Message

From: Praskins, Wayne [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=4F47BC0A2C2E42A98347D59CD1A98B19-WPRASKIN]
Sent: 2/9/2021 9:52:28 PM
To: Walker, Stuart [Walker.Stuart@epa.gov]
Subject: RE: Dissipation factor

Kim NK, Hawley J. 1985. Re-entry guidelines: Binghamton State Office Building. New York State Dept. of Health, Bureau of Toxic Substances Assessment, Division of Health Risk Control. Albany, NY. August. Document 0549P.

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From: Walker, Stuart <Walker.Stuart@epa.gov>
Sent: Tuesday, February 9, 2021 1:07 PM
To: Praskins, Wayne <Praskins.Wayne@epa.gov>; Dolislager, Fredrick <dolislagerf1@ornl.gov>
Subject: RE: Dissipation factor

My initial thought would if the soil nearby is covered/capped and/or uncontaminated there would be little to none tracked inside by shoes to replenish dust indoors, which is the main source of recontamination from the outside. The secondary source of resuspension from wind or vehicles would also not be an issue.

The cleaning processes would be similar if the buildings were reused as residences.

The WTC dissipation rate was derived from studies that are not quite the same conceptual model. But the key would be not continuing to replenish the contaminated dust with more contamination.

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From: Praskins, Wayne <Praskins.Wayne@epa.gov>
Sent: Tuesday, February 09, 2021 2:14 PM
To: Walker, Stuart <Walker.Stuart@epa.gov>; Dolislager, Fredrick <dolislagerf1@ornl.gov>
Subject: RE: Dissipation factor

What's your argument that the WTC dissipation rate (and conceptual site model) applies to Hunters Point buildings?

Hunters Point buildings were identified based on the usage, handling, packaging, or disposal of radioactive materials inside the building.

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From: Walker, Stuart <Walker.Stuart@epa.gov>
Sent: Tuesday, February 9, 2021 11:02 AM
To: Dolislager, Fredrick <dolislagerf1@ornl.gov>; Praskins, Wayne <Praskins.Wayne@epa.gov>
Subject: RE: Dissipation factor

Problem with all of this is there are varying size rooms within a building, and movement of dust between rooms. So without studies on this, it seems a lot harder to justify than using a dissipation rate. Particularly transfers via hand are part of the dissipation rate. Using WTC dissipation rate gets about an order of magnitude rise in BPRG values. Trying to justify another methodology with less components but a higher rate of source removal really seems unlikely.

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From: Dolislager, Fredrick <dolislagerf1@ornl.gov>
Sent: Tuesday, February 09, 2021 12:49 PM
To: Praskins, Wayne <Praskins.Wayne@epa.gov>; Walker, Stuart <Walker.Stuart@epa.gov>
Subject: RE: Dissipation factor

Wayne,

If you are trying to slow down the dust ingestion so it takes 26 years to eat it all, that's easy enough. I changed the SA of the fingers to be 4.14. That gave me 14.9 cm2 ingested per day. Multiply by 250 days per year and 25 years you get 93,125 cm2 ingested and the room is clean. In the Am-241 indoor worker, parent only with decay I did the default BPRG goes from 0.0102 pCi/cm2 to 0.119 pCi/cm2.

fred d.

From: Praskins, Wayne <Praskins.Wayne@epa.gov>
Sent: Tuesday, February 9, 2021 12:19 PM
To: Dolislager, Fredrick <dolislagerf1@ornl.gov>; Walker, Stuart <Walker.Stuart@epa.gov>
Subject: [EXTERNAL] RE: Dissipation factor

Fred –

So…, for room sizes 100 x 100 or bigger, accounting for dissipation/loss through ingestion won't change the PRGs much.

For a small room (10 x 10), a k value doesn't make sense but loss through ingestion is going to decrease the contaminated area by an order of magnitude or two and increase the PRG similarly? I estimated the average contaminated area over the 26 year period as follows.

Initial contaminated area: 92,903 cm2
Time to remediate: 0.755 years
Average area over 0.755 years = 92,903 cm2/2 = 46,452 cm2

Number of 0.755 year intervals in 26 year exposure period = 26 years/0.755 years = ~ 34
Average area over 26 years = (46,452 cm2 + 0 + 0 + 0 + ...)/34 = 1,366 cm2

Does this make sense? The average area over a 26 year exposure period is about 1.5% of initial area, increasing the PRG by a factor of 65 or so?

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From: Dolislager, Fredrick <dolislagerf1@ornl.gov>
Sent: Tuesday, February 9, 2021 6:14 AM
To: Praskins, Wayne <Praskins.Wayne@epa.gov>; Walker, Stuart <Walker.Stuart@epa.gov>
Subject: RE: Dissipation factor

Wayne,

Yes, the table gives years to remediate for each room size.

Check out my spreadsheet for K values I get. I agree with the one you came up with. The second tab has a graph of the decay comparing a linear (simple subtraction from year to year) function to a k function used in the BPRG. They both look linear to me but slightly different. I'm not sure what it proves. I can't talk intelligently about whether a k can be used in a linear situation.

I did run Am-241 default indoor worker with no k and got 0.0102 pCi/cm2. I then ran it with a k about 0.02 and got a BPRG of 0.0127 pCi/cm2. Not much difference.

fred d.

From: Praskins, Wayne <Praskins.Wayne@epa.gov>
Sent: Monday, February 8, 2021 9:01 PM
To: Dolislager, Fredrick <dolislagerf1@ornl.gov>; Walker, Stuart <Walker.Stuart@epa.gov>
Subject: [EXTERNAL] RE: Dissipation factor

Fred - I'm looking at your table below with years to remediate as a function of room size. Is this right?

- For the 100' x 100' room, about a third of the activity is remediated/lost over the 26 year exposure period (26/75.5). That gives a k of about 0.02 year^{-1} assuming first order decay.

For the 10 x 10 and 50 x 50 rooms can you calculate a first order dissipation factor (k) since the contamination is gone before 26 years?

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From: Dolislager, Fredrick <dolislagerf1@ornl.gov>
Sent: Friday, February 5, 2021 4:24 AM
To: Praskins, Wayne <Praskins.Wayne@epa.gov>; Walker, Stuart <Walker.Stuart@epa.gov>
Subject: RE: Dissipation factor

Wayne,

1. Yes
2. Yes, No, Yes. There is no assumption that it is the floor, a table or a wall.
3. Yes, every event is on a contaminated surface, every transfer efficiency the same, every saliva extraction the same for every event. Those events are set at RME levels, so they are protective of the times where the receptor may touch a less contaminated surface, not press as much on their hand, or not lick fingers hard enough. Conversely using the RME also protects from the KFC finger licking good events where contamination may be aggressively consumed.

fred d.

From: Praskins, Wayne <Praskins.Wayne@epa.gov>
Sent: Thursday, February 4, 2021 10:00 PM
To: Dolislager, Fredrick <dolislagerf1@ornl.gov>; Walker, Stuart <Walker.Stuart@epa.gov>
Subject: [EXTERNAL] RE: Dissipation factor

Fred –

Thanks!

1. The k value in the BPRG assumes first order decay? So it's a calculus problem?

2. Is it correct that:

   - for dust, BPRGs are independent of room size?
   - your calculