



**American Radiolabeled  
Chemicals, Inc.**

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April 20, 2008

U.S. Nuclear Regulatory Commission, Region III  
2443 Warrenville Road, Suite 210  
Lisle, IL 60532-4351

ATTN: Pat Loudon

LICENSE No: 24-21362-01

SUBJECT: Upper Bound on Potential Dose .

Gentlemen:

American Radiolabeled Chemicals, Inc (ARC) has completed an analysis of the upper bound on potential dose to individuals with non-removable contamination on the seats of their private owned vehicles

A copy of this report is attached in compliance with our agreementr..

If you have any questions or require clarification on any of the information stated above, you may contact Regis A. Greenwood, CHP at 314-991-4545.

*Sincerely*

AMERICAN RADIOLABELLED CHEMICALS, INC

Surendra K. Gupta, PhD  
President

ATTACHMENT

1. Upper Bound Calculation for C-14 Surface Contamination.

RECEIVED APR 22 2008

## Upper Bound Calculations for C-14 Surface Contamination

### Dose to an Adult sitting on the contaminated car seat

#### Assumptions:

1. Contamination is fixed, efforts to remove have failed.
2. Contamination is buried approx 1 mm depth, which is an air gap of 1 mm .
3. Maximum activity found was 425,000 d/m/17 cm<sup>2</sup> , 25,000 d/m/ cm<sup>2</sup>
4. It is assumed that an activity of 50,000 d/m/cm<sup>2</sup> is an upper bound.
5. The contamination is evenly spread over the entire car seat.
6. The seat is 20 inches wide by 20 inches deep. (2580.6 cm<sup>2</sup>)
7. This gives a upper bound total of 58.1 microcuries for the entire seat.
8. A child/infant safety seat is significantly smaller.
9. The individual seated is wearing clothing at least as thick as a pair of coveralls.
10. Dose will be calculated at a depth of 1 cm; no critical organ is closer to the skin surface.
11. First run will assume the individual is seated for 2 hours/day for a year. (730 hours) No decay correction is necessary as the nuclide is C-14.
12. Subsequent runs will cover 8 hours per day and 24 hours per day.

**The result of all three calculation using VARSKIN Mod3 is zero dose at 1 cm in tissue.**

It is assumed that the actual clothing/cover on a small child would be significantly thicker than the 5 mm of 0.4 gm/cm<sup>2</sup> cloth used in the calculation, resulting in an even lower likelihood of any dose.

#### Assumptions for ingestion/inhalation by child/infant

1. The same total amount is present (58.1 microcuries) on the child seat as was present on the adult car seat.
2. Although the activity has been shown to resist all efforts at removal, it is assumed that the infant/child is able to ingest/ inhale 5 % of the activity, 2.91 microcuries.
3. The ALI for C-14 is 2000 microcuries.
4. This would result in an upper bound intake of 0.0015 of the ALI, corresponding to a dose of 7.26 millirem (CEDE).
5. As CEDE predicates the dose committed over the next 50 years, and the half life of C-14 is very much greater than 50 years, the actual dose delivered will be essentially equal yearly increments over that time.

**This would result in an actual dose of significantly less than 1 millirem in a year.**

# Varskin 3 Beta Test Versi

Version 0.1.1

Date: 4/11/2008

Time: 3:00:03 PM

## Hot Seat 2hr/day

### 2-D Disk Source Geometry

Skin Density Thickness: 1000 mg/cm<sup>2</sup>  
Air Gap Thickness: 1 mm  
Protective Clothing Thickness: 5 mm  
Protective Clothing Density: 0.40 g/cm<sup>3</sup>  
Source Diameter: 57 cm  
Source Area: 2551.759 cm<sup>2</sup>  
Irradiation Time: 43800 min  
Irradiation Area: 10 cm<sup>2</sup>

Nuclide: C-14  
Half Life: 50229180 h  
Average Beta Energy: 0.049 MeV  
1.8\*X90 Distance: 0.017 cm  
Average Gamma Energy: 0.000 MeV  
Specific Gamma Ray Constant: 0.000 R-cm<sup>2</sup>/(mCi-h)  
Source Strength: 58.1 µCi

	<b>Initial Dose Rate</b>	<b>Dose (No Decay)</b>	<b>Decay-Corrected Dose</b>
<b>Beta</b>	0.00E+00 rad/h	0.00E+00 rad	0.00E+00 rad
		<b>Gamma Dose Not Calculated</b>	
<b>Total</b>	0.00E+00 rad/h	0.00E+00 rad	0.00E+00 rad

# Varskin 3 Beta Test Versi

Version 0.1.1

Date: 4/11/2008

Time: 3:02:51 PM

## Hot seat 8hr/dat-2

### 2-D Disk Source Geometry

Skin Density Thickness: 1000 mg/cm<sup>2</sup>  
Air Gap Thickness: 1 mm  
Protective Clothing Thickness: 5 mm  
Protective Clothing Density: 0.40 g/cm<sup>3</sup>  
Source Diameter: 57 cm  
Source Area: 2551.759 cm<sup>2</sup>  
Irradiation Time: 2920 hr  
Irradiation Area: 10 cm<sup>2</sup>

Nuclide: C-14  
Half Life: 50229180 h  
Average Beta Energy: 0.049 MeV  
1.8\*X90 Distance: 0.017 cm  
Average Gamma Energy: 0.000 MeV  
Specific Gamma Ray Constant: 0.000 R-cm<sup>2</sup>/(mCi-h)  
Source Strength: 58.1 µCi

	Initial Dose Rate	Dose (No Decay)	Decay-Corrected Dose
<b>Beta</b>	0.00E+00 rad/h	0.00E+00 rad	0.00E+00 rad
		<b>Gamma Dose Not Calculated</b>	
<b>Total</b>	0.00E+00 rad/h	0.00E+00 rad	0.00E+00 rad

# Varskin 3 Beta Test Versi

Version 0.1.1

Date: 4/11/2008

Time: 3:04:35 PM

## Hot seat 24 hr/day

### 2-D Disk Source Geometry

Skin Density Thickness: 1000 mg/cm<sup>2</sup>  
Air Gap Thickness: 1 mm  
Protective Clothing Thickness: 5 mm  
Protective Clothing Density: 0.40 g/cm<sup>3</sup>  
Source Diameter: 57 cm  
Source Area: 2551.759 cm<sup>2</sup>  
Irradiation Time: 8760 hr  
Irradiation Area: 10 cm<sup>2</sup>

Nuclide: C-14  
Half Life: 50229180 h  
Average Beta Energy: 0.049 MeV  
1.8\*X90 Distance: 0.017 cm  
Average Gamma Energy: 0.000 MeV  
Specific Gamma Ray Constant: 0.000 R-cm<sup>2</sup>/(mCi-h)  
Source Strength: 58.1 µCi

	<b>Initial Dose Rate</b>	<b>Dose (No Decay)</b>	<b>Decay-Corrected Dose</b>
<b>Beta</b>	0.00E+00 rad/h	0.00E+00 rad	0.00E+00 rad
		<b>Gamma Dose Not Calculated</b>	
<b>Total</b>	0.00E+00 rad/h	0.00E+00 rad	0.00E+00 rad

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