eff})	0.0001337	[cm2/s]

"A" Parameter	1.194e-5	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.
"B" Parameter	2935.	
"C" Parameter	0.004918	

Johnson & Ettinger Attenuation Factor (α) 1.192e-5

	INDOOR AIR RESULTS FOR GROUND WATER		SAMPLE DATA					
	Low Prediction[1]			Best Estimate			High Prediction[2]	
Indoor Air Concentration	4.943e-4 [µg/m3]	3.240e-5 [ppbv]		8.716e-4 [µg/m3]	5.712e-5 [ppbv]		9.934e-4 [µg/m3]	6.510e-5 [ppbv]
Cancer Risk	1.572e-7			2.772e-7			3.159e-7	
Hazard Quotient	1.935e-4			3.411e-4			3.888e-4	

[1] "Low Prediction" concentration produced with HIGHEST moisture content and DEEPEST depth to contamination.

[2] "High Prediction" concentration produced with LOWEST moisture content and SHALLOWEST depth to contamination.

[CLEAR ALL]

[FORMAT REPORT FOR PRINTER]

What do these results mean?

Comments or suggestions

Top ^
Home | Glossary | Notation | Links | References | Calculators

⊕EPA United States
Environmental Protection
Agency

Ecosystems Research Division

EPA On-line Tools for Site Assessment Calculation

Screening Level Implementation of the Johnson and Ettinger Vapor Intrusion Model with two variable/uncertain parameters (source depth, moisture content)

Forward Calculation of Indoor Air Concentration

Backward Calculation full uncertainty analysis

Background

Migration of volatile chemicals from the subsurface into overlying buildings is called vapor intrusion (VI). Volatile organic chemicals in contaminated soils or groundwater can emit vapors, which may migrate through subsurface soils and may enter the indoor air of overlying buildings. Building depressurization may cause these vapors to enter the home through cracks in the foundation. Depressurization can be caused by a combination of wind effects and stack effects, which are the result of heating within the building and/or mechanical ventilation. In extreme cases, the vapors may accumulate in dwellings to levels that may pose near-term safety hazards, such as explosion. Typically, however, vapor concentrations are present at low levels, to which long-term exposure may pose increased risk for chronic health effects.

This on-line calculator implements the Johnson and Ettinger (J&E) (Johnson and Ettinger, 1991) simplified model to evaluate the vapor intrusion pathway into buildings. This J&E model replicates the implementation that the US EPA Office of Solid Waste and Emergency Response (OSWER) used in developing its draft vapor intrusion guidance, but includes a number of enhancements that are facilitated by web implementation: temperature dependence of Henry's Law Constants and gaseous diffusivities, automatic sensitivity analysis of certain parameters, and others described on the background page.

The results you obtain from this OnSite implementation of the Johnson and Ettinger model may differ from other versions of the Johnson & Ettinger Model. In addition to the OSWER implementation that was used for the draft vapor intrusion guidance, EPA Office of Emergency Response and Remediation (OERR) distributes a set of spreadsheet implementations of the model. The differences among these implementations is described in detail on the results page. Beyond these differences the on-line version includes a simplified uncertainty analysis the other implementations lack.

Click For an Example			
Enter Site Name (optional):	Industrial Worker - phase II		
Enter sample concentration, units and media type	2.91e-1	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)	7	meters	
This value can change by +/-	1	meters	
What is your contaminant of concern (COC)?	alpha-HCH (alpha-BHC)		
What type of building are you investigating at your site?	Slab-on-Grade		
What type of soil is beneath the building?	Loam		
What is the average soil/ground water temperature?	55	Farenheit	

Chemical Properties

CAS Number	319846	
Molecular Weight (MW)	290.83	[g/mole]
Henry's Law Constant at ground water temperature (H)	0.000098B6	[unitless]
Free-Air Diffusion Coefficient (D_a)	1.420e-2	[cm2/s]
Diffusivity in Water (D_w)	7.340e-6	[cm2/s]
Unit Risk Factor (URF)	1.80e-3	[(µg/m3)-1]
Reference Concentration (RfC)	0.	[mg/m3]

Soil Properties

Total Porosity (n)		0.399	[unitless]	
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]	
Height of Capillary Zone (CZ_n)		0.375	[m]	
Soil-gas Flow Rate into the Building (Q_{soil})		5.00	[L/min]	

Building Properties

Air Exchange Rate (E_B)	0.250	[hr-1]
Building Mixing Height (H_B)	2.44	[m]
Building Footprint Area (F_B)	100.0	[m2]
Subsurface Foundation Area (A_B)	106.0	[m2]

Building Crack Ratio (η)	0.00038	[unitless]
Building Foundation Slab Thickness (L_{crack})	0.100	[m]

Exposure Parameters

Exposure Duration for Carcinogens (ED_c)	26	[years]
Exposure Frequency for Carcinogens (EF_c)	250	[days/year]
Averaging Time for Carcinogens (AT_c)	70	[years]
Exposure Duration for Non-Carcinogens (ED_{nc})	25	[years]
Exposure Frequency for Non-Carcinogens (EF_{nc})	250	[days/year]
Averaging Time for Non-Carcinogens (AT_{nc})	25	[years]

CALCULATE RESULTS

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (D_{eff})	0.001699	[cm²/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (D^T_{eff})	0.001780	[cm²/s]

"A" Parameter	1.591e-4	Based on parameter analysis: Advection is the dominant mechanism across foundation.
"B" Parameter	1218.	Diffusion through soil is the overall rate-limiting process for the subsurface to
"C" Parameter	0.004918	indoor-air pathway.

Johnson & Ettinger Attenuation Factor (α) 1.541e-4

	INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA								
	Low Prediction[1]			Best Estimate			High Prediction[2]		
Indoor Air Concentration	3.872e-6	[µg/m³] 3.257e-7	[ppbv]	4.434e-6	[µg/m³] 3.730e-7	[ppbv]	1.207e-5	[µg/m³] 1.015e-6	[ppbv]
Cancer Risk	1.705e-9			1.952e-9			5.313e-9		
Hazard Quotient	0.			0.			0.		

[1] "Low Prediction" concentration produced with BEST ESTIMATE moisture content and DEEPEST depth to contamination.

[2] "High Prediction" concentration produced with HIGHEST moisture content and SHALLOWEST depth to contamination.

CLEAR ALL

FORMAT REPORT FOR PRINTER
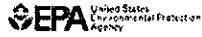
What do these results mean?

Comments or suggestions

Top ^
Home | Glossary | Notation | Links | References | Calculators

WCMS
Last updated on Thursday, April 07, 2011

http://www.epa.gov/athens/learn2model/part-two/onsite/JnE_lite_forward.html

EPA United States
Environmental Protection
Agency

Ecosystems Research Division

EPA On-line Tools for Site Assessment Calculation

Screening Level Implementation of the Johnson and Ettinger Vapor Intrusion Model with two variable/uncertain parameters (source depth, moisture content)

Forward Calculation of Indoor Air Concentration

Backward Calculation **full uncertainty analysis**

Background

Migration of volatile chemicals from the subsurface into overlying buildings is called vapor intrusion (VI). Volatile organic chemicals in contaminated soils or groundwater can emit vapors, which may migrate through subsurface soils and may enter the indoor air of overlying buildings. Building depressurization may cause these vapors to enter the home through cracks in the foundation. Depressurization can be caused by a combination of wind effects and stack effects, which are the result of heating within the building and/or mechanical ventilation. In extreme cases, the vapors may accumulate in dwellings to levels that may pose near-term safety hazards, such as explosion. Typically, however, vapor concentrations are present at low levels, to which long-term exposure may pose increased risk for chronic health effects.

This on-line calculator implements the Johnson and Ettinger (J&E) (Johnson and Ettinger, 1991) simplified model to evaluate the vapor intrusion pathway into buildings. This J&E model replicates the implementation that the US EPA Office of Solid Waste and Emergency Response (OSWER) used in developing its draft vapor intrusion guidance, but includes a number of enhancements that are facilitated by web implementation: temperature dependence of Henry's Law Constants and gaseous diffusivities, automatic sensitivity analysis of certain parameters, and others described on the background page.

The results you obtain from this OnSite implementation of the Johnson and Ettinger model may differ from other versions of the Johnson & Ettinger Model. In addition to the OSWER implementation that was used for the draft vapor intrusion guidance, EPA Office of Emergency Response and Remediation (OERR) distributes a set of spreadsheet implementations of the model. The differences among these implementations is described in detail on the results page. Beyond these differences the on-line version includes a simplified uncertainty analysis the other implementations lack.

Click For an Example				
Enter Site Name (optional):		Industrial Worker - phase II		
Enter sample concentration, units and media type	2.96e-1	µg/L		Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)		7		meters
This value can change by +/-		1		meters
What is your contaminant of concern (COC)?	alpha-HCH (alpha-BHC)			
What type of building are you investigating at your site?			Slab-on-Grade	
What type of soil is beneath the building?			Loam	
What is the average soil/ground water temperature?			55	Farenheit

Chemical Properties

CAS Number	319846	
Molecular Weight (MW)	290.83	[g/mole]
Henry's Law Constant at ground water temperature (H)	0.00009886	[unitless]
Free-Air Diffusion Coefficient (D_a)	1.420e-2	[cm2/s]
Diffusivity in Water (D_w)	7.340e-6	[cm2/s]
Unit Risk Factor (URF)	1.80e-3	[(µg/m3)-1]
Reference Concentration (RfC)	0.	[mg/m3]

Soil Properties

Total Porosity (n)		0.399	[unitless]	
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]	
Height of Capillary Zone (CZ_h)		0.375	[m]	
Soil-gas Flow Rate Into the Building (Q_{soil})		5.00	[L/min]	

Building Properties

Air Exchange Rate (E_B)	0.250	[hr-1]
Building Mixing Height (H_B)	2.44	[m]
Building Footprint Area (F_B)	100.0	[m2]
Subsurface Foundation Area (A_B)	106.0	[m2]

Building Crack Ratio (η)	0.00038	[unitless]
Building Foundation Slab Thickness (L$_{crack}$)	0.100	[m]

Exposure Parameters

Exposure Duration for Carcinogens (ED$_c$)	25	[years]
Exposure Frequency for Carcinogens (EF$_c$)	250	[days/year]
Averaging Time for Carcinogens (AT$_c$)	70	[years]
Exposure Duration for Non-Carcinogens (ED$_{nc}$)	25	[years]
Exposure Frequency for Non-Carcinogens (EF$_{nc}$)	250	[days/year]
Averaging Time for Non-Carcinogens (AT$_{nc}$)	25	[years]

<p style="text-align:center">[CALCULATE RESULTS]</p>

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (D$_{eff}$)	0.001699	[cm2/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (D^T eff)	0.001780	[cm2/s]

"A" Parameter	1.591e-4	Based on parameter analysis: Advection is the dominant mechanism across foundation.
"B" Parameter	1218.	Diffusion through soil is the overall rate-limiting process for the subsurface to
"C" Parameter	0.004918	indoor-air pathway.

Johnson & Ettinger Attenuation Factor (α)　　　　　　　　　　　　　　1.541e-4

	INDOOR AIR RESULTS FOR GROUND WATER			SAMPLE DATA						
	Low Prediction1			Best Estimate			High Prediction2			
Indoor Air Concentration	3.939e-6	[μg/m3]	3.313e-7	[ppbv] 4.510e-6	[μg/m3]	3.794e-7	[ppbv] 1.227e-5	[μg/m3]	1.033e-6	[ppbv]
Cancer Risk	1.734e-9			1.986e-9			5.405e-9			
Hazard Quotient	0.			0.			0.			

1 "Low Prediction" concentration produced with BEST ESTIMATE　　　moisture content and DEEPEST　　　　depth to contamination.

2 "High Prediction" concentration produced with HIGHEST　　　moisture content and SHALLOWEST　　　depth to contamination.

[CLEAR ALL]

[FORMAT REPORT FOR PRINTER]

What do these results mean?

Comments or suggestions

Top ^
Home | Glossary | Notation | Links | References | Calculators

✪EPA United States Environmental Protection Agency

Ecosystems Research Division

EPA On-line Tools for Site Assessment Calculation

Screening Level Implementation of the Johnson and Ettinger Vapor Intrusion Model with two variable/uncertain parameters (source depth, moisture content)

Forward Calculation of Indoor Air Concentration

Backward Calculation **full uncertainty analysis**

Background

Migration of volatile chemicals from the subsurface into overlying buildings is called vapor intrusion (VI). Volatile organic chemicals in contaminated soils or groundwater can emit vapors, which may migrate through subsurface soils and may enter the indoor air of overlying buildings. Building depressurization may cause these vapors to enter the home through cracks in the foundation. Depressurization can be caused by a combination of wind effects and stack effects, which are the result of heating within the building and/or mechanical ventilation. In extreme cases, the vapors may accumulate in dwellings to levels that may pose near-term safety hazards, such as explosion. Typically, however, vapor concentrations are present at low levels, to which long-term exposure may pose increased risk for chronic health effects.

This on-line calculator implements the Johnson and Ettinger (J&E) (Johnson and Ettinger, 1991) simplified model to evaluate the vapor intrusion pathway into buildings. This J&E model replicates the implementation that the US EPA Office of Solid Waste and Emergency Response (OSWER) used in developing its draft vapor intrusion guidance, but includes a number of enhancements that are facilitated by web implementation: temperature dependence of Henry's Law Constants and gaseous diffusivities, automatic sensitivity analysis of certain parameters, and others described on the background page.

The results you obtain from this OnSite implementation of the Johnson and Ettinger model may differ from other versions of the Johnson & Ettinger Model. In addition to the OSWER implementation that was used for the draft vapor intrusion guidance, EPA Office of Emergency Response and Remediation (OERR) distributes a set of spreadsheet implementations of the model. The differences among these implementations is described in detail on the results page. Beyond these differences the on-line version includes a simplified uncertainty analysis the other implementations lack.

Click For an Example

Enter Site Name (optional):	Industrial Worker - phase II		
Enter sample concentration, units and media type	1.11e-1	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)	7		meters
This value can change by +/-	1		meters
What is your contaminant of concern (COC)?	Dieldrin		
What type of building are you investigating at your site?			Slab-on-Grade
What type of soil is beneath the building?			Loam
What is the average soil/ground water temperature?		55	Farenheit

Chemical Properties

CAS Number	60571	
Molecular Weight (MW)	380.91	[g/mole]
Henry's Law Constant at ground water temperature (H)	0.00010989	[unitless]
Free-Air Diffusion Coefficient (D_a)	1.250e-2	[cm2/s]
Diffusivity in Water (D_w)	4.740e-6	[cm2/s]
Unit Risk Factor (URF)	4.60e-3	[(µg/m3)-1]
Reference Concentration (RfC)	1.75e-4	[mg/m3]

Soil Properties

Total Porosity (n)		0.399	[unitless]	
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]	
Height of Capillary Zone (CZ_h)		0.375	[m]	
Soil-gas Flow Rate Into the Building (Q_{soil})		5.00	[L/min]	

Building Properties

Air Exchange Rate (E_B)	0.250	[hr-1]
Building Mixing Height (H_B)	2.44	[m]
Building Footprint Area (F_B)	100.0	[m2]
Subsurface Foundation Area (A_B)	106.0	[m2]

Building Crack Ratio (η)		0.00038	[unitless]
Building Foundation Slab Thickness (Lcrack)		0.100	[m]

Exposure Parameters

Exposure Duration for Carcinogens (EDc)		25	[years]
Exposure Frequency for Carcinogens (EFc)		250	[days/year]
Averaging Time for Carcinogens (ATc)		70	[years]
Exposure Duration for Non-Carcinogens (EDnc)		25	[years]
Exposure Frequency for Non-Carcinogens (EFnc)		250	[days/year]
Averaging Time for Non-Carcinogens (ATnc)		25	[years]

CALCULATE RESULTS

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (Deff)	0.001254	[cm2/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (DT eff)	0.001312	[cm2/s]

"A" Parameter	1.172e-4	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.
"B" Parameter	1649.	
"C" Parameter	0.004918	

Johnson & Ettinger Attenuation Factor (α)   1.145e-4

	INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA								
	Low Prediction1			Best Estimate			High Prediction2		
Indoor Air Concentration	1.219e-6	[μg/m3]	7.829e-8 [ppbv]	1.397e-6	[μg/m3]	8.972e-8 [ppbv]	3.151e-6	[μg/m3]	2.024e-7 [ppbv]
Cancer Risk	1.372e-9			1.572e-9			3.545e-9		
Hazard Quotient	4.771e-6			5.467e-6			1.233e-5		

1 "Low Prediction" concentration produced with BEST ESTIMATE   moisture content and DEEPEST   depth to contamination.

2 "High Prediction" concentration produced with HIGHEST   moisture content and SHALLOWEST   depth to contamination.

CLEAR ALL

FORMAT REPORT FOR PRINTER

What do these results mean?

Comments or suggestions

Top ^
Home | Glossary | Notation | Links | References | Calculators

⬥EPA United States
Environmental Protection
Agency

Ecosystems Research Division

EPA On-line Tools for Site Assessment Calculation

48 of 67

Screening Level Implementation of the Johnson and Ettinger Vapor Intrusion Model with two variable/uncertain parameters (source depth, moisture content)

Forward Calculation of Indoor Air Concentration

Backward Calculation full uncertainty analysis

Background

Migration of volatile chemicals from the subsurface into overlying buildings is called vapor intrusion (VI). Volatile organic chemicals in contaminated soils or groundwater can emit vapors, which may migrate through subsurface soils and may enter the indoor air of overlying buildings. Building depressurization may cause these vapors to enter the home through cracks in the foundation. Depressurization can be caused by a combination of wind effects and stack effects, which are the result of heating within the building and/or mechanical ventilation. In extreme cases, the vapors may accumulate in dwellings to levels that may pose near-term safety hazards, such as explosion. Typically, however, vapor concentrations are present at low levels, to which long-term exposure may pose increased risk for chronic health effects.

This on-line calculator implements the Johnson and Ettinger (J&E) (Johnson and Ettinger, 1991) simplified model to evaluate the vapor intrusion pathway into buildings. This J&E model replicates the implementation that the US EPA Office of Solid Waste and Emergency Response (OSWER) used in developing its draft vapor intrusion guidance, but includes a number of enhancements that are facilitated by web implementation: temperature dependence of Henry's Law Constants and gaseous diffusivities, automatic sensitivity analysis of certain parameters, and others described on the background page.

The results you obtain from this OnSite implementation of the Johnson and Ettinger model may differ from other versions of the Johnson & Ettinger Model. In addition to the OSWER implementation that was used for the draft vapor intrusion guidance, EPA Office of Emergency Response and Remediation (OERR) distributes a set of spreadsheet implementations of the model. The differences among these implementations is described in detail on the results page. Beyond these differences the on-line version includes a simplified uncertainty analysis the other implementations lack.

	Click For an Example	
Enter Site Name (optional):		adult resident - Phase II
Enter sample concentration, units and media type	1.6	µg/L · Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)	7	meters
This value can change by +/-	1	meters
What is your contaminant of concern (COC)?	Benzene	
What type of building are you investigating at your site?		Slab-on-Grade
What type of soil is beneath the building?		Loam
What is the average soil/ground water temperature?		55 Farenheit

Chemical Properties

CAS Number	71432	
Molecular Weight (MW)	78.11	[g/mole]
Henry's Law Constant at ground water temperature (H)	0.1316031	[unitless]
Free-Air Diffusion Coefficient (D_a)	8.800e-2	[cm2/s]
Diffusivity in Water (D_w)	9.800e-6	[cm2/s]
Unit Risk Factor (URF)	7.80e-6	[(µg/m3)-1]
Reference Concentration (RfC)	0.	[mg/m3]

Soil Properties

Total Porosity (n)		0.399		[unitless]
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332		[unitless]
Height of Capillary Zone (CZ_h)		0.375		[m]
Soil-gas Flow Rate Into the Building (Q_{soil})		5.00		[L/min]

Building Properties

Air Exchange Rate (E_B)	0.250	[hr-1]
Building Mixing Height (H_B)	2.44	[m]
Building Footprint Area (F_B)	100.0	[m2]
Subsurface Foundation Area (A_B)	106.0	[m2]

Building Crack Ratio (η)	0.00038	[unitless]
Building Foundation Slab Thickness (L$_{crack}$)	0.100	[m]

Exposure Parameters

Exposure Duration for Carcinogens (ED$_c$)	30	[years]
Exposure Frequency for Carcinogens (EF$_c$)	350	[days/year]
Averaging Time for Carcinogens (AT$_c$)	70	[years]
Exposure Duration for Non-Carcinogens (ED$_{nc}$)	30	[years]
Exposure Frequency for Non-Carcinogens (EF$_{nc}$)	365	[days/year]
Averaging Time for Non-Carcinogens (AT$_{nc}$)	30	[years]

CALCULATE RESULTS

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (D$_{eff}$)	0.005540	[cm2/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (DT$_{eff}$)	0.001190	[cm2/s]

"A" Parameter	1.064e-4	Based on parameter analysis: Advection is the dominant mechanism across foundation.
"B" Parameter	373.4	Diffusion through soil is the overall rate-limiting process for the subsurface to
"C" Parameter	0.004918	indoor-air pathway.

Johnson & Ettinger Attenuation Factor (α)   1.041e-4

INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA								
	Low Prediction1			Best Estimate			High Prediction2	
Indoor Air Concentration	0.01188 [µg/m3]	0.003721 [ppbv]		0.02192 [µg/m3]	0.006866 [ppbv]		0.02538 [µg/m3]	0.007950 [ppbv]
Cancer Risk	3.808e-8			7.027e-8			8.136e-8	
Hazard Quotient	0.			0.			0.	

1 "Low Prediction" concentration produced with HIGHEST   moisture content and DEEPEST   depth to contamination.

2 "High Prediction" concentration produced with LOWEST   moisture content and SHALLOWEST   depth to contamination.

CLEAR ALL

FORMAT REPORT FOR PRINTER

What do these results mean?

Comments or suggestions

Top ^
Home | Glossary | Notation | Links | References | Calculators

⊕EPA United States
Environmental Protection
Agency

Ecosystems Research Division

EPA On-line Tools for Site Assessment Calculation

48 of 67

Screening Level Implementation of the Johnson and Ettinger Vapor Intrusion Model with two variable/uncertain parameters (source depth, moisture content)

Forward Calculation of Indoor Air Concentration

Backward Calculation **full uncertainty analysis**

Background

Migration of volatile chemicals from the subsurface into overlying buildings is called vapor intrusion (VI). Volatile organic chemicals in contaminated soils or groundwater can emit vapors, which may migrate through subsurface soils and may enter the indoor air of overlying buildings. Building depressurization may cause these vapors to enter the home through cracks in the foundation. Depressurization can be caused by a combination of wind effects and stack effects, which are the result of heating within the building and/or mechanical ventilation. In extreme cases, the vapors may accumulate in dwellings to levels that may pose near-term safety hazards, such as explosion. Typically, however, vapor concentrations are present at low levels, to which long-term exposure may pose increased risk for chronic health effects.

This on-line calculator implements the Johnson and Ettinger (J&E) (Johnson and Ettinger, 1991) simplified model to evaluate the vapor intrusion pathway into buildings. This J&E model replicates the implementation that the US EPA Office of Solid Waste and Emergency Response (OSWER) used in developing its draft vapor intrusion guidance, but includes a number of enhancements that are facilitated by web implementation: temperature dependence of Henry's Law Constants and gaseous diffusivities, automatic sensitivity analysis of certain parameters, and others described on the background page.

The results you obtain from this OnSite implementation of the Johnson and Ettinger model may differ from other versions of the Johnson & Ettinger Model. In addition to the OSWER implementation that was used for the draft vapor intrusion guidance, EPA Office of Emergency Response and Remediation (OERR) distributes a set of spreadsheet implementations of the model. The differences among these implementations is described in detail on the results page. Beyond these differences the on-line version includes a simplified uncertainty analysis the other implementations lack.

Click For an Example			
Enter Site Name (optional):		adult resident - Phase II	
Enter sample concentration, units and media type	.316	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)		7	meters
This value can change by +/-		1	meters
What is your contaminant of concern (COC)?	1,4-Dichlorobenzene		
What type of building are you investigating at your site?		Slab-on-Grade	
What type of soil is beneath the building?		Loam	
What is the average soil/ground water temperature?		55	Farenheit

Chemical Properties

CAS Number	106467		
Molecular Weight (MW)	147	[g/mole]	
Henry's Law Constant at ground water temperature (H)	0.04543560	[unitless]	
Free-Air Diffusion Coefficient (D_a)	6.900e-2	[cm2/s]	
Diffusivity in Water (D_w)	7.900e-6	[cm2/s]	
Unit Risk Factor (URF)	0.	[(µg/m3)⁻1]	
Reference Concentration (RfC)	0.800	[mg/m3]	

Soil Properties

Total Porosity (n)		0.399	[unitless]		
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]	
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]		
Height of Capillary Zone (CZh)		0.375	[m]		
Soil-gas Flow Rate Into the Building (Q_{soil})		5.00	[L/min]		

Building Properties

Air Exchange Rate (E_B)	0.250	[hr⁻1]
Building Mixing Height (H_B)	2.44	[m]
Building Footprint Area (F_B)	100.0	[m2]
Subsurface Foundation Area (A_B)	106.0	[m2]

Building Crack Ratio (η)		0.00038	[unitless]
Building Foundation Slab Thickness (L_{crack})		0.100	[m]

Exposure Parameters

Exposure Duration for Carcinogens (ED_c)	30	[years]
Exposure Frequency for Carcinogens (EF_c)	350	[days/year]
Averaging Time for Carcinogens (AT_c)	70	[years]
Exposure Duration for Non-Carcinogens (ED_{nc})	30	[years]
Exposure Frequency for Non-Carcinogens (EF_{nc})	365	[days/year]
Averaging Time for Non-Carcinogens (AT_{nc})	30	[years]

[CALCULATE RESULTS]

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (D_{eff})	0.004345	[cm2/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (D^T_{eff})	0.001140	[cm2/s]

"A" Parameter	1.018e-4	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.
"B" Parameter	476.1	
"C" Parameter	0.004918	

Johnson & Ettinger Attenuation Factor (α)   9.977e-5

	INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA								
	Low Prediction1			Best Estimate			High Prediction2		
Indoor Air Concentration	7.075e-4	[μg/m3]	1.177e-4 [ppbv]	0.001432	[μg/m3]	2.384e-4 [ppbv]	0.001719	[μg/m3]	2.860e-4 [ppbv]
Cancer Risk	0.			0.			0.		
Hazard Quotient	8.843e-7			1.791e-6			2.148e-6		

1 "Low Prediction" concentration produced with HIGHEST   moisture content and DEEPEST   depth to contamination.

2 "High Prediction" concentration produced with LOWEST   moisture content and SHALLOWEST   depth to contamination.

[CLEAR ALL]

[FORMAT REPORT FOR PRINTER]

What do these results mean?

Comments or suggestions

Top ^
Home | Glossary | Notation | Links | References | Calculators

⊕EPA United States
Environmental Protection
Agency

Ecosystems Research Division

EPA On-line Tools for Site Assessment Calculation

Screening Level Implementation of the Johnson and Ettinger Vapor Intrusion Model with two variable/uncertain parameters (source depth, moisture content)

Forward Calculation of Indoor Air Concentration

Backward Calculation **full uncertainty analysis**

Background

Migration of volatile chemicals from the subsurface into overlying buildings is called vapor intrusion (VI). Volatile organic chemicals in contaminated soils or groundwater can emit vapors, which may migrate through subsurface soils and may enter the indoor air of overlying buildings. Building depressurization may cause these vapors to enter the home through cracks in the foundation. Depressurization can be caused by a combination of wind effects and stack effects, which are the result of heating within the building and/or mechanical ventilation. In extreme cases, the vapors may accumulate in dwellings to levels that may pose near-term safety hazards, such as explosion. Typically, however, vapor concentrations are present at low levels, to which long-term exposure may pose increased risk for chronic health effects.

This on-line calculator implements the Johnson and Ettinger (J&E) (Johnson and Ettinger, 1991) simplified model to evaluate the vapor intrusion pathway into buildings. This J&E model replicates the implementation that the US EPA Office of Solid Waste and Emergency Response (OSWER) used in developing its draft vapor intrusion guidance, but includes a number of enhancements that are facilitated by web implementation: temperature dependence of Henry's Law Constants and gaseous diffusivities, automatic sensitivity analysis of certain parameters, and others described on the background page.

The results you obtain from this OnSite implementation of the Johnson and Ettinger model may differ from other versions of the Johnson & Ettinger Model. In addition to the OSWER implementation that was used for the draft vapor intrusion guidance, EPA Office of Emergency Response and Remediation (OERR) distributes a set of spreadsheet implementations of the model. The differences among these implementations is described in detail on the results page. Beyond these differences the on-line version includes a simplified uncertainty analysis the other implementations lack.

	Click For an Example	
Enter Site Name (optional):		adult resident - Phase II
Enter sample concentration, units and media type	2.91	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)	7	meters
This value can change by +/-	1	meters
What is your contaminant of concern (COC)?	1,1-Dichloroethane	
What type of building are you investigating at your site?		Slab-on-Grade
What type of soil is beneath the building?		Loam
What is the average soil/ground water temperature?		55	Farenheit

Chemical Properties

CAS Number	75343	
Molecular Weight (MW)	98.96	[g/mole]
Henry's Law Constant at ground water temperature (H)	0.1399030	[unitless]
Free-Air Diffusion Coefficient (D_a)	7.420e-2	[cm2/s]
Diffusivity in Water (D_w)	1.050e-5	[cm2/s]
Unit Risk Factor (URF)	0.	[(µg/m3)-1]
Reference Concentration (RfC)	0.500	[mg/m3]

Soil Properties

Total Porosity (n)		0.399		[unitless]
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332		[unitless]
Height of Capillary Zone (CZ_h)		0.375		[m]
Soil-gas Flow Rate into the Building (Q_{soil})		5.00		[L/min]

Building Properties

Air Exchange Rate (E_B)	0.250	[hr-1]
Building Mixing Height (H_B)	2.44	[m]
Building Footprint Area (F_B)	100.0	[m2]
Subsurface Foundation Area (A_B)	106.0	[m2]

	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (L$_{crack}$)	0.100	[m]
Exposure Parameters			
	Exposure Duration for Carcinogens (ED$_c$)	30	[years]
	Exposure Frequency for Carcinogens (EF$_c$)	350	[days/year]
	Averaging Time for Carcinogens (AT$_c$)	70	[years]
	Exposure Duration for Non-Carcinogens (ED$_{nc}$)	30	[years]
	Exposure Frequency for Non-Carcinogens (EF$_{nc}$)	365	[days/year]
	Averaging Time for Non-Carcinogens (AT$_{nc}$)	30	[years]

CALCULATE RESULTS

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (D$_{eff}$)	0.004671	[cm2/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (DT eff)	0.001027	[cm2/s]

"A" Parameter	9.175e-5	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.
"B" Parameter	442.9	
"C" Parameter	0.004918	

Johnson & Ettinger Attenuation Factor (α)   9.006e-5

INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA									
	Low Prediction1			Best Estimate			High Prediction2		
Indoor Air Concentration	0.01964	[μg/m3]	0.004857 [ppbv]	0.03667	[μg/m3]	0.009065 [ppbv]	0.04263	[μg/m3]	0.01054 [ppbv]
Cancer Risk	0.			0.			0.		
Hazard Quotient	3.929e-5			7.333e-5			8.525e-5		

1 "Low Prediction" concentration produced with HIGHEST   moisture content and DEEPEST   depth to contamination.

2 "High Prediction" concentration produced with LOWEST   moisture content and SHALLOWEST   depth to contamination.
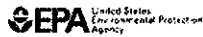
CLEAR ALL

FORMAT REPORT FOR PRINTER

What do these results mean?

Comments or suggestions

Top ^
Home | Glossary | Notation | Links | References | Calculators

Phase I Data

⊕EPA United States
Environmental Protection
Agency

Ecosystems Research Division

EPA On-line Tools for Site Assessment Calculation

48 of 67

Screening Level Implementation of the Johnson and Ettinger Vapor Intrusion Model with two variable/uncertain parameters (source depth, moisture content)

Forward Calculation of Indoor Air Concentration

Backward Calculation full uncertainty analysis

Background

Migration of volatile chemicals from the subsurface into overlying buildings is called vapor intrusion (VI). Volatile organic chemicals in contaminated soils or groundwater can emit vapors, which may migrate through subsurface soils and may enter the indoor air of overlying buildings. Building depressurization may cause these vapors to enter the home through cracks in the foundation. Depressurization can be caused by a combination of wind effects and stack effects, which are the result of heating within the building and/or mechanical ventilation. In extreme cases, the vapors may accumulate in dwellings to levels that may pose near-term safety hazards, such as explosion. Typically, however, vapor concentrations are present at low levels, to which long-term exposure may pose increased risk for chronic health effects.

This on-line calculator implements the Johnson and Ettinger (J&E) (Johnson and Ettinger, 1991) simplified model to evaluate the vapor intrusion pathway into buildings. This J&E model replicates the implementation that the US EPA Office of Solid Waste and Emergency Response (OSWER) used in developing its draft vapor intrusion guidance, but includes a number of enhancements that are facilitated by web implementation: temperature dependence of Henry's Law Constants and gaseous diffusivities, automatic sensitivity analysis of certain parameters, and others described on the background page.

The results you obtain from this OnSite implementation of the Johnson and Ettinger model may differ from other versions of the Johnson & Ettinger Model. In addition to the OSWER implementation that was used for the draft vapor intrusion guidance, EPA Office of Emergency Response and Remediation (OERR) distributes a set of spreadsheet implementations of the model. The differences among these implementations is described in detail on the results page. Beyond these differences the on-line version includes a simplified uncertainty analysis the other implementations lack.

Click For an Example

Enter Site Name (optional):		Industrial worker	
Enter sample concentration, units and media type	0.0698	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)		7	meters
This value can change by +/-		1	meters
What is your contaminant of concern (COC)?		alpha-HCH (alpha-BHC)	
What type of building are you investigating at your site?		Slab-on-Grade	
What type of soil is beneath the building?		Loam	
What is the average soil/ground water temperature?		55	Farenheit

Chemical Properties

CAS Number	319846	
Molecular Weight (MW)	290.83	[g/mole]
Henry's Law Constant at ground water temperature (H)	0.00009886	[unitless]
Free-Air Diffusion Coefficient (D_a)	1.420e-2	[cm2/s]
Diffusivity in Water (D_w)	7.340e-6	[cm2/s]
Unit Risk Factor (URF)	1.80e-3	[(µg/m3)-1]
Reference Concentration (RfC)	0.	[mg/m3]

Soil Properties

Total Porosity (n)			0.399		[unitless]
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610		Best Estimate 0.148	High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)			0.332		[unitless]
Height of Capillary Zone (CZ_h)			0.375		[m]
Soil-gas Flow Rate into the Building (Q_{soil})			5.00		[L/min]

Building Properties

Air Exchange Rate (E_B)	0.250	[hr-1]
Building Mixing Height (H_B)	2.44	[m]
Building Footprint Area (F_B)	100.0	[m2]
Subsurface Foundation Area (A_B)	106.0	[m2]

Building Crack Ratio (η)	0.00038	[unitless]
Building Foundation Slab Thickness (L_crack)	0.100	[m]

Exposure Parameters

Exposure Duration for Carcinogens (ED_c)	25	[years]
Exposure Frequency for Carcinogens (EF_c)	250	[days/year]
Averaging Time for Carcinogens (AT_c)	70	[years]
Exposure Duration for Non-Carcinogens (ED_nc)	25	[years]
Exposure Frequency for Non-Carcinogens (EF_nc)	250	[days/year]
Averaging Time for Non-Carcinogens (AT_nc)	25	[years]

CALCULATE RESULTS

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (D_eff)	0.001699	[cm2/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (DT_eff)	0.001780	[cm2/s]

"A" Parameter	1.591e-4	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.
"B" Parameter	1218.	
"C" Parameter	0.004918	

Johnson & Ettinger Attenuation Factor (α)   1.541e-4

INDOOR AIR RESULTS FOR GROUND WATER   SAMPLE DATA

	Low Prediction[1]				Best Estimate				High Prediction[2]			
Indoor Air Concentration	9.288e-7	[μg/m3]	7.813e-8	[ppbv]	1.064e-6	[μg/m3]	8.947e-8	[ppbv]	2.894e-6	[μg/m3]	2.435e-7	[ppbv]
Cancer Risk	4.090e-10				4.683e-10				1.274e-9			
Hazard Quotient	0.				0.				0.			

[1] "Low Prediction" concentration produced with BEST ESTIMATE   moisture content and DEEPEST   depth to contamination.

[2] "High Prediction" concentration produced with HIGHEST   moisture content and SHALLOWEST   depth to contamination.

CLEAR ALL

FORMAT REPORT FOR PRINTER

What do these results mean?

Comments or suggestions

Top ^
Home | Glossary | Notation | Links | References | Calculators

⊗EPA United States
Environmental Protection
Agency

Ecosystems Research Division

EPA On-line Tools for Site Assessment Calculation

Screening Level Implementation of the Johnson and Ettinger Vapor Intrusion Model with two variable/uncertain parameters (source depth, moisture content)

Forward Calculation of Indoor Air Concentration

Backward Calculation full uncertainty analysis

Background

Migration of volatile chemicals from the subsurface into overlying buildings is called vapor intrusion (VI). Volatile organic chemicals in contaminated soils or groundwater can emit vapors, which may migrate through subsurface soils and may enter the indoor air of overlying buildings. Building depressurization may cause these vapors to enter the home through cracks in the foundation. Depressurization can be caused by a combination of wind effects and stack effects, which are the result of heating within the building and/or mechanical ventilation. In extreme cases, the vapors may accumulate in dwellings to levels that may pose near-term safety hazards, such as explosion. Typically, however, vapor concentrations are present at low levels, to which long-term exposure may pose increased risk for chronic health effects.

This on-line calculator implements the Johnson and Ettinger (J&E) (Johnson and Ettinger, 1991) simplified model to evaluate the vapor intrusion pathway into buildings. This J&E model replicates the implementation that the US EPA Office of Solid Waste and Emergency Response (OSWER) used in developing its draft vapor intrusion guidance, but includes a number of enhancements that are facilitated by web implementation: temperature dependence of Henry's Law Constants and gaseous diffusivities, automatic sensitivity analysis of certain parameters, and others described on the background page.

