Message

From: Walker, Stuart [Walker.Stuart@epa.gov]
Sent: 12/11/2020 6:01:57 PM
To: Hays, David C Jr CIV USARMY CENWK (USA) [David.C.Hays@usace.army.mil]
CC: Praskins, Wayne [Praskins.Wayne@epa.gov]; Clements, Julie A CIV (USA) [Julie.A.Clements@usace.army.mil]; Rankins, Jonathan E CIV USARMY CEMVS (USA) [Jonathan.E.Rankins@usace.army.mil]; Filips, Michael R CIV USARMY CEHNC (USA) [Michael.R.Filips@usace.army.mil]
Subject: RE: Dust ingestion - BPRG v RESRAD BUILD

Thanks Dave, I think the report will greatly help inform discussions about the two models at the site.

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From: Hays, David C Jr CIV USARMY CENWK (USA) <David.C.Hays@usace.army.mil>
Sent: Friday, December 11, 2020 8:53 AM
To: Walker, Stuart <Walker.Stuart@epa.gov>
Cc: Praskins, Wayne <Praskins.Wayne@epa.gov>; Clements, Julie A CIV (USA) <Julie.A.Clements@usace.army.mil>; Rankins, Jonathan E CIV USARMY CEMVS (USA) <Jonathan.E.Rankins@usace.army.mil>; Filips, Michael R CIV USARMY CEHNC (USA) <Michael.R.Filips@usace.army.mil>
Subject: RE: Dust ingestion - BPRG v RESRAD BUILD

Stuart, I will do a quick eval of the direct ingestion aspects and have been working on adding some discussions of the air model comparison to the report. I will wrap those up today and get the report to you and all on Monday.

FYI: RESRAD BLD reports the air concentration it uses so I can take that value and plug into the BPRG air model and compare results. I think in doing so we have a complete comparison between models. I can not find where RESRAD presents the actual calculated dust concentrations but it is somewhere in the code. I have asked ANL if that can be found in any of the output reports? But regardless will wrap report up.

Dave

From: Praskins, Wayne <Praskins.Wayne@epa.gov>
Sent: Thursday, December 10, 2020 8:51 PM
To: Hays, David C Jr CIV USARMY CENWK (USA) <David.C.Hays@usace.army.mil>
Cc: Walker, Stuart <Walker.Stuart@epa.gov>
Subject: [Non-DoD Source] FW: Dust ingestion - BPRG v RESRAD BUILD

Dave –

I spent some time running RESRAD BUILD to try to get a better sense of the differences, on the dust side, compared to BPRG. Can you give me some feedback whether my understanding is correct?

1. RRB has two options for modeling the ingestion pathway: 1) direct ingestion from the source; 2) indirect ingestion of settled dust derived from a portion of the source that is assumed to become airborne, allowing for

the loss of some of the airborne contamination through exchange with outdoor air. The Navy ran their Hunter's Point simulations assuming no direct ingestion.

2. The amount of indirect ingestion is sensitive to the "airborne release fraction" (the Navy assumed 10%) and the air exchange rate (the Navy assumed 0.45/hour). The indirect ingestion pathway, with the assumed parameter values, greatly attenuates the dust concentration.

3. The effective ingestion rate used by the Navy in their RRB simulations is an order of magnitude or so less than the default BPRG value.

And a few questions:

4. Would using the direct ingestion option in RRB (vs indirect ingestion) more closely match the BPRG approach?

5. Do you have an opinion on the reasonableness of the values the Navy chose for airborne release fraction (0.1) and air exchange rate (0.45/hr)? A higher airborne release fraction and lower air exchange rate give higher risks more in line with the BPRG.

6. On the dust side, do you think the two differences (lower RRB ingestion rate, RRB dust concentration attenuated by the low air release fraction and loss to the outdoors) are the two biggest reasons the Hunters Point RRB and BPRG results differ?

Thanks!

Wayne Praskins | Superfund Project Manager
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From: Dolislager, Fredrick G. <dolislagerf1@ornl.gov>
Sent: Friday, December 4, 2020 4:24 AM
To: Praskins, Wayne <Praskins.Wayne@epa.gov>; Walker, Stuart <Walker.Stuart@epa.gov>
Cc: David Hays <David.C.Hays@usace.army.mil>
Subject: RE: Dust ingestion - BPRG v RESRAD BUILD

Howdy,

350, not 355 days/yr.

24cm2/day is 4.9 by 4.9 cm area. That a 2 inch by 2 inch area. That's ridiculously small. For a kid with a FQ 0f 17 times/day.

RESRAD only does 16 hr/day.

I 'll have to look more closely at their user guide later today, but their approach is quite different than traditional EPA exposure parameter determination.

fred d.

From: Praskins, Wayne <Praskins.Wayne@epa.gov>
Sent: Thursday, December 3, 2020 8:54 PM

To: Walker, Stuart <Walker.Stuart@epa.gov>
Cc: Dolislager, Fredrick G. <dolislagerf1@ornl.gov>; David Hays <David.C.Hays@usace.army.mil>
Subject: [EXTERNAL] RE: Dust ingestion - BPRG v RESRAD BUILD

Thanks!

So, using 355 days/year instead of 365, the average BPRG ingestion rate is 347 cm2/day (290 cm2/day for adults and 536 cm2/day for children).

For their Hunter's Point evaluation, using RESRAD BUILD, the Navy used 24 cm2/day for adults and 48 cm2/day for children. (They say they doubled the rate for children to be consistent with the adult/child ratio in the 2017 update to the Exposures Factor Handbook). So the Navy/RESRAD ingestion rates are 11 - 12 times lower for both adults and children.

Karessa suggested looking at the FTSS, FQ, SE, and SA values in RESRAD BUILD. As best I can tell, they are not explicitly described in the RESRAD BUILD User's Guide.

The basis for the Navy's adult ingestion rate (0.0001 m2/hr = 24 cm2/day) is described on pp. J-66 to J-68 of the RESRAD BUILD User's Guide (attached). They appear to have chosen a mean value from the lesser of two distributions presented in a 1998 letter report by Walt Beyeler at Sandia. Are you familiar with the Beyeler report? Any comment on their choice or interpretation of the data and how that compares to the FTSS, FQ, SE, and SA values used to model ingestion in the BPRG?

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From: Walker, Stuart <Walker.Stuart@epa.gov>
Sent: Thursday, December 3, 2020 7:57 AM
To: Praskins, Wayne <Praskins.Wayne@epa.gov>
Cc: Dolislager, Fredrick G. <dolislagerf1@ornl.gov>; David Hays <David.C.Hays@usace.army.mil>
Subject: FW: Dust ingestion - BPRG v RESRAD BUILD

Hi Wayne, see email chain with Fred on your questions

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From: Walker, Stuart
Sent: Thursday, December 03, 2020 9:36 AM
To: Dolislager, Fredrick G. <dolislagerf1@ornl.gov>
Cc: Manning, Karessa <manningkl@ornl.gov>
Subject: RE: Dust ingestion - BPRG v RESRAD BUILD

Thanks, but I don't think we need to get into the potential future default numbers we might adopt.

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From: Dolislager, Fredrick G. <dolislagerf1@ornl.gov>
Sent: Thursday, December 03, 2020 8:48 AM
To: Walker, Stuart <Walker.Stuart@epa.gov>
Cc: Manning, Karessa <manningkl@ornl.gov>
Subject: RE: Dust ingestion - BPRG v RESRAD BUILD

See below
Karessa may have comments on what our proposed new parameters might be.

The WTC https://archive.epa.gov/wtc/web/pdf/contaminants_of_concern_benchmark_study.pdf says FTSS for hands is 10% and 50% for soft and hard surfaces, respectively. The SA is 15 and 45 cm2 for child and adult, respectively. The FQ is 9.5 and times per day for child and adult, respectively. The SE is 50%. ET is 8 hr/day for soft and 4 hr/day for hard surfaces.

fred d.

From: Walker, Stuart <Walker.Stuart@epa.gov>
Sent: Wednesday, December 2, 2020 10:50 PM
To: Dolislager, Fredrick G. <dolislagerf1@ornl.gov>
Subject: [EXTERNAL] FW: Dust ingestion - BPRG v RESRAD BUILD

See Wayne's question below. I think in addition to answering the question, maybe we should show each default parameter that goes into the yellow highlighted dust ingestion value, and also list the default parameters that went into the WTC dust ingestion value.

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From: Praskins, Wayne <Praskins.Wayne@epa.gov>
Sent: Wednesday, December 02, 2020 8:41 PM
To: Walker, Stuart <Walker.Stuart@epa.gov>; Hays, David C Jr CIV USARMY CENWK (USA) <David.C.Hays@usace.army.mil>
Subject: Dust ingestion - BPRG v RESRAD BUILD

Stuart / Dave –

1. In the ORNL calculations that you (Stuart) shared in October (included in 12/2/19 email below), there is a calculated value for a BPRG "Ingestion Fraction of Dust for Resident - Age Adjusted." The value is 3,200,400 cm2. Is it appropriate to divide by 26 years x 365 days/yr to get an average daily exposure of 337 cm2/day? I would divide by 350 days/year since that is the value that went into the 3,200,400 value. I would think you would want to know the adult and child total intake separately if going to compare to RESRAD. Also comparing to RESRAD, I would look at the FTSS, FQ, SE, and SA used by RESRAD, if any is even presented. Looking at those can tell why the IR is different and not just that is different. If I do adult only for 20 years I get 2,058,000 cm2 and for child for 6 years I get 1,142,400 cm2. If you add those you get 3,200,400 cm2 which is reassuring.

2. The RESRAD BUILD User's Guide (Appendix J, Section J.3.6) gives an ingestion rate of 0.0001 m2/hr. That's 24 cm2/day. (Jon R had said there is a higher child ingestion rate of 0.0002 m2/hr but couldn't find that value in the User's Guide.) Is it appropriate to compare the 337 and 24 cm2/day values? It's very appropriate if the FTSS, FQ, SE, and SA are the same. If they aren't it's still ok to compare, but you just need to be aware of why they may be different.

3. If so, is the difference between the BPRG and RESRAD BUILD ingestion rates (337 vs. 24) one of the biggest (or the biggest) contributor to the differing risk estimates for dust? I don't know RESRAD well enough to answer that.

The Navy has told us to expect a response to our 8/20/20 letter on the Hunter's Point building RGs. Awaiting their letter.

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From: Walker, Stuart <Walker.Stuart@epa.gov>
Sent: Wednesday, October 21, 2020 1:05 PM
To: Praskins, Wayne <Praskins.Wayne@epa.gov>
Subject: FW: Current vs proposed dust ingestion exposure factors

I asked ORNL to simulate running the BPRG dust for Ra-226 with the proposed input parameters vs current default inputs. As you can see there was no significant difference.

Karessa's run with proposed numbers comes out to 5.63E-05 pCi/m2 for Secular Equilibrium at 1 x 10-6 risk, as opposed to current BPRG input values coming out to 5.48E-05 pCi/cm2 for Secular Equilibrium at 1 x 10-6 risk

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From: Manning, Karessa <manningkl@ornl.gov>
Sent: Wednesday, October 21, 2020 1:38 PM
To: Dolislager, Fredrick G. <dolislagerf1@ornl.gov>; Walker, Stuart <Walker.Stuart@epa.gov>
Subject: RE: Current vs proposed dust ingestion exposure factors

I have attached an updated spreadsheet that includes the updated age adjusted variables. Please let me know if you have any questions.

Thanks!

~Karessa

From: Dolislager, Fredrick G. <dolislagerf1@ornl.gov>
Sent: Wednesday, October 21, 2020 11:46 AM
To: Walker, Stuart <Walker.Stuart@epa.gov>
Cc: Manning, Karessa <manningkl@ornl.gov>
Subject: RE: Current vs proposed dust ingestion exposure factors

Stuart,

Ra-226 resident dust default is 5.48E-05 pCi/cm2 for SE with TR=1E-06.
Ra-226 resident dust new values is 6.17E-05 pCi/cm2 for SE with TR=1E-06. Note that I fractionally adjusted the hand surface area but could not average the fraction transferred from soft and hard surface for adult and child to the hand. The tool is not programmed to have separate adult and child fraction transferred inputs. I do not believe this matters much at all. Maybe Karessa can figure it out, however, since she's the time weight average master.

Ra-226 indoor worker dust default is 3.87E-04 pCi/cm2 for SE with TR=1E-06.
Ra-226 indoor worker dust default is 8.41-04 pCi/cm2 for SE with TR=1E-06. I was able to use all the new inputs and I fractionally adjusted the hand surface area.

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From: Walker, Stuart <Walker.Stuart@epa.gov>
Sent: Wednesday, October 21, 2020 11:05 AM

To: Dolislager, Fredrick G. <dolislagerf1@ornl.gov>
Cc: Manning, Karessa <manningkl@ornl.gov>
Subject: [EXTERNAL] FW: Current vs proposed dust ingestion exposure factors

I remember there was some change Karessa proposed that would involve a change to the equations. Without doing that, could you or Karessa do a run for resident and indoor worker for Ra-226 SE with as close as possible to the proposed changes for dust ingestion? Basically Wayne wanted an idea on current vs future BPRG dust runs.

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From: Walker, Stuart
Sent: Thursday, October 15, 2020 2:13 PM
To: Praskins, Wayne <Praskins.Wayne@epa.gov>
Subject: FW: Current vs proposed dust ingestion exposure factors

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From: Walker, Stuart
Sent: Friday, May 08, 2020 4:31 PM
To: Stralka, Daniel <Stralka.Daniel@epa.gov>
Subject: FW: Current vs proposed dust ingestion exposure factors

Information on the dust ingestion changes we are considering.

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From: Manning, Karessa L. <manningkl@ornl.gov>
Sent: Wednesday, December 04, 2019 2:16 PM
To: Walker, Stuart <Walker.Stuart@epa.gov>; Dolislager, Fredrick G. <dolislagerf1@ornl.gov>
Subject: RE: Current vs proposed dust ingestion exposure factors

Here is the xlsx file. Are you able to open this one?

~Karessa

From: Walker, Stuart <Walker.Stuart@epa.gov>
Sent: Wednesday, December 4, 2019 2:07 PM
To: Manning, Karessa L. <manningkl@ornl.gov>; Dolislager, Fredrick G. <dolislagerf1@ornl.gov>
Subject: [EXTERNAL] RE: Current vs proposed dust ingestion exposure factors

I am back in the office and still can't see the revised table you did. This is a screenshot of what I see

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From: Manning, Karessa L. <manningkl@ornl.gov>
Sent: Tuesday, December 03, 2019 2:02 PM
To: Walker, Stuart <Walker.Stuart@epa.gov>; Dolislager, Fredrick G. <dolislagerf1@ornl.gov>
Subject: RE: Current vs proposed dust ingestion exposure factors

Stuart,

I have attached a new table with parameter descriptions. Regarding point number 2, the new SAchild and adult values are for the whole surface area, a new factor has been included called FSA which is the fraction of the hand mouthed. This more closely follows the equation presented in section 5.3.3.5 in the EFH pdf attached. In table 5-13 of this document, you will also see the values used to calculate the new time weighted averages. In addition, I have attached the excel file I used to calculate the time weighted averages called TWA_dust_calculations.

Note: I had to make a small adjustment for FTSSh for children as infants are assumed to not come into contact with hard surfaces, this changed the value of FTSSh-childfrom the previous table I sent to you.

-Karessa

From: Walker, Stuart <Walker.Stuart@epa.gov>
Sent: Monday, December 2, 2019 11:01 PM
To: Manning, Karessa L. <manningkl@ornl.gov>; Dolislager, Fredrick G. <dolislagerf1@ornl.gov>
Subject: [EXTERNAL] Re: Current vs proposed dust ingestion exposure factors

Karessa, the table looks good. Some comments:

1. I would suggest either in the table or as a key under the table, including the definition of the parameter as described in table 1, for example FQchild is Frequency of Hand to Mouth - Child
2. On the SAchild and and adult, the increase is astounding. Is the new EFH proposed values for how much of the surface area of the finger gets in the mouth, or just the average surface area for fingers? If you take the proposed SA values and use only 5%, you have something similar to the current defaults. It would seem extreme to think we are putting all of our fingers inside our mouth every event
3. I would probably include a pdf of the relevant pages from the new EFH as an attachment.

