

ALARA Analysis Worksheet

Survey Area: <u>00L-08</u>		Survey Unit: <u>01</u>		
A. Estimation of Total Cost (Cost_T)				
1. Cost of performing remediation work (Cost _R)		<u>2 persons for 2h @ ASD per h (no brush clearing or heavy equipment)</u>	\$ <u>200</u>	
2. Cost of waste disposal (Cost _{WD}) = (2.a) · (2.b)		<u>1 m² to depth of 6"</u>	\$ <u>1242</u>	
a. estimated waste volume <u>0.1524</u> m ³		<u>1m * 1m * 0.1524m = 0.1524 m³</u>		
b. cost of waste disposal <u>8147</u> \$/m ³				
3. Cost of workplace accident (Cost _{ACC}) = \$3,000,000 person ⁻¹ · 4.2x10 ⁻⁸ h ⁻¹ · (3.a)			\$ <u>0.50</u>	
a. time to perform remediation action <u>4</u> person-hours				
4. Cost of traffic fatality (Cost _{TF}) = { \$3,000,000 · 3.8x10 ⁻⁸ km ⁻¹ · (2.a) · (4.a) } / (4.b)			\$ <u>5.11</u>	
a. total distance traveled per shipment <u>~4000</u> km (to E of U)				
b. waste volume per shipment <u>13.6</u> m ³ , if unknown, use 13.6m ³ as a default value				
5. Cost of worker dose (Cost _{WDose}) = \$2,000 per person-rem · (5.a) · (5.b)			\$ <u>4.1 x 10⁻⁶</u>	
a. worker TEDE <u>1.14 x 10⁻⁶</u> rem/h (soil assumed at 10 mrem/y DCGL)				
b. remediation exposure time <u>4</u> person-hour				
Cost _T			\$ <u>1448</u>	
B. Survey Unit Radiological Information				
Radionuclide	Average Concentration	Relative Fraction ^a	Half-Life (y)	Decay Constant ^b (y ⁻¹)
1. <u>Cs137</u>	<u>3.44 pCi/g</u> (3.28, 3.0)	b. <u>1.0</u>	c. <u>30.17</u>	d. <u>0.023</u>
2. _____	a. _____	b. _____	c. _____	d. _____
3. _____	a. _____	b. _____	c. _____	d. _____
4. _____	a. _____	b. _____	c. _____	d. _____
5. _____	a. _____	b. _____	c. _____	d. _____
6. _____	a. _____	b. _____	c. _____	d. _____
7. _____	a. _____	b. _____	c. _____	d. _____
8. _____	a. <u>3.0</u> (3.28)	b. _____	c. _____	d. _____
Total Concentration: <u>3.44 pCi/g</u>				
^a Relative fraction = average concentration divided by the total concentration. ^b Decay constant = 0.693 divided by half-life.				

C. Calculation of ALARA Action Level (AL)

1. Removable fraction for remediation action being evaluated 1
2. Monetary discount rate 0.03 y⁻¹
3. Number of years over which the collective dose is calculated 1000 y
4. Population density for the critical group 0.0004 people/m²
5. Survey unit area ^{Area being evaluated} 1 m² (Note: The original working is incorrect - this is a pending rev.1 change.)

6. AL for each radionuclide-of-interest:

- a. AL = {Cost_T/(\$2000 · C.4 · 0.025 · C.1 · C.5)} · {(C.2 + B.1.d)/(1-e^{-(C.2+B.1.d)·C.3})} · {B.1.b} = 3,837
 - b. AL = {Cost_T/(\$2000 · C.4 · 0.025 · C.1 · C.5)} · {(C.2 + B.2.d)/(1-e^{-(C.2+B.2.d)·C.3})} · {B.2.b} = _____
 - c. AL = {Cost_T/(\$2000 · C.4 · 0.025 · C.1 · C.5)} · {(C.2 + B.3.d)/(1-e^{-(C.2+B.3.d)·C.3})} · {B.3.b} = _____
 - d. AL = {Cost_T/(\$2000 · C.4 · 0.025 · C.1 · C.5)} · {(C.2 + B.4.d)/(1-e^{-(C.2+B.4.d)·C.3})} · {B.4.b} = _____
 - e. AL = {Cost_T/(\$2000 · C.4 · 0.025 · C.1 · C.5)} · {(C.2 + B.5.d)/(1-e^{-(C.2+B.5.d)·C.3})} · {B.5.b} = _____
 - f. AL = {Cost_T/(\$2000 · C.4 · 0.025 · C.1 · C.5)} · {(C.2 + B.6.d)/(1-e^{-(C.2+B.6.d)·C.3})} · {B.6.b} = _____
 - g. AL = {Cost_T/(\$2000 · C.4 · 0.025 · C.1 · C.5)} · {(C.2 + B.7.d)/(1-e^{-(C.2+B.7.d)·C.3})} · {B.7.b} = _____
 - h. AL = {Cost_T/(\$2000 · C.4 · 0.025 · C.1 · C.5)} · {(C.2 + B.8.d)/(1-e^{-(C.2+B.8.d)·C.3})} · {B.8.b} = _____
- 7..... Sum of ALs (= ALARA AL) = 3,837