The results you obtain from this OnSite implementation of the Johnson and Ettinger model may differ from other versions of the Johnson & Ettinger Model. In addition to the OSWER implementation that was used for the draft vapor intrusion guidance, EPA Office of Emergency Response and Remediation (OERR) distributes a set of spreadsheet implementations of the model. The differences among these implementations is described in detail on the results page. Beyond these differences the on-line version includes a simplified uncertainty analysis the other implementations lack.

Click For an Example		
Enter Site Name (optional):		Industrial Worker
Enter sample concentration, units and media type	2.726	μg/L · Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)	7	meters
This value can change by +/-	1	meters
What is your contaminant of concern (COC)?	gamma-HCH (Lindane)	
What type of building are you investigating at your site?		Slab-on-Grade
What type of soil is beneath the building?		Loam
What is the average soil/ground water temperature?		55 Farenheit

Chemical Properties

CAS Number	58899	
Molecular Weight (MW)	290.83	[g/mole]
Henry's Law Constant at ground water temperature (H)	0.00013057	[unitless]
Free-Air Diffusion Coefficient (D_a)	1.420e-2	[cm2/s]
Diffusivity in Water (D_w)	7.340e-6	[cm2/s]
Unit Risk Factor (URF)	3.71e-4	[(μg/m3)-1]
Reference Concentration (RfC)	1.05e-3	[mg/m3]

Soil Properties

Total Porosity (n)		0.399		[unitless]
Unsaturated Zone Moisture Content ($θ_w$)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($θ_{w,cap}$)		0.332		[unitless]
Height of Capillary Zone (CZ_h)		0.375		[m]
Soil-gas Flow Rate into the Building (Q_{soil})		5.00		[L/min]

Building Properties

Air Exchange Rate (E_B)	0.250	[hr-1]
Building Mixing Height (H_B)	2.44	[m]
Building Footprint Area (F_B)	100.0	[m2]
Subsurface Foundation Area (A_B)	106.0	[m2]

Building Crack Ratio (η)	0.00038	[unitless]
Building Foundation Slab Thickness (L$_{crack}$)	0.100	[m]

Exposure Parameters

Exposure Duration for Carcinogens (ED$_c$)	25	[years]
Exposure Frequency for Carcinogens (EF$_c$)	250	[days/year]
Averaging Time for Carcinogens (AT$_c$)	70	[years]
Exposure Duration for Non-Carcinogens (ED$_{nc}$)	25	[years]
Exposure Frequency for Non-Carcinogens (EF$_{nc}$)	250	[days/year]
Averaging Time for Non-Carcinogens (AT$_{nc}$)	25	[years]

[CALCULATE RESULTS]

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (D$_{eff}$)	0.001503	[cm2/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (D^T$_{eff}$)	0.001573	[cm2/s]

"A" Parameter — 1.406e-4

"B" Parameter — 1376.

"C" Parameter — 0.004918

Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.

Johnson & Ettinger Attenuation Factor (α)   1.367e-4

INDOOR AIR RESULTS FOR GROUND WATER		SAMPLE DATA			
	Low Prediction[1]		Best Estimate		High Prediction[2]
Indoor Air Concentration	4.248e-5 [µg/m3] 3.574e-6 [ppbv]		4.866e-5 [µg/m3] 4.093e-6 [ppbv]		1.170e-4 [µg/m3] 9.842e-6 [ppbv]
Cancer Risk	3.855e-9		4.416e-9		1.062e-8
Hazard Quotient	2.771e-5		3.174e-5		7.632e-5

[1] "Low Prediction" concentration produced with BEST ESTIMATE   moisture content and DEEPEST   depth to contamination.

[2] "High Prediction" concentration produced with HIGHEST   moisture content and SHALLOWEST   depth to contamination.

[CLEAR ALL]
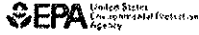
[FORMAT REPORT FOR PRINTER]

What do these results mean?

Comments or suggestions

Top ^
Home | Glossary | Notation | Links | References | Calculators

⊕EPA United States
Environmental Protection
Agency

Ecosystems Research Division

EPA On-line Tools for Site Assessment Calculation

48 of 67

Screening Level Implementation of the Johnson and Ettinger Vapor Intrusion Model with two variable/uncertain parameters (source depth, moisture content)

Forward Calculation of Indoor Air Concentration

Backward Calculation full uncertainty analysis

Background

Migration of volatile chemicals from the subsurface into overlying buildings is called vapor intrusion (VI). Volatile organic chemicals in contaminated soils or groundwater can emit vapors, which may migrate through subsurface soils and may enter the indoor air of overlying buildings. Building depressurization may cause these vapors to enter the home through cracks in the foundation. Depressurization can be caused by a combination of wind effects and stack effects, which are the result of heating within the building and/or mechanical ventilation. In extreme cases, the vapors may accumulate in dwellings to levels that may pose near-term safety hazards, such as explosion. Typically, however, vapor concentrations are present at low levels, to which long-term exposure may pose increased risk for chronic health effects.

This on-line calculator implements the Johnson and Ettinger (J&E) (Johnson and Ettinger, 1991) simplified model to evaluate the vapor intrusion pathway into buildings. This J&E model replicates the implementation that the US EPA Office of Solid Waste and Emergency Response (OSWER) used in developing its draft vapor intrusion guidance, but includes a number of enhancements that are facilitated by web implementation: temperature dependence of Henry's Law Constants and gaseous diffusivities, automatic sensitivity analysis of certain parameters, and others described on the background page.

The results you obtain from this OnSite implementation of the Johnson and Ettinger model may differ from other versions of the Johnson & Ettinger Model. In addition to the OSWER implementation that was used for the draft vapor intrusion guidance, EPA Office of Emergency Response and Remediation (OERR) distributes a set of spreadsheet implementations of the model. The differences among these implementations is described in detail on the results page. Beyond these differences the on-line version includes a simplified uncertainty analysis the other implementations lack.

Click For an Example

Enter Site Name (optional):		Industrial Worker	
Enter sample concentration, units and media type	0.29	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)		7	meters
This value can change by +/-		1	meters
What is your contaminant of concern (COC)?	alpha-HCH (alpha-BHC)		
What type of building are you investigating at your site?		Slab-on-Grade	
What type of soil is beneath the building?		Loam	
What is the average soil/ground water temperature?		55	Farenheit

Chemical Properties

CAS Number	319846	
Molecular Weight (MW)	290.83	[g/mole]
Henry's Law Constant at ground water temperature (H)	0.00009886	[unitless]
Free-Air Diffusion Coefficient (D_a)	1.420e-2	[cm2/s]
Diffusivity in Water (D_w)	7.340e-6	[cm2/s]
Unit Risk Factor (URF)	1.80e-3	[(µg/m3)-1]
Reference Concentration (RfC)	0.	[mg/m3]

Soil Properties

Total Porosity (n)		0.399	[unitless]	
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]	
Height of Capillary Zone (CZ_h)		0.375	[m]	
Soil-gas Flow Rate Into the Building (Q_{soil})		5.00	[L/min]	

Building Properties

Air Exchange Rate (E_B)	0.250	[hr-1]
Building Mixing Height (H_B)	2.44	[m]
Building Footprint Area (F_B)	100.0	[m2]
Subsurface Foundation Area (A_B)	106.0	[m2]

	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (L_{crack})	0.100	[m]
Exposure Parameters			
	Exposure Duration for Carcinogens (ED_c)	25	[years]
	Exposure Frequency for Carcinogens (EF_c)	250	[days/year]
	Averaging Time for Carcinogens (AT_c)	70	[years]
	Exposure Duration for Non-Carcinogens (ED_{nc})	25	[years]
	Exposure Frequency for Non-Carcinogens (EF_{nc})	250	[days/year]
	Averaging Time for Non-Carcinogens (AT_{nc})	25	[years]

<div style="text-align:center">[CALCULATE RESULTS]</div>

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (D_{eff})	0.001699	[cm2/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (DT eff)	0.001780	[cm2/s]

"A" Parameter	1.591e-4	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.
"B" Parameter	1218.	
"C" Parameter	0.004918	

Johnson & Ettinger Attenuation Factor (α)　　　　　　　　　　　　　　　　1.541e-4

INDOOR AIR RESULTS FOR GROUND WATER	SAMPLE DATA							
	Low Prediction[1]			Best Estimate			High Prediction[2]	
Indoor Air Concentration	3.859e-6 [µg/m3]	3.246e-7 [ppbv]		4.419e-6 [µg/m3]	3.717e-7 [ppbv]		1.203e-5 [µg/m3]	1.012e-6 [ppbv]
Cancer Risk	1.699e-9			1.946e-9			5.295e-9	
Hazard Quotient	0.			0.			0.	

[1] "Low Prediction" concentration produced with BEST ESTIMATE moisture content and DEEPEST depth to contamination.

[2] "High Prediction" concentration produced with HIGHEST moisture content and SHALLOWEST depth to contamination.

[CLEAR ALL]

[FORMAT REPORT FOR PRINTER]

What do these results mean?

Comments or suggestions

Top ^
Home | Glossary | Notation | Links | References | Calculators

⊕EPA United States
Environmental Protection
Agency

Ecosystems Research Division

EPA On-line Tools for Site Assessment Calculation

Screening Level Implementation of the Johnson and Ettinger Vapor Intrusion Model with two variable/uncertain parameters (source depth, moisture content)

Forward Calculation of Indoor Air Concentration

Backward Calculation full uncertainty analysis

Background

Migration of volatile chemicals from the subsurface into overlying buildings is called vapor intrusion (VI). Volatile organic chemicals in contaminated soils or groundwater can emit vapors, which may migrate through subsurface soils and may enter the indoor air of overlying buildings. Building depressurization may cause these vapors to enter the home through cracks in the foundation. Depressurization can be caused by a combination of wind effects and stack effects, which are the result of heating within the building and/or mechanical ventilation. In extreme cases, the vapors may accumulate in dwellings to levels that may pose near-term safety hazards, such as explosion. Typically, however, vapor concentrations are present at low levels, to which long-term exposure may pose increased risk for chronic health effects.

This on-line calculator implements the Johnson and Ettinger (J&E) (Johnson and Ettinger, 1991) simplified model to evaluate the vapor intrusion pathway into buildings. This J&E model replicates the implementation that the US EPA Office of Solid Waste and Emergency Response (OSWER) used in developing its draft vapor intrusion guidance, but includes a number of enhancements that are facilitated by web implementation: temperature dependence of Henry's Law Constants and gaseous diffusivities, automatic sensitivity analysis of certain parameters, and others described on the background page.

The results you obtain from this OnSite implementation of the Johnson and Ettinger model may differ from other versions of the Johnson & Ettinger Model. In addition to the OSWER implementation that was used for the draft vapor intrusion guidance, EPA Office of Emergency Response and Remediation (OERR) distributes a set of spreadsheet implementations of the model. The differences among these implementations is described in detail on the results page. Beyond these differences the on-line version includes a simplified uncertainty analysis the other implementations lack.

	Click For an Example		
Enter Site Name (optional):		Industrial Worker	
Enter sample concentration, units and media type	57.29	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(Lᴛ)		7	meters
This value can change by +/-		1	meters
What is your contaminant of concern (COC)?		Tetrachloroethylene	
What type of building are you investigating at your site?			Slab-on-Grade
What type of soil is beneath the building?			Loam
What is the average soil/ground water temperature?			55 Farenheit

Chemical Properties

CAS Number	127184	
Molecular Weight (MW)	165.83	[g/mole]
Henry's Law Constant at ground water temperature (H)	0.3934997	[unitless]
Free-Air Diffusion Coefficient (Dₐ)	7.200e-2	[cm2/s]
Diffusivity in Water (Dᵥᵥ)	8.200e-6	[cm2/s]
Unit Risk Factor (URF)	3.00e-6	[(µg/m3)-1]
Reference Concentration (RfC)	0.	[mg/m3]

Soil Properties

Total Porosity (n)			0.399	[unitless]	
Unsaturated Zone Moisture Content (θᵥᵥ)	Low 0.0610		Best Estimate 0.148	High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure (θᵥᵥ,ᴄₐₚ)			0.332	[unitless]	
Height of Capillary Zone (CZₕ)			0.375	[m]	
Soil-gas Flow Rate into the Building (Qₛₒᵢₗ)			5.00	[L/min]	

Building Properties

Air Exchange Rate (Eᴮ)	0.250	[hr-1]
Building Mixing Height (Hᴮ)	2.44	[m]
Building Footprint Area (Fᴮ)	100.0	[m2]
Subsurface Foundation Area (Aᴮ)	106.0	[m2]

	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (Lcrack)	0.100	[m]

Exposure Parameters

Exposure Duration for Carcinogens (EDc)	25	[years]
Exposure Frequency for Carcinogens (EFc)	250	[days/year]
Averaging Time for Carcinogens (ATc)	70	[years]
Exposure Duration for Non-Carcinogens (EDnc)	25	[years]
Exposure Frequency for Non-Carcinogens (EFnc)	250	[days/year]
Averaging Time for Non-Carcinogens (ATnc)	25	[years]

[CALCULATE RESULTS]

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (Deff)	0.004532	[cm2/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (DT eff)	0.0008963	[cm2/s]

"A" Parameter	8.010e-5	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.
"B" Parameter	456.5	
"C" Parameter	0.004918	

Johnson & Ettinger Attenuation Factor (α)   7.882e-5

	INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA								
	Low Prediction[1]			Best Estimate			High Prediction[2]		
Indoor Air Concentration	0.9959	[μg/m3]	0.1469 [ppbv]	1.777	[μg/m3]	0.2622 [ppbv]	2.033	[μg/m3]	0.3000 [ppbv]
Cancer Risk	7.308e-7			1.304e-6			1.492e-6		
Hazard Quotient	0.			0.			0.		