From: Manning, Karessa L. <manningkl@ornl.gov>
Sent: Monday, December 2, 2019 4:54 PM
To: Walker, Stuart <Walker.Stuart@epa.gov>; Dolislager, Fredrick G. <dolislagerf1@ornl.gov>
Subject: RE: Current vs proposed dust ingestion exposure factors

Here we are. Please let me know if you have any questions.

Parameter	Current Value	Current Units	Current Reference	Proposed Value	Proposed Units	Proposed Reference
FQchild	17	events/hour	EPA 2011 Table 4.1 and EPA 2003. Time weighted average of all age groups from birth to 6 years.	17.7	events/hour	EPA 2017 Table 5-13. Time weighted average of all age groups from birth to 6 years.

FQadult	3	events/hour	EPA 2011 Table 4.1 and EPA 2003. Time weighted average of all age groups from 6 to 26 years.	3.025	events/hour	EPA 2017 Table 5-13. Time weighted average of all age groups from 16 to 26 years.
SE	0.5	fraction	EPA World Trade Center Document 2003 (pg. D-5)	0.5	fraction	EPA 2017 Table 5-13.
SAchild	16	cm^2	EPA 2011 Table 7.2. 5% of the average of child male and female.	223	cm^2	EPA 2017 Table 5-13. Time weighted average of all age groups from birth to 6 years.
SAadult	49	cm^2	EPA 2011 Table 7.2. 5% of the average of adult male and female.	398	cm^2	EPA 2017 Table 5-13. Time weighted average of all age groups from 16 to 26 years.
FTSSh	0.5	fraction	EPA World Trade Center Document 2003 (pg. D-3)	Now divided into child and adult. Values are provided in the next 2 rows.		
FTSSh-child				0.7	fraction	EPA 2017 Table 5-13. Time weighted average of all age groups from birth to 6 years.
FTSSh-adult				0.4	fraction	EPA 2017 Table 5-13. Time weighted average of all age groups from 16 to 26 years.
FTSSs	0.1	fraction	EPA World Trade Center Document 2003 (pg. D-3)	Now divided into child and adult. Values are provided in the next 2 rows.		

FTSSs-child				0.14	fraction	EPA 2017 Table 5-13. Time weighted average of all age groups from birth to 6 years.
FTSSs-adult				0.08	fraction	EPA 2017 Table 5-13. Time weighted average of all age groups from 16 to 26 years.
FSAchild				0.1	fraction	EPA 2017 Table 5-13. Time weighted average of all age groups from birth to 6 years.
FSAadult				0.07	fraction	EPA 2017 Table 5-13. Time weighted average of all age groups from 16 to 26 years.
IFDiw	176.4	cm^2/day	Calculated based on EPA World Trade Center Document 2003 (pg. D-4)	81	cm^2/day	The two new proposed variables have incorporated a factor called FSA (fraction of hand mouthed) that has not previously been used.
IFDres	3200400	cm^2	Calculated based on EPA World Trade Center Document 2003 (pg. D-4)	3264792	cm^2	

-Karessa

From: Walker, Stuart <Walker.Stuart@epa.gov>
Sent: Friday, November 22, 2019 4:13 PM
To: Dolislager, Fredrick G. <dolislagerf1@ornl.gov>; Manning, Karessa L. <manningkl@ornl.gov>
Subject: [EXTERNAL] Re: Current vs proposed dust ingestion exposure factors

Yes, this looks good.

From: Dolislager, Fredrick G. <dolislagerf1@ornl.gov>
Sent: Friday, November 22, 2019 4:02 PM
To: Manning, Karessa L. <manningkl@ornl.gov>; Walker, Stuart <Walker.Stuart@epa.gov>
Subject: Current vs proposed dust ingestion exposure factors

Karessa,

I propose a table like this. Stuart, anything to add?