D. ALARA Evaluation

Radionuclide	DCGL	DCGL Fraction ^a
1. <u>Cs 137</u>	³⁰ <u>3.28</u> ^{JWB 10/27/04} <u>3.44 pCi/g</u>	b. (B.1.a)/(D.1.a) = <u>1.0</u>
2. _____	a. _____	b. (B.2.a)/(D.3.a) = _____
3. _____	a. _____	b. (B.3.a)/(D.4.a) = _____
4. _____	a. _____	b. (B.4.a)/(D.5.a) = _____
5. _____	a. _____	b. (B.5.a)/(D.6.a) = _____
6. _____	a. _____	b. (B.7.a)/(D.7.a) = _____
7. _____	a. _____	b. (B.8.a)/(D.8.a) = _____
8. _____	a. _____	b. (B.9.a)/(D.9.a) = _____
9.....	Sum of DCGL Fractions = <u>1.0</u>	

^a DCGL fraction = average residual concentration in survey unit (from Section B) divided by the DCGL.

10. Comparison of the sum of the DCGL fractions (D.9) to ALARA AL (C.7):

Check one: Sum of the DCGL Fractions < ALARA AL Sum of the DCGL Fractions > ALARA AL

12. **Decision Criteria:** If the sum of the DCGL fractions $< AL$, then additional remediation is not cost beneficial. If the sum of the DCGL fractions $> AL$, then additional remediation is cost beneficial.

Check one: Additional remediation **IS NOT** cost beneficial
Additional remediation **IS** cost beneficial

Prepared by J. W. Busm Date 10/7/04
FSS Radiological Engineer

Reviewed by [Signature] Date 10/13/04
FSS Project Manager

Generic ALARA Evaluation Comparison Worksheet

Survey Area: <u>OOL-08</u>		Survey Unit: <u>02</u>	
Reference Generic ALARA Evaluation No.: _____		<u>YA-REPT-00-003-05</u>	
Applicable Generic ALARA AL: _____		<u>165</u>	
Radionuclide	Average Concentration	DCGL	fraction DCGL
1 <u>Co-60</u>	<u>0.0067</u>	<u>1.4</u>	<u>4.79E-03</u>
2 <u>Cs-137</u>	<u>0.4354</u>	<u>3</u>	<u>1.45E-01</u>
3 _____	_____	_____	_____
4 _____	_____	_____	_____
		Σ (fraction DCGL):	<u>1.50E-01</u>
<p>If the Σ(fraction DCGL) < the generic ALARA AL, then the generic ALARA evaluation is applicable to the survey unit.</p> <p>Check one:</p> <p><input checked="" type="checkbox"/> Generic ALARA AL IS satisfied.</p> <p><input type="checkbox"/> Generic ALARA AL IS NOT satisfied.</p>			
Prepared by: <u>Ron Shippee</u> <i>Ronald Shippee</i>		Date: <u>7/10/2006</u>	
FSS Radiological Engineer			
Reviewed by: <i>Rennhack ML</i>		Date: <u>7-12-06</u>	
FSS Project Manager/Radiation Protection Manager <i>MR 7-12-06</i>			
FSS Rad Engineer			

Generic ALARA Evaluation Comparison Worksheet

Survey Area: OOL-08 Survey Unit: 03
 Reference Generic ALARA Evaluation No.: YA-REPT-00-003-05
 Applicable Generic ALARA AL: 165

Radionuclide	Average Concentration	DCGL	fraction DCGL
1. <u>Cs-137</u>	<u>0.632 pCi/g</u>	<u>3 pCi/g</u>	<u>0.21</u>
2. _____	_____	_____	_____
3. _____	_____	_____	_____
4. _____	_____	_____	_____
$\Sigma(\text{fraction DCGL}) =$			<u>0.21</u>

If the $\Sigma(\text{fraction DCGL}) <$ the generic ALARA AL, then the generic ALARA evaluation is applicable to the survey unit.

Check one:

- Generic ALARA AL **IS** satisfied.
 Generic ALARA AL **IS NOT** satisfied.

Prepared by: J. Hummer Date: 4/18/06
 FSS Radiological Engineer
 Reviewed by: Marta C. Bial Date: 5/4/06
 FSS Project Manager

Generic ALARA Evaluation Comparison Worksheet

Survey Area: <u> OOL-08 </u>		Survey Unit: <u> 04 </u>	
Reference Generic ALARA Evaluation No.: <u> </u>		YA-REPT-00-003-05	
Applicable Generic ALARA AL: <u> </u>		165	

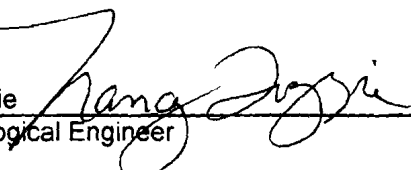
Radionuclide	Average Concentration	DCGL	fraction DCGL
1 <u> Cs-137 </u>	<u> 0.1697 </u>	<u> 3 </u>	<u> 5.66E-02 </u>
2 <u> </u>	<u> 0 </u>	<u> </u>	<u> </u>
3 <u> </u>	<u> </u>	<u> </u>	<u> </u>
4 <u> </u>	<u> </u>	<u> </u>	<u> </u>
$\Sigma(\text{fraction DCGL}):$			<u> 5.66E-02 </u>


If the $\Sigma(\text{fraction DCGL}) <$ the generic ALARA AL, then the generic ALARA evaluation is applicable to the survey unit.