[1] "Low Prediction" concentration produced with HIGHEST moisture content and DEEPEST depth to contamination.

[2] "High Prediction" concentration produced with LOWEST moisture content and SHALLOWEST depth to contamination.

[CLEAR ALL]

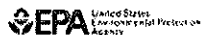[FORMAT REPORT FOR PRINTER]

What do these results mean?

Comments or suggestions

Top ^
Home | Glossary | Notation | Links | References | Calculators

WCMS
Last updated on Thursday, April 07, 2011

http://www.epa.gov/AthensR/learn2model/part-two/onsite/JnE_lite_forward.html

≎EPA United States
Environmental Protection
Agency

Ecosystems Research Division

EPA On-line Tools for Site Assessment Calculation

Screening Level Implementation of the Johnson and Ettinger Vapor Intrusion Model with two variable/uncertain parameters (source depth, moisture content)

Forward Calculation of Indoor Air Concentration

Backward Calculation full uncertainty analysis

Background

Migration of volatile chemicals from the subsurface into overlying buildings is called vapor intrusion (VI). Volatile organic chemicals in contaminated soils or groundwater can emit vapors, which may migrate through subsurface soils and may enter the indoor air of overlying buildings. Building depressurization may cause these vapors to enter the home through cracks in the foundation. Depressurization can be caused by a combination of wind effects and stack effects, which are the result of heating within the building and/or mechanical ventilation. In extreme cases, the vapors may accumulate in dwellings to levels that may pose near-term safety hazards, such as explosion. Typically, however, vapor concentrations are present at low levels, to which long-term exposure may pose increased risk for chronic health effects.

This on-line calculator implements the Johnson and Ettinger (J&E) (Johnson and Ettinger, 1991) simplified model to evaluate the vapor intrusion pathway into buildings. This J&E model replicates the implementation that the US EPA Office of Solid Waste and Emergency Response (OSWER) used in developing its draft vapor intrusion guidance, but includes a number of enhancements that are facilitated by web implementation: temperature dependence of Henry's Law Constants and gaseous diffusivities, automatic sensitivity analysis of certain parameters, and others described on the background page.

The results you obtain from this OnSite implementation of the Johnson and Ettinger model may differ from other versions of the Johnson & Ettinger Model. In addition to the OSWER implementation that was used for the draft vapor intrusion guidance, EPA Office of Emergency Response and Remediation (OERR) distributes a set of spreadsheet implementations of the model. The differences among these implementations is described in detail on the results page. Beyond these differences the on-line version includes a simplified uncertainty analysis the other implementations lack.

Click For an Example				
Enter Site Name (optional):		Industrial Worker		
Enter sample concentration, units and media type	0.175	µg/L		Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)		7		meters
This value can change by +/-		1		meters
What is your contaminant of concern (COC)?	Naphthalene			
What type of building are you investigating at your site?			Slab-on-Grade	
What type of soil is beneath the building?			Loam	
What is the average soil/ground water temperature?			55	Farenheit

Chemical Properties

CAS Number	91203	
Molecular Weight (MW)	128.18	[g/mole]
Henry's Law Constant at ground water temperature (H)	0.00810628	[unitless]
Free-Air Diffusion Coefficient (D_a)	5.900e-2	[cm2/s]
Diffusivity in Water (Dw)	7.500e-6	[cm2/s]
Unit Risk Factor (URF)	0.	[(µg/m3)-1]
Reference Concentration (RfC)	3.00e-3	[mg/m3]

Soil Properties

Total Porosity (n)		0.399	[unitless]	
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]	
Height of Capillary Zone (CZ_h)		0.375	[m]	
Soil-gas Flow Rate Into the Building (Q_{soil})		5.00	[L/min]	

Building Properties

Air Exchange Rate (E_B)	0.250	[hr-1]
Building Mixing Height (H_B)	2.44	[m]
Building Footprint Area (F_B)	100.0	[m2]
Subsurface Foundation Area (A_B)	106.0	[m2]

Building Crack Ratio (η)	0.00038	[unitless]
Building Foundation Slab Thickness (L$_{crack}$)	0.100	[m]

Exposure Parameters

Exposure Duration for Carcinogens (ED$_c$)	25	[years]
Exposure Frequency for Carcinogens (EF$_c$)	250	[days/year]
Averaging Time for Carcinogens (AT$_c$)	70	[years]
Exposure Duration for Non-Carcinogens (ED$_{nc}$)	25	[years]
Exposure Frequency for Non-Carcinogens (EF$_{nc}$)	250	[days/year]
Averaging Time for Non-Carcinogens (AT$_{nc}$)	25	[years]

CALCULATE RESULTS

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (D$_{eff}$)	0.003724	[cm2/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (DT eff)	0.001883	[cm2/s]
"A" Parameter	1.683e-4	
"B" Parameter	555.6	
"C" Parameter	0.004918	

Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.

Johnson & Ettinger Attenuation Factor (α)   1.627e-4

INDOOR AIR RESULTS FOR GROUND WATER		SAMPLE DATA					
	Low Prediction[1]		Best Estimate		High Prediction[2]		
Indoor Air Concentration	8.135e-5 [µg/m3]	1.553e-5 [ppbv]	2.308e-4 [µg/m3]	4.406e-5 [ppbv]	3.377e-4 [µg/m3]	6.447e-5 [ppbv]	
Cancer Risk	0.		0.		0.		
Hazard Quotient	1.857e-5		5.270e-5		7.711e-5		

[1] "Low Prediction" concentration produced with HIGHEST   moisture content and DEEPEST   depth to contamination.

[2] "High Prediction" concentration produced with LOWEST   moisture content and SHALLOWEST   depth to contamination.
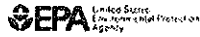
CLEAR ALL

FORMAT REPORT FOR PRINTER

What do these results mean?

Comments or suggestions

Top ^
Home | Glossary | Notation | Links | References | Calculators

⬥EPA United States
Environmental Protection
Agency

Ecosystems Research Division

EPA On-line Tools for Site Assessment Calculation

Screening Level Implementation of the Johnson and Ettinger Vapor Intrusion Model with two variable/uncertain parameters (source depth, moisture content)

Forward Calculation of Indoor Air Concentration

Backward Calculation full uncertainty analysis

Background

Migration of volatile chemicals from the subsurface into overlying buildings is called vapor intrusion (VI). Volatile organic chemicals in contaminated soils or groundwater can emit vapors, which may migrate through subsurface soils and may enter the indoor air of overlying buildings. Building depressurization may cause these vapors to enter the home through cracks in the foundation. Depressurization can be caused by a combination of wind effects and stack effects, which are the result of heating within the building and/or mechanical ventilation. In extreme cases, the vapors may accumulate in dwellings to levels that may pose near-term safety hazards, such as explosion. Typically, however, vapor concentrations are present at low levels, to which long-term exposure may pose increased risk for chronic health effects.

This on-line calculator implements the Johnson and Ettinger (J&E) (Johnson and Ettinger, 1991) simplified model to evaluate the vapor intrusion pathway into buildings. This J&E model replicates the implementation that the US EPA Office of Solid Waste and Emergency Response (OSWER) used in developing its draft vapor intrusion guidance, but includes a number of enhancements that are facilitated by web implementation: temperature dependence of Henry's Law Constants and gaseous diffusivities, automatic sensitivity analysis of certain parameters, and others described on the background page.

The results you obtain from this OnSite implementation of the Johnson and Ettinger model may differ from other versions of the Johnson & Ettinger Model. In addition to the OSWER implementation that was used for the draft vapor intrusion guidance, EPA Office of Emergency Response and Remediation (OERR) distributes a set of spreadsheet implementations of the model. The differences among these implementations is described in detail on the results page. Beyond these differences the on-line version includes a simplified uncertainty analysis the other implementations lack.

	Click For an Example			
Enter Site Name (optional):		Adult resident		
Enter sample concentration, units and media type	0.0698		μg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)		7		meters
This value can change by +/-		1		meters
What is your contaminant of concern (COC)?	alpha-HCH (alpha-BHC)			
What type of building are you investigating at your site?			Slab-on-Grade	
What type of soil is beneath the building?			Loam	
What is the average soil/ground water temperature?			55	Farenheit

Chemical Properties

CAS Number	319846		
Molecular Weight (MW)	290.83	[g/mole]	
Henry's Law Constant at ground water temperature (H)	0.00009886	[unitless]	
Free-Air Diffusion Coefficient (D_a)	1.420e-2	[cm2/s]	
Diffusivity in Water (D_w)	7.340e-6	[cm2/s]	
Unit Risk Factor (URF)	1.80e-3	[(μg/m3)-1]	
Reference Concentration (RfC)	0.	[mg/m3]	

Soil Properties

Total Porosity (n)		0.399	[unitless]		
Unsaturated Zone Moisture Content ($θ_w$)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]	
Capillary Zone Moisture Content at Air-Entry Pressure ($θ_{w,cap}$)		0.332	[unitless]		
Height of Capillary Zone (CZ_h)		0.375	[m]		
Soil-gas Flow Rate Into the Building (Q_{soil})		5.00	[L/min]		

Building Properties

Air Exchange Rate (E_B)	0.250	[hr-1]
Building Mixing Height (H_B)	2.44	[m]
Building Footprint Area (F_B)	100.0	[m2]
Subsurface Foundation Area (A_B)	106.0	[m2]

Building Crack Ratio (η)	0.00038	[unitless]
Building Foundation Slab Thickness (L$_{crack}$)	0.100	[m]

Exposure Parameters

Exposure Duration for Carcinogens (ED$_c$)	30	[years]
Exposure Frequency for Carcinogens (EF$_c$)	350	[days/year]
Averaging Time for Carcinogens (AT$_c$)	70	[years]
Exposure Duration for Non-Carcinogens (ED$_{nc}$)	30	[years]
Exposure Frequency for Non-Carcinogens (EF$_{nc}$)	365	[days/year]
Averaging Time for Non-Carcinogens (AT$_{nc}$)	30	[years]

[CALCULATE RESULTS]

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (D$_{eff}$)	0.001699	[cm2/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (D$^T_{eff}$)	0.001780	[cm2/s]

"A" Parameter	1.591e-4	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.
"B" Parameter	1218.	
"C" Parameter	0.004918	

Johnson & Ettinger Attenuation Factor (α)   1.541e-4

INDOOR AIR RESULTS FOR GROUND WATER			SAMPLE DATA					
	Low Prediction[1]			Best Estimate			High Prediction[2]	
Indoor Air Concentration	9.288e-7 [µg/m3]	7.813e-8 [ppbv]		1.064e-6 [µg/m3]	8.947e-8 [ppbv]		2.894e-6 [µg/m3]	2.435e-7 [ppbv]
Cancer Risk	6.871e-10			7.867e-10			2.141e-9	
Hazard Quotient	0.			0.			0.	

[1] "Low Prediction" concentration produced with BEST ESTIMATE   moisture content and DEEPEST   depth to contamination.

[2] "High Prediction" concentration produced with HIGHEST   moisture content and SHALLOWEST   depth to contamination.

[CLEAR ALL]

[FORMAT REPORT FOR PRINTER]

What do these results mean?

Comments or suggestions

Top ^
Home | Glossary | Notation | Links | References | Calculators

WCMS
Last updated on Thursday, April 07, 2011

http://www.epa.gov/AthensR/learn2model/part-two/onsite/JnE_lite_forward.html

⊕EPA United States
Environmental Protection
Agency

Ecosystems Research Division

EPA On-line Tools for Site Assessment Calculation

Screening Level Implementation of the Johnson and Ettinger Vapor Intrusion Model with two variable/uncertain parameters (source depth, moisture content)

Forward Calculation of Indoor Air Concentration

Backward Calculation full uncertainty analysis

Background

Migration of volatile chemicals from the subsurface into overlying buildings is called vapor intrusion (VI). Volatile organic chemicals in contaminated soils or groundwater can emit vapors, which may migrate through subsurface soils and may enter the indoor air of overlying buildings. Building depressurization may cause these vapors to enter the home through cracks in the foundation. Depressurization can be caused by a combination of wind effects and stack effects, which are the result of heating within the building and/or mechanical ventilation. In extreme cases, the vapors may accumulate in dwellings to levels that may pose near-term safety hazards, such as explosion. Typically, however, vapor concentrations are present at low levels, to which long-term exposure may pose increased risk for chronic health effects.