Parameter	Current Value	Current Reference	Proposed Value	Proposed Reference
FQchild				
FQadult				
SE				
SAchild				
SAadult				
etc				

fred d.

From: Walker, Stuart <Walker.Stuart@epa.gov>
Sent: Wednesday, November 6, 2019 3:57 PM
To: Burgess, Michele <Burgess.Michele@epa.gov>; Gaines, Linda <Gaines.Linda@epa.gov>
Cc: Dolislager, Fredrick G. <dolislagerf1@ornl.gov>; Manning, Karessa L. <manningkl@ornl.gov>
Subject: [EXTERNAL] FW: BPRG dust

Michele and Linda, fyi, this shows the email exchange I had with Karessa at ORNL on potential changes to some of the settled dust ingestion default values we using in the Building (BPRG) calculator.

Thanks for bringing up the newer food EFH revisions, we may need to update our resident garden/farmer produce ingestion values at some point.

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From: Walker, Stuart
Sent: Friday, November 01, 2019 11:35 AM
To: Manning, Karessa L. <manningkl@ornl.gov>; Dolislager, Fredrick G. <dolislagerf1@ornl.gov>
Subject: RE: BPRG dust

We did a few updates to BPRG/BDCC from an earlier EFH update. When EPA did the WTC risk assessment, they did note that many of the values had limited data supporting them, so there was a commitment to get more data/better supported values that would show up in future EFH. So there was an expectation we would use this stuff.

I would suggest when you guys get a chance with Fred off of RSL stuff and the RVISL is out for review, a table indicating the current BPRG default input and the proposed EFH influence new BPRG default input. We can also use that as something to link to in the What's New section.

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From: Manning, Karessa L. <manningkl@ornl.gov>
Sent: Friday, November 01, 2019 11:25 AM
To: Walker, Stuart <Walker.Stuart@epa.gov>; Dolislager, Fredrick G. <dolislagerf1@ornl.gov>
Subject: RE: BPRG dust

Interesting. I was not aware of the 2017 update from the EFH chapter 5 update,. I would be more inclined to use the EFH than the WTC because it is newer. I calculated a TWA of 17.7 for the child FQ using the EFH-2017. For adults, I suggest we use the 20-59 year age range from the table 5-13 below (1.5?).

Exposure Factors Handbook - 2017						
	Age	Segment	Age Span	Years	FQ	TWA
Child	0-2	Infants	0-6 months	0.5	28	17.7
		Infants	6 months - 2 years	1.5	28	
	2-6	Toddlers	7 months - 4 years	2	16	
		Children	5-11 years	2	9.1	

The EFH Chapter 5 update provides a lot of new values that could be implemented in our current model. In addition, it gives dust loading factors for soft and hard surfaces in table 5-13, so we could also provide BPRGs in units of mass instead of (or in addition to) area. Please review the updated table and let us know if there are any changes we can implement in our current model.

Table 5-13. Age-Dependent Probability Density Functions Used to Estimate Dust and Soil Ingestion Rates via the Activity Pattern Modeling Approach