Check one:

Generic ALARA AL **IS** satisfied.

Generic ALARA AL **IS NOT** satisfied.

Prepared by: Nancy Tozzie  Date: 7/13/2006
FSS Radiological Engineer

Reviewed by: Matt C. Smith  Date: 7/13/06
FSS Project Manager/Radiation Protection Manager

Generic ALARA Evaluation Comparison Worksheet

Survey Area: OOL-08

Survey Unit: 05

Reference Generic ALARA Evaluation No.: YA-REPT-00-003-05

Applicable Generic ALARA Action Level = 165

RADIONUCLIDE	AVERAGE CONCENTRATION	DCGL	FRACTION DCGL
Cs-137	0.05 pCi/g	3 pCi/g	0.02
$\Sigma(\text{fraction DCGL}) =$			0.02

If the $\Sigma(\text{fraction DCGL}) <$ the generic ALARA AL, then the generic ALARA evaluation is applicable to the survey unit.

Check one:

Generic ALARA AL **IS** satisfied.

Generic ALARA AL **IS NOT** satisfied.

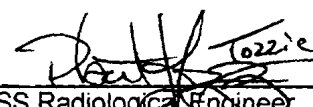
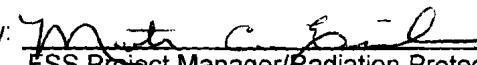
Prepared by: Mat C. Gail Date: 5/9/06
FSS Radiological Engineer

Reviewed by: Jm Balmeau Date: 5/10/06
FSS Project Manager/Radiation Protection Manager

Generic ALARA Evaluation Comparison Worksheet

Survey Area: <u> OOL-08 </u>		Survey Unit: <u> 06 </u>		
Reference Generic ALARA Evaluation No.: <u> YA-REPT-00-003-05 </u>				
Applicable Generic ALARA AL: <u> 165 </u>				
	Radionuclide	Average Concentration	DCGL	fraction DCGL
1	<u> Co-60 </u>	<u> 0.0067 </u>	<u> 1.4 </u>	<u> 4.79E-03 </u>
2	<u> Cs-137 </u>	<u> 0.4292 </u>	<u> 3 </u>	<u> 1.43E-01 </u>
3	<u> </u>	<u> </u>	<u> </u>	<u> </u>
4	<u> </u>	<u> </u>	<u> </u>	<u> </u>
			$\Sigma(\text{fraction DCGL}):$	<u> 1.48E-01 </u>
<p>If the $\Sigma(\text{fraction DCGL}) <$ the generic ALARA AL, then the generic ALARA evaluation is applicable to the survey unit.</p> <p>Check one:</p> <p><input checked="" type="checkbox"/> <u> X </u> Generic ALARA AL IS satisfied.</p> <p><input type="checkbox"/> <u> </u> Generic ALARA AL IS NOT satisfied.</p>				
Prepared by: <u> Ron Shippee </u> <i>Ronald Shippee</i>		Date: <u> 8/7/2006 </u>		
FSS Radiological Engineer				
Reviewed by: <u> <i>Mat C. Gail</i> </u>		Date: <u> 8/7/06 </u>		
FSS Project Manager/Radiation Protection Manager				

Generic ALARA Evaluation Comparison Worksheet

Survey Area: <u>OOL-08</u>		Survey Unit: <u>07</u>	
Reference Generic ALARA Evaluation No.: _____		<u>YA-REPT-00-003-05</u>	
Applicable Generic ALARA AL: _____		<u>165</u>	
	Radionuclide	Average Concentration	DCGL
1	<u>Co-60</u>	<u>0.0065</u>	<u>1.4</u>
2	<u>Cs-137</u>	<u>0.4337</u>	<u>3</u>
3	_____	_____	_____
4	_____	_____	_____
			$\Sigma(\text{fraction DCGL}):$ <u>1.49E-01</u>
<p>If the $\Sigma(\text{fraction DCGL}) <$ the generic ALARA AL, then the generic ALARA evaluation is applicable to the survey unit.</p> <p>Check one:</p> <p><input checked="" type="checkbox"/> Generic ALARA AL IS satisfied.</p> <p><input type="checkbox"/> Generic ALARA AL IS NOT satisfied.</p>			
Prepared by: <u>0 </u>		Date: <u>9/12/2006</u>	
FSS Radiological Engineer			
Reviewed by: <u></u>		Date: <u>9/12/06</u>	
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