This on-line calculator implements the Johnson and Ettinger (J&E) (Johnson and Ettinger, 1991) simplified model to evaluate the vapor intrusion pathway into buildings. This J&E model replicates the implementation that the US EPA Office of Solid Waste and Emergency Response (OSWER) used in developing its draft vapor intrusion guidance, but includes a number of enhancements that are facilitated by web implementation: temperature dependence of Henry's Law Constants and gaseous diffusivities, automatic sensitivity analysis of certain parameters, and others described on the background page.

The results you obtain from this OnSite implementation of the Johnson and Ettinger model may differ from other versions of the Johnson & Ettinger Model. In addition to the OSWER implementation that was used for the draft vapor intrusion guidance, EPA Office of Emergency Response and Remediation (OERR) distributes a set of spreadsheet implementations of the model. The differences among these implementations is described in detail on the results page. Beyond these differences the on-line version includes a simplified uncertainty analysis the other implementations lack.

	Click For an Example	
Enter Site Name (optional):	Adult resident	
Enter sample concentration, units and media type	2.726	μg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)	7	meters	
This value can change by +/-	1	meters	
What is your contaminant of concern (COC)?	gamma-HCH (Lindane)		
What type of building are you investigating at your site?		Slab-on-Grade	
What type of soil is beneath the building?		Loam	
What is the average soil/ground water temperature?	55	Farenheit	

Chemical Properties

CAS Number	58899	
Molecular Weight (MW)	290.83	[g/mole]
Henry's Law Constant at ground water temperature (H)	0.00013057	[unitless]
Free-Air Diffusion Coefficient (D_a)	1.420e-2	[cm²/s]
Diffusivity in Water (D_w)	7.340e-6	[cm²/s]
Unit Risk Factor (URF)	3.71e-4	[(μg/m³)⁻¹]
Reference Concentration (RfC)	1.05e-3	[mg/m³]

Soil Properties

Total Porosity (n)		0.399	[unitless]		
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]	
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]		
Height of Capillary Zone (CZh)		0.375	[m]		
Soil-gas Flow Rate into the Building (Q_{soil})		5.00	[L/min]		

Building Properties

Air Exchange Rate (E_B)	0.250	[hr⁻¹]
Building Mixing Height (H_B)	2.44	[m]
Building Footprint Area (F_B)	100.0	[m²]
Subsurface Foundation Area (A_B)	106.0	[m²]

		Building Crack Ratio (η)	0.00038	[unitless]
		Building Foundation Slab Thickness (L$_{crack}$)	0.100	[m]
Exposure Parameters				
		Exposure Duration for Carcinogens (ED$_c$)	30	[years]
		Exposure Frequency for Carcinogens (EF$_c$)	350	[days/year]
		Averaging Time for Carcinogens (AT$_c$)	70	[years]
		Exposure Duration for Non-Carcinogens (ED$_{nc}$)	30	[years]
		Exposure Frequency for Non-Carcinogens (EF$_{nc}$)	365	[days/year]
		Averaging Time for Non-Carcinogens (AT$_{nc}$)	30	[years]

CALCULATE RESULTS

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (D$_{eff}$)	0.001503	[cm2/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (D^T$_{eff}$)	0.001573	[cm2/s]

"A" Parameter	1.406e-4	Based on parameter analysis: Advection is
"B" Parameter	1376.	the dominant mechanism across foundation. Diffusion through soil is the overall rate-
"C" Parameter	0.004918	limiting process for the subsurface to indoor-air pathway.

Johnson & Ettinger Attenuation Factor (α)   1.367e-4

	INDOOR AIR RESULTS FOR GROUND WATER		SAMPLE DATA					
	Low Prediction[1]			Best Estimate			High Prediction[2]	
Indoor Air Concentration	4.248e-5 [μg/m3]	3.574e-6 [ppbv]		4.866e-5 [μg/m3]	4.093e-6 [ppbv]		1.170e-4 [μg/m3]	9.842e-6 [ppbv]
Cancer Risk	6.477e-9			7.419e-9			1.784e-8	
Hazard Quotient	4.046e-5			4.634e-5			1.114e-4	

[1] "Low Prediction" concentration produced with BEST ESTIMATE moisture content and DEEPEST depth to contamination.

[2] "High Prediction" concentration produced with HIGHEST moisture content and SHALLOWEST depth to contamination.
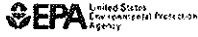
CLEAR ALL

FORMAT REPORT FOR PRINTER

What do these results mean?

Comments or suggestions

Top ^
Home | Glossary | Notation | Links | References | Calculators

♻ EPA United States
Environmental Protection
Agency

Ecosystems Research Division

EPA On-line Tools for Site Assessment Calculation

48 of 67

Screening Level Implementation of the Johnson and Ettinger Vapor Intrusion Model with two variable/uncertain parameters (source depth, moisture content)

Forward Calculation of Indoor Air Concentration

Backward Calculation full uncertainty analysis

Background

Migration of volatile chemicals from the subsurface into overlying buildings is called vapor intrusion (VI). Volatile organic chemicals in contaminated soils or groundwater can emit vapors, which may migrate through subsurface soils and may enter the indoor air of overlying buildings. Building depressurization may cause these vapors to enter the home through cracks in the foundation. Depressurization can be caused by a combination of wind effects and stack effects, which are the result of heating within the building and/or mechanical ventilation. In extreme cases, the vapors may accumulate in dwellings to levels that may pose near-term safety hazards, such as explosion. Typically, however, vapor concentrations are present at low levels, to which long-term exposure may pose increased risk for chronic health effects.

This on-line calculator implements the Johnson and Ettinger (J&E) (Johnson and Ettinger, 1991) simplified model to evaluate the vapor intrusion pathway into buildings. This J&E model replicates the implementation that the US EPA Office of Solid Waste and Emergency Response (OSWER) used in developing its draft vapor intrusion guidance, but includes a number of enhancements that are facilitated by web implementation: temperature dependence of Henry's Law Constants and gaseous diffusivities, automatic sensitivity analysis of certain parameters, and others described on the background page.

The results you obtain from this OnSite implementation of the Johnson and Ettinger model may differ from other versions of the Johnson & Ettinger Model. In addition to the OSWER implementation that was used for the draft vapor intrusion guidance, EPA Office of Emergency Response and Remediation (OERR) distributes a set of spreadsheet implementations of the model. The differences among these implementations is described in detail on the results page. Beyond these differences the on-line version includes a simplified uncertainty analysis the other implementations lack.

Click For an Example	

Enter Site Name (optional):		Adult Resident	
Enter sample concentration, units and media type	0.29	μg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)	7	meters	
This value can change by +/-	1	meters	
What is your contaminant of concern (COC)?	alpha-HCH (alpha-BHC)		
What type of building are you investigating at your site?		Slab-on-Grade	
What type of soil is beneath the building?		Loam	
What is the average soil/ground water temperature?		55	Farenheit

Chemical Properties

CAS Number	319846	
Molecular Weight (MW)	290.83	[g/mole]
Henry's Law Constant at ground water temperature (H)	0.00009886	[unitless]
Free-Air Diffusion Coefficient (D_a)	1.420e-2	[cm2/s]
Diffusivity in Water (D_w)	7.340e-6	[cm2/s]
Unit Risk Factor (URF)	1.80e-3	[(μg/m3)-1]
Reference Concentration (RfC)	0.	[mg/m3]

Soil Properties

Total Porosity (n)		0.399	[unitless]	
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]	
Height of Capillary Zone (CZ_h)		0.375	[m]	
Soil-gas Flow Rate into the Building (Q_{soil})		5.00	[L/min]	

Building Properties

Air Exchange Rate (E_B)	0.250	[hr-1]
Building Mixing Height (H_B)	2.44	[m]
Building Footprint Area (F_B)	100.0	[m2]
Subsurface Foundation Area (A_B)	106.0	[m2]

	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (L_{crack})	0.100	[m]
Exposure Parameters			
	Exposure Duration for Carcinogens (ED_c)	30	[years]
	Exposure Frequency for Carcinogens (EF_c)	350	[days/year]
	Averaging Time for Carcinogens (AT_c)	70	[years]
	Exposure Duration for Non-Carcinogens (ED_{nc})	30	[years]
	Exposure Frequency for Non-Carcinogens (EF_{nc})	365	[days/year]
	Averaging Time for Non-Carcinogens (AT_{nc})	30	[years]

CALCULATE RESULTS

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (D_{eff})	0.001699	[cm2/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (D^T_{eff})	0.001780	[cm2/s]

"A" Parameter	1.591e-4	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.
"B" Parameter	1218.	
"C" Parameter	0.004918	

Johnson & Ettinger Attenuation Factor (α)   1.541e-4

	INDOOR AIR RESULTS FOR GROUND WATER			SAMPLE DATA					
	Low Prediction[1]			Best Estimate			High Prediction[2]		
Indoor Air Concentration	3.859e-6	[µg/m3] 3.246e-7	[ppbv]	4.419e-6	[µg/m3] 3.717e-7	[ppbv]	1.203e-5	[µg/m3] 1.012e-6	[ppbv]
Cancer Risk	2.855e-9			3.269e-9			8.896e-9		
Hazard Quotient	0.			0.			0.		

[1] "Low Prediction" concentration produced with BEST ESTIMATE   moisture content and DEEPEST   depth to
contamination.

[2] "High Prediction" concentration produced with HIGHEST   moisture content and SHALLOWEST   depth to
contamination.

CLEAR ALL

FORMAT REPORT FOR PRINTER

What do these results mean?

Comments or suggestions

Top ^
Home | Glossary | Notation | Links | References | Calculators

♦EPA United States
Environmental Protection
Agency

Ecosystems Research Division

EPA On-line Tools for Site Assessment Calculation

Screening Level Implementation of the Johnson and Ettinger Vapor Intrusion Model with two variable/uncertain parameters (source depth, moisture content)

Forward Calculation of Indoor Air Concentration

Backward Calculation full uncertainty analysis

Background

Migration of volatile chemicals from the subsurface into overlying buildings is called vapor intrusion (VI). Volatile organic chemicals in contaminated soils or groundwater can emit vapors, which may migrate through subsurface soils and may enter the indoor air of overlying buildings. Building depressurization may cause these vapors to enter the home through cracks in the foundation. Depressurization can be caused by a combination of wind effects and stack effects, which are the result of heating within the building and/or mechanical ventilation. In extreme cases, the vapors may accumulate in dwellings to levels that may pose near-term safety hazards, such as explosion. Typically, however, vapor concentrations are present at low levels, to which long-term exposure may pose increased risk for chronic health effects.

This on-line calculator implements the Johnson and Ettinger (J&E) (Johnson and Ettinger, 1991) simplified model to evaluate the vapor intrusion pathway into buildings. This J&E model replicates the implementation that the US EPA Office of Solid Waste and Emergency Response (OSWER) used in developing its draft vapor intrusion guidance, but includes a number of enhancements that are facilitated by web implementation: temperature dependence of Henry's Law Constants and gaseous diffusivities, automatic sensitivity analysis of certain parameters, and others described on the background page.

The results you obtain from this OnSite implementation of the Johnson and Ettinger model may differ from other versions of the Johnson & Ettinger Model. In addition to the OSWER implementation that was used for the draft vapor intrusion guidance, EPA Office of Emergency Response and Remediation (OERR) distributes a set of spreadsheet implementations of the model. The differences among these implementations is described in detail on the results page. Beyond these differences the on-line version includes a simplified uncertainty analysis the other implementations lack.

Click For an Example					
Enter Site Name (optional):			Adult Resident		
Enter sample concentration, units and media type	57.29		µg/L	·	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L$_T$)			7		meters
This value can change by +/-			1		meters
What is your contaminant of concern (COC)?			Tetrachloroethylene		
What type of building are you investigating at your site?				Slab-on-Grade	
What type of soil is beneath the building?				Loam	
What is the average soil/ground water temperature?				55	Farenheit

Chemical Properties

CAS Number	127184	
Molecular Weight (MW)	165.83	[g/mole]
Henry's Law Constant at ground water temperature (H)	0.3934997	[unitless]
Free-Air Diffusion Coefficient (D$_a$)	7.200e-2	[cm^2/s]
Diffusivity in Water (D$_w$)	8.200e-6	[cm^2/s]
Unit Risk Factor (URF)	3.00e-6	[(µg/m^3)$^{-1}$]
Reference Concentration (RfC)	0.	[mg/m^3]

Soil Properties

Total Porosity (n)			0.399	[unitless]	
Unsaturated Zone Moisture Content (θ$_w$)	Low 0.0610		Best Estimate 0.148	High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure (θ$_{w,cap}$)			0.332	[unitless]	
Height of Capillary Zone (CZ$_h$)			0.375	[m]	
Soil-gas Flow Rate Into the Building (Q$_{soil}$)			5.00	[L/min]	

Building Properties

Air Exchange Rate (E$_B$)	0.250	[hr^{-1}]
Building Mixing Height (H$_B$)	2.44	[m]
Building Footprint Area (F$_B$)	100.0	[m^2]
Subsurface Foundation Area (A$_B$)	106.0	[m^2]

Building Crack Ratio (η)   0.00038   [unitless]
Building Foundation Slab Thickness (L_{crack})   0.100   [m]

Exposure Parameters

Exposure Duration for Carcinogens (ED_c)   30   [years]
Exposure Frequency for Carcinogens (EF_c)   350   [days/year]
Averaging Time for Carcinogens (AT_c)   70   [years]
Exposure Duration for Non-Carcinogens (ED_{nc})   30   [years]
Exposure Frequency for Non-Carcinogens (EF_{nc}) 365   [days/year]
Averaging Time for Non-Carcinogens (AT_{nc})   30   [years]

[CALCULATE RESULTS]

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (D_{eff})   0.004532   [cm2/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (D^T_{eff})   0.0008963   [cm2/s]

"A" Parameter   8.010e-5
"B" Parameter   456.5
"C" Parameter   0.004918

Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.