Parameters	Age Groups					
	Infants 0–6 Months	Toddlers 7 Months–4 Years	Children 5–11 Years	Teens 12–19 Years	Adults 20–59 Years	Seniors 60+ Years
DSL_{hand} (mg/cm²)	NA	AM 0.052 ± 0.065, LN	AM 0.052 ± 0.065, LN	AM 0.052 ± 0.065, LN	AM 0.052 ± 0.065, LN	AM 0.052 ± 0.065, LN
DSL_{soil} (mg/cm²)	AM 0.139 ± 0.305, LN	AM 0.139 ± 0.305, LN	AM 0.139 ± 0.305, LN	AM 0.139 ± 0.305, LN	AM 0.139 ± 0.305, LN	AM 0.139 ± 0.305, LN
ET (hr/d)	24 hr/d-ST	24 hr/d-ST-TO	24 hr/d-ST-TO	24 hr/d-ST-TO[a]	24 hr/d-ST-TO[b]	24 hr/d-ST-TO[c]
ST (hr/d)	12; 13; 15, TRI	10.5 ± 2.78, LN	9.9 ± 2.6, LN	9.1 ± 2.4, LN	8.4 ± 2.2, LN	8.5 ± 2.2, LN
TO (hr/d)	NA	0; 1.2; 3.0, TRI	0; 2.2; 4.0, TRI	1.4 ± 1.2, LN	1.4 ± 1.3, LN	1.3 ± 1.4, LN
FQ (events/hr)	28 ± 22, LN	16 ± 9.9, LN	9.1 ± 6.8, LN	1.0 ± 0.50, LN	1.0 ± 0.50, LN	1.0 ± 0.50, LN
FSA_{hands} (unitless)	0.05; 0.08; 0.10, TRI	0.04; 0.07; 0.10, TRI	0.04; 0.07; 0.10, TRI	0.04; 0.05; 0.06, TRI	0.04; 0.05; 0.06, TRI	0.04; 0.05; 0.06, TRI
$FTSS_{hand}$ (unitless)	NA	0.7 ± 0.1, LN	0.7 ± 0.1, LN	0.4 ± 0.1, LN	0.4 ± 0.1, LN	0.4 ± 0.1, LN
$FTSS_{soil}$ (unitless)	0.14 ± 0.02, LN	0.14 ± 0.02, LN	0.14 ± 0.02, LN	0.08 ± 0.02, LN	0.08 ± 0.02, LN	0.08 ± 0.02, LN
SA_{hand} (cm²)	160 ± 15, LN	215 ± 25, LN	295 ± 40, LN	400 ± 50, LN	445 ± 55, LN	450 ± 55, LN
SE (unitless)	0; 0.5; 1.0, TRI	0; 0.5; 1.0, TRI	0; 0.5; 1.0, TRI	0; 0.5; 1.0, TRI	0; 0.5; 1.0, TRI	0; 0.5; 1.0, TRI
SL_{hands} (mg/cm²)	GM 0.1 ± 1.8, LN	GM 0.1 ± 1.8, LN	GM 0.1 ± 1.8, LN	GM 0.1 ± 1.8, LN	GM 0.1 ± 1.8, LN	GM 0.1 ± 1.8, LN

[a] 93.3% of teens were assumed to spend time outdoors and 6.7% were assumed to spend no time outdoors.
[b] 89.5% of adults were assumed to spend time outdoors and 10.5% were assumed to spend no time outdoors.
[c] 71.8% of seniors were assumed to spend time outdoors and 28.2% were assumed to spend no time outdoors.

AM = Arithmetic mean.
DSL = Dust surface loading.
ET = Exposure time.
FQ = Frequency of hand to mouth events.
FSA = Fraction of surface area of hands.
FTSS = Fraction of dust transferred from surfaces to skin.
GM = Geometric mean.
LN = Lognormal distribution.
NA = Not applicable.
SA = Surface area of the hand.
SE = Saliva extraction fraction.
SL = Soil loading.
ST = Sleep time.
TO = Time outdoors.
TRI = Triangular distribution.

Source: Wilson et al. (2013).

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-----Original Message-----
From: Walker, Stuart <Walker.Stuart@epa.gov>
Sent: Thursday, October 31, 2019 10:46 AM
To: Dolislager, Fredrick G. <dolislagerf1@ornl.gov>; Manning, Karessa L. <manningkl@ornl.gov>
Subject: [EXTERNAL] BPRG dust

Notes from a Navy set of runs using the BPRG.

"The BPRG default values for FQ (17 events/hr child and 3 events/hr adult) are based on the 2011 Exposure Factors Handbook Table 4-1. However, there is no data for adults older than 11 years and the BPRG default values are based on those for 6-11 years. The 2017 update to Chapter 5 of the EFH uses 1 event/hr for adults (Pages 5-37, 5-65). From the 2003 World Trade Center report page D-5, the time-weighted average for adults age 7-26 is a minimum of 1.35/hr, maximum of 1.92/hr and an average of 1.64/hr."