Johnson & Ettinger Attenuation Factor (α)   7.882e-5

	INDOOR AIR RESULTS FOR GROUND WATER		SAMPLE DATA					
	Low Prediction[1]			Best Estimate			High Prediction[2]		
Indoor Air Concentration	0.9959	[µg/m3]	0.1469	[ppbv] 1.777	[µg/m3] 0.2622	[ppbv] 2.033	[µg/m3] 0.3000	[ppbv]
Cancer Risk	1.228e-6			2.191e-6			2.507e-6		
Hazard Quotient	0.			0.			0.		

[1] "Low Prediction" concentration produced with HIGHEST   moisture content and DEEPEST   depth to contamination.

[2] "High Prediction" concentration produced with LOWEST   moisture content and SHALLOWEST   depth to contamination.

[CLEAR ALL]

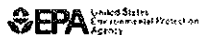[FORMAT REPORT FOR PRINTER]

What do these results mean?

Comments or suggestions

Top ^
Home | Glossary | Notation | Links | References | Calculators

WCMS
Last updated on Thursday, April 07, 2011

http://www.epa.gov/AthensR/learn2model/part-two/onsite/JnE_lite_forward.html

⊕EPA United States
Environmental Protection
Agency

Ecosystems Research Division

EPA On-line Tools for Site Assessment Calculation

Screening Level Implementation of the Johnson and Ettinger Vapor Intrusion Model with two variable/uncertain parameters (source depth, moisture content)

Forward Calculation of Indoor Air Concentration

Backward Calculation full uncertainty analysis

Background

Migration of volatile chemicals from the subsurface into overlying buildings is called vapor intrusion (VI). Volatile organic chemicals in contaminated soils or groundwater can emit vapors, which may migrate through subsurface soils and may enter the indoor air of overlying buildings. Building depressurization may cause these vapors to enter the home through cracks in the foundation. Depressurization can be caused by a combination of wind effects and stack effects, which are the result of heating within the building and/or mechanical ventilation. In extreme cases, the vapors may accumulate in dwellings to levels that may pose near-term safety hazards, such as explosion. Typically, however, vapor concentrations are present at low levels, to which long-term exposure may pose increased risk for chronic health effects.

This on-line calculator implements the Johnson and Ettinger (J&E) (Johnson and Ettinger, 1991) simplified model to evaluate the vapor intrusion pathway into buildings. This J&E model replicates the implementation that the US EPA Office of Solid Waste and Emergency Response (OSWER) used in developing its draft vapor intrusion guidance, but includes a number of enhancements that are facilitated by web implementation: temperature dependence of Henry's Law Constants and gaseous diffusivities, automatic sensitivity analysis of certain parameters, and others described on the background page.

The results you obtain from this OnSite implementation of the Johnson and Ettinger model may differ from other versions of the Johnson & Ettinger Model. In addition to the OSWER implementation that was used for the draft vapor intrusion guidance, EPA Office of Emergency Response and Remediation (OERR) distributes a set of spreadsheet implementations of the model. The differences among these implementations is described in detail on the results page. Beyond these differences the on-line version includes a simplified uncertainty analysis the other implementations lack.

	Click For an Example			
Enter Site Name (optional):		Adult Resident		
Enter sample concentration, units and media type	0.175	µg/L		Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)		7		meters
This value can change by +/-		1		meters
What is your contaminant of concern (COC)?	Naphthalene			
What type of building are you investigating at your site?			Slab-on-Grade	
What type of soil is beneath the building?			Loam	
What is the average soil/ground water temperature?			55	Farenheit

Chemical Properties

CAS Number	91203		
Molecular Weight (MW)	128.18	[g/mole]	
Henry's Law Constant at ground water temperature (H)	0.00810628	[unitless]	
Free-Air Diffusion Coefficient (D_a)	5.900e-2	[cm2/s]	
Diffusivity in Water (D_w)	7.500e-6	[cm2/s]	
Unit Risk Factor (URF)	0.	[(µg/m3)-1]	
Reference Concentration (RfC)	3.00e-3	[mg/m3]	

Soil Properties

Total Porosity (n)		0.399	[unitless]		
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]	
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]		
Height of Capillary Zone (CZ_h)		0.375	[m]		
Soil-gas Flow Rate Into the Building (Q_{soil})		5.00	[L/min]		

Building Properties

Air Exchange Rate (E_B)	0.250	[hr-1]
Building Mixing Height (H_B)	2.44	[m]
Building Footprint Area (F_B)	100.0	[m2]
Subsurface Foundation Area (A_B)	106.0	[m2]

	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (L$_{crack}$)	0.100	[m]
Exposure Parameters			
	Exposure Duration for Carcinogens (ED$_c$)	30	[years]
	Exposure Frequency for Carcinogens (EF$_c$)	350	[days/year]
	Averaging Time for Carcinogens (AT$_c$)	70	[years]
	Exposure Duration for Non-Carcinogens (ED$_{nc}$)	30	[years]
	Exposure Frequency for Non-Carcinogens (EF$_{nc}$)	365	[days/year]
	Averaging Time for Non-Carcinogens (AT$_{nc}$)	30	[years]

[CALCULATE RESULTS]

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (D$_{eff}$)	0.003724	[cm2/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (D^T$_{eff}$)	0.001883	[cm2/s]

"A" Parameter	1.683e-4	Based on parameter analysis: Advection is
"B" Parameter	555.6	the dominant mechanism across foundation. Diffusion through soil is the overall rate-
"C" Parameter	0.004918	limiting process for the subsurface to indoor-air pathway.

Johnson & Ettinger Attenuation Factor (α)   1.627e-4

	INDOOR AIR RESULTS FOR GROUND WATER			SAMPLE DATA					
	Low Prediction1			Best Estimate			High Prediction2		
Indoor Air Concentration	8.135e-5	[μg/m3]	1.553e-5 [ppbv]	2.300e-4	[μg/m3]	4.408e-5 [ppbv]	3.377e-4	[μg/m3]	6.447e-5 [ppbv]
Cancer Risk	0.			0.			0.		
Hazard Quotient	2.712e-5			7.695e-5			1.126e-4		

1 "Low Prediction" concentration produced with HIGHEST   moisture content and DEEPEST   depth to contamination.

2 "High Prediction" concentration produced with LOWEST   moisture content and SHALLOWEST   depth to contamination.

[CLEAR ALL]

[FORMAT REPORT FOR PRINTER]

What do these results mean?

Comments or suggestions

Top ^
Home | Glossary | Notation | Links | References | Calculators

EPA United States
Environmental Protection
Agency

Ecosystems Research Division

EPA On-line Tools for Site Assessment Calculation

Screening Level Implementation of the Johnson and Ettinger Vapor Intrusion Model with two variable/uncertain parameters (source depth, moisture content)

Forward Calculation of Indoor Air Concentration

Backward Calculation full uncertainty analysis

Background

Migration of volatile chemicals from the subsurface into overlying buildings is called vapor intrusion (VI). Volatile organic chemicals in contaminated soils or groundwater can emit vapors, which may migrate through subsurface soils and may enter the indoor air of overlying buildings. Building depressurization may cause these vapors to enter the home through cracks in the foundation. Depressurization can be caused by a combination of wind effects and stack effects, which are the result of heating within the building and/or mechanical ventilation. In extreme cases, the vapors may accumulate in dwellings to levels that may pose near-term safety hazards, such as explosion. Typically, however, vapor concentrations are present at low levels, to which long-term exposure may pose increased risk for chronic health effects.

This on-line calculator implements the Johnson and Ettinger (J&E) (Johnson and Ettinger, 1991) simplified model to evaluate the vapor intrusion pathway into buildings. This J&E model replicates the implementation that the US EPA Office of Solid Waste and Emergency Response (OSWER) used in developing its draft vapor intrusion guidance, but includes a number of enhancements that are facilitated by web implementation: temperature dependence of Henry's Law Constants and gaseous diffusivities, automatic sensitivity analysis of certain parameters, and others described on the background page.

The results you obtain from this OnSite implementation of the Johnson and Ettinger model may differ from other versions of the Johnson & Ettinger Model. In addition to the OSWER implementation that was used for the draft vapor intrusion guidance, EPA Office of Emergency Response and Remediation (OERR) distributes a set of spreadsheet implementations of the model. The differences among these implementations is described in detail on the results page. Beyond these differences the on-line version includes a simplified uncertainty analysis the other implementations lack.

	Click For an Example			
Enter Site Name (optional):		adult resident - Phase II		
Enter sample concentration, units and media type	83.5	µg/L	Ground Water	
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)		7	meters	
This value can change by +/-		1	meters	
What is your contaminant of concern (COC)?	cis-1,2-Dichloroethylene			
What type of building are you investigating at your site?			Slab-on-Grade	
What type of soil is beneath the building?			Loam	
What is the average soil/ground water temperature?		55	Farenheit	

Chemical Properties

CAS Number	156592		
Molecular Weight (MW)	96.94	[g/mole]	
Henry's Law Constant at ground water temperature (H)	0.09948721	[unitless]	
Free-Air Diffusion Coefficient (D_a)	7.360e-2	[cm2/s]	
Diffusivity in Water (D_w)	1.130e-5	[cm2/s]	
Unit Risk Factor (URF)	0.	[(µg/m3)-1]	
Reference Concentration (RfC)	3.50e-2	[mg/m3]	

Soil Properties

Total Porosity (n)			0.399	[unitless]		
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610		Best Estimate 0.148	High 0.240	[unitless]	
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)			0.332	[unitless]		
Height of Capillary Zone (CZ_h)			0.375	[m]		
Soil-gas Flow Rate into the Building (Q_{soil})			5.00	[L/min]		

Building Properties

Air Exchange Rate (E_B)	0.250	[hr-1]
Building Mixing Height (H_B)	2.44	[m]
Building Footprint Area (F_B)	100.0	[m2]
Subsurface Foundation Area (A_B)	106.0	[m2]

	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (L_{crack})	0.100	[m]

Exposure Parameters

	Exposure Duration for Carcinogens (ED_c)	30	[years]
	Exposure Frequency for Carcinogens (EF_c)	350	[days/year]
	Averaging Time for Carcinogens (AT_c)	70	[years]
	Exposure Duration for Non-Carcinogens (ED_{nc})	30	[years]
	Exposure Frequency for Non-Carcinogens (EF_{nc})	365	[days/year]
	Averaging Time for Non-Carcinogens (AT_{nc})	30	[years]

CALCULATE RESULTS

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (D_{eff})		0.004634	[cm2/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (D^T_{eff})		0.001090	[cm2/s]

"A" Parameter   9.743e-5

"B" Parameter   446.4

"C" Parameter   0.004918

Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.

Johnson & Ettinger Attenuation Factor (α)   9.553e-5

	INDOOR AIR RESULTS FOR GROUND WATER		SAMPLE DATA					
	Low Prediction[1]			Best Estimate			High Prediction[2]	
Indoor Air Concentration	0.4124 [µg/m3]	0.1041 [ppbv]		0.7936 [µg/m3]	0.2003 [ppbv]		0.9331 [µg/m3]	0.2355 [ppbv]
Cancer Risk	0.			0.			0.	
Hazard Quotient	0.01178			0.02267			0.02666	

[1] "Low Prediction" concentration produced with HIGHEST contamination.   moisture content and DEEPEST   depth to

[2] "High Prediction" concentration produced with LOWEST contamination.   moisture content and SHALLOWEST   depth to

CLEAR ALL

FORMAT REPORT FOR PRINTER
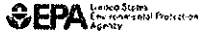
What do these results mean?

Comments or suggestions

Top ^
Home | Glossary | Notation | Links | References | Calculators

⊕EPA United States
Environmental Protection
Agency

Ecosystems Research Division

EPA On-line Tools for Site Assessment Calculation

Screening Level Implementation of the Johnson and Ettinger Vapor Intrusion Model with two variable/uncertain parameters (source depth, moisture content)

Forward Calculation of Indoor Air Concentration

Backward Calculation **full uncertainty analysis**

Background

Migration of volatile chemicals from the subsurface into overlying buildings is called vapor intrusion (VI). Volatile organic chemicals in contaminated soils or groundwater can emit vapors, which may migrate through subsurface soils and may enter the indoor air of overlying buildings. Building depressurization may cause these vapors to enter the home through cracks in the foundation. Depressurization can be caused by a combination of wind effects and stack effects, which are the result of heating within the building and/or mechanical ventilation. In extreme cases, the vapors may accumulate in dwellings to levels that may pose near-term safety hazards, such as explosion. Typically, however, vapor concentrations are present at low levels, to which long-term exposure may pose increased risk for chronic health effects.

This on-line calculator implements the Johnson and Ettinger (J&E) (Johnson and Ettinger, 1991) simplified model to evaluate the vapor intrusion pathway into buildings. This J&E model replicates the implementation that the US EPA Office of Solid Waste and Emergency Response (OSWER) used in developing its draft vapor intrusion guidance, but includes a number of enhancements that are facilitated by web implementation: temperature dependence of Henry's Law Constants and gaseous diffusivities, automatic sensitivity analysis of certain parameters, and others described on the background page.

The results you obtain from this OnSite implementation of the Johnson and Ettinger model may differ from other versions of the Johnson & Ettinger Model. In addition to the OSWER implementation that was used for the draft vapor intrusion guidance, EPA Office of Emergency Response and Remediation (OERR) distributes a set of spreadsheet implementations of the model. The differences among these implementations is described in detail on the results page. Beyond these differences the on-line version includes a simplified uncertainty analysis the other implementations lack.

Click For an Example			
Enter Site Name (optional):	adult resident - Phase II		
Enter sample concentration, units and media type	.377	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)	7	meters	
This value can change by +/-	1	meters	
What is your contaminant of concern (COC)?	Ethylbenzene		
What type of building are you investigating at your site?		Slab-on-Grade	
What type of soil is beneath the building?		Loam	
What is the average soil/ground water temperature?		55	Farenheit

Chemical Properties

CAS Number	100414	
Molecular Weight (MW)	106.17	[g/mole]
Henry's Law Constant at ground water temperature (H)	0.1613978	[unitless]
Free-Air Diffusion Coefficient (D_a)	7.500e-2	[cm2/s]
Diffusivity in Water (D_w)	7.800e-6	[cm2/s]
Unit Risk Factor (URF)	1.10e-6	[(µg/m3)-1]
Reference Concentration (RfC)	1.00	[mg/m3]

Soil Properties

Total Porosity (n)		0.399	[unitless]		
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]	
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]		
Height of Capillary Zone (CZ_h)		0.375	[m]		
Soil-gas Flow Rate into the Building (Q_{soil})		5.00	[L/min]		

Building Properties

Air Exchange Rate (E_B)	0.250	[hr-1]
Building Mixing Height (H_B)	2.44	[m]
Building Footprint Area (F_B)	100.0	[m2]
Subsurface Foundation Area (A_B)	106.0	[m2]

Building Crack Ratio (η)		0.00038	[unitless]
Building Foundation Slab Thickness (L$_{crack}$)		0.100	[m]

Exposure Parameters

Exposure Duration for Carcinogens (ED$_c$)		30	[years]
Exposure Frequency for Carcinogens (EF$_c$)		350	[days/year]
Averaging Time for Carcinogens (AT$_c$)		70	[years]
Exposure Duration for Non-Carcinogens (ED$_{nc}$)		30	[years]
Exposure Frequency for Non-Carcinogens (EF$_{nc}$)		365	[days/year]
Averaging Time for Non-Carcinogens (AT$_{nc}$)		30	[years]

[CALCULATE RESULTS]

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (D$_{eff}$)	0.004721	[cm2/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (D^T$_{eff}$)	0.0009855	[cm2/s]

"A" Parameter	8.807e-5	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.
"B" Parameter	438.2	
"C" Parameter	0.004918	

Johnson & Ettinger Attenuation Factor (α)   8.652e-5

	INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA								
	Low Prediction[1]			Best Estimate			High Prediction[2]		
Indoor Air Concentration	0.002885	[µg/m3]	6.647e-4 [ppbv]	0.005265	[µg/m3]	0.001213 [ppbv]	0.006071	[µg/m3]	0.001399 [ppbv]
Cancer Risk	1.304e-9			2.380e-9			2.745e-9		
Hazard Quotient	2.885e-6			5.265e-6			6.071e-6		

[1] "Low Prediction" concentration produced with HIGHEST   moisture content and DEEPEST   depth to contamination.

[2] "High Prediction" concentration produced with LOWEST   moisture content and SHALLOWEST   depth to contamination.

[CLEAR ALL]

[FORMAT REPORT FOR PRINTER]

What do these results mean?

Comments or suggestions

Top ^
Home | Glossary | Notation | Links | References | Calculators

&EPA United States
Environmental Protection
Agency

Ecosystems Research Division

EPA On-line Tools for Site Assessment Calculation

Screening Level Implementation of the Johnson and Ettinger Vapor Intrusion Model with two variable/uncertain parameters (source depth, moisture content)

Forward Calculation of Indoor Air Concentration

Backward Calculation **full uncertainty analysis**

Background

Migration of volatile chemicals from the subsurface into overlying buildings is called vapor intrusion (VI). Volatile organic chemicals in contaminated soils or groundwater can emit vapors, which may migrate through subsurface soils and may enter the indoor air of overlying buildings. Building depressurization may cause these vapors to enter the home through cracks in the foundation. Depressurization can be caused by a combination of wind effects and stack effects, which are the result of heating within the building and/or mechanical ventilation. In extreme cases, the vapors may accumulate in dwellings to levels that may pose near-term safety hazards, such as explosion. Typically, however, vapor concentrations are present at low levels, to which long-term exposure may pose increased risk for chronic health effects.

This on-line calculator implements the Johnson and Ettinger (J&E) (Johnson and Ettinger, 1991) simplified model to evaluate the vapor intrusion pathway into buildings. This J&E model replicates the implementation that the US EPA Office of Solid Waste and Emergency Response (OSWER) used in developing its draft vapor intrusion guidance, but includes a number of enhancements that are facilitated by web implementation: temperature dependence of Henry's Law Constants and gaseous diffusivities, automatic sensitivity analysis of certain parameters, and others described on the background page.

The results you obtain from this OnSite implementation of the Johnson and Ettinger model may differ from other versions of the Johnson & Ettinger Model. In addition to the OSWER implementation that was used for the draft vapor intrusion guidance, EPA Office of Emergency Response and Remediation (OERR) distributes a set of spreadsheet implementations of the model. The differences among these implementations is described in detail on the results page. Beyond these differences the on-line version includes a simplified uncertainty analysis the other implementations lack.

Click For an Example		
Enter Site Name (optional):		adult resident - Phase II

Enter sample concentration, units and media type	7	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L$_T$)		7	meters
This value can change by +/-		1	meters
What is your contaminant of concern (COC)?	Naphthalene		
What type of building are you investigating at your site?		Slab-on-Grade	
What type of soil is beneath the building?		Loam	
What is the average soil/ground water temperature?		55	Farenheit

Chemical Properties

CAS Number	91203	
Molecular Weight (MW)	128.18	[g/mole]
Henry's Law Constant at ground water temperature (H)	0.00810628	[unitless]
Free-Air Diffusion Coefficient (D$_a$)	5.900e-2	[cm2/s]
Diffusivity in Water (D$_w$)	7.500e-6	[cm2/s]
Unit Risk Factor (URF)	0.	[(µg/m3)-1]
Reference Concentration (RfC)	3.00e-3	[mg/m3]

Soil Properties

Total Porosity (n)		0.399	[unitless]	
Unsaturated Zone Moisture Content (θ$_w$)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure (θ$_{w,cap}$)		0.332	[unitless]	
Height of Capillary Zone (CZ$_n$)		0.375	[m]	
Soil-gas Flow Rate into the Building (Q$_{soil}$)		5.00	[L/min]	

Building Properties

Air Exchange Rate (E$_B$)	0.250	[hr-1]
Building Mixing Height (H$_B$)	2.44	[m]
Building Footprint Area (F$_B$)	100.0	[m2]
Subsurface Foundation Area (A$_B$)	106.0	[m2]

Building Crack Ratio (η)   0.00038   [unitless]
Building Foundation Slab Thickness (L_{crack})   0.100   [m]

Exposure Parameters

Exposure Duration for Carcinogens (ED_c)	30	[years]
Exposure Frequency for Carcinogens (EF_c)	350	[days/year]
Averaging Time for Carcinogens (AT_c)	70	[years]
Exposure Duration for Non-Carcinogens (ED_{nc})	30	[years]
Exposure Frequency for Non-Carcinogens (EF_{nc})	365	[days/year]
Averaging Time for Non-Carcinogens (AT_{nc})	30	[years]

[CALCULATE RESULTS]

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (D_{eff})	0.003724	[cm2/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (D^T_{eff})	0.001883	[cm2/s]

"A" Parameter   1.683e-4   Based on parameter analysis: Advection is
"B" Parameter   555.6   the dominant mechanism across foundation.
Diffusion through soil is the overall rate-
"C" Parameter   0.004918   limiting process for the subsurface to
indoor-air pathway.

Johnson & Ettinger Attenuation Factor (α)   1.627e-4

INDOOR AIR RESULTS FOR GROUND WATER			SAMPLE DATA					
	Low Prediction1			Best Estimate			High Prediction2	
Indoor Air Concentration	0.003254 [µg/m3]	6.211e-4 [ppbv]		0.009234 [µg/m3]	0.001762 [ppbv]		0.01351 [µg/m3]	0.002579 [ppbv]
Cancer Risk	0.			0.			0.	
Hazard Quotient	0.001085			0.003078			0.004503	

1 "Low Prediction" concentration produced with HIGHEST   moisture content and DEEPEST   depth to
contamination.

2 "High Prediction" concentration produced with LOWEST   moisture content and SHALLOWEST   depth to
contamination.

[CLEAR ALL]

[FORMAT REPORT FOR PRINTER]

What do these results mean?

Comments or suggestions

Top ^
Home | Glossary | Notation | Links | References | Calculators

⊕EPA United States
Environmental Protection
Agency

Ecosystems Research Division

EPA On-line Tools for Site Assessment Calculation

Screening Level Implementation of the Johnson and Ettinger Vapor Intrusion Model with two variable/uncertain parameters (source depth, moisture content)

Forward Calculation of Indoor Air Concentration

Backward Calculation full uncertainty analysis

Background

Migration of volatile chemicals from the subsurface into overlying buildings is called vapor intrusion (VI). Volatile organic chemicals in contaminated soils or groundwater can emit vapors, which may migrate through subsurface soils and may enter the indoor air of overlying buildings. Building depressurization may cause these vapors to enter the home through cracks in the foundation. Depressurization can be caused by a combination of wind effects and stack effects, which are the result of heating within the building and/or mechanical ventilation. In extreme cases, the vapors may accumulate in dwellings to levels that may pose near-term safety hazards, such as explosion. Typically, however, vapor concentrations are present at low levels, to which long-term exposure may pose increased risk for chronic health effects.

This on-line calculator implements the Johnson and Ettinger (J&E) (Johnson and Ettinger, 1991) simplified model to evaluate the vapor intrusion pathway into buildings. This J&E model replicates the implementation that the US EPA Office of Solid Waste and Emergency Response (OSWER) used in developing its draft vapor intrusion guidance, but includes a number of enhancements that are facilitated by web implementation: temperature dependence of Henry's Law Constants and gaseous diffusivities, automatic sensitivity analysis of certain parameters, and others described on the background page.

The results you obtain from this OnSite implementation of the Johnson and Ettinger model may differ from other versions of the Johnson & Ettinger Model. In addition to the OSWER implementation that was used for the draft vapor intrusion guidance, EPA Office of Emergency Response and Remediation (OERR) distributes a set of spreadsheet implementations of the model. The differences among these implementations is described in detail on the results page. Beyond these differences the on-line version includes a simplified uncertainty analysis the other implementations lack.

	Click For an Example	
Enter Site Name (optional):		adult resident - Phase II

Enter sample concentration, units and media type	161	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)		7	meters
This value can change by +/-		1	meters
What is your contaminant of concern (COC)?	Tetrachloroethylene		
What type of building are you investigating at your site?		Slab-on-Grade	
What type of soil is beneath the building?		Loam	
What is the average soil/ground water temperature?		55	Farenheit

Chemical Properties

CAS Number	127184	
Molecular Weight (MW)	165.83	[g/mole]
Henry's Law Constant at ground water temperature (H)	0.3934997	[unitless]
Free-Air Diffusion Coefficient (D_a)	7.200e-2	[cm2/s]
Diffusivity in Water (D_w)	8.200e-6	[cm2/s]
Unit Risk Factor (URF)	3.00e-6	[(µg/m3)-1]
Reference Concentration (RfC)	0.	[mg/m3]

Soil Properties

Total Porosity (n)		0.399	[unitless]		
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]	
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]		
Height of Capillary Zone (CZ_h)		0.375	[m]		
Soil-gas Flow Rate Into the Building (Q_{soil})		5.00	[L/min]		

Building Properties

Air Exchange Rate (E_B)	0.250	[hr-1]
Building Mixing Height (H_B)	2.44	[m]
Building Footprint Area (F_B)	100.0	[m2]
Subsurface Foundation Area (A_B)	106.0	[m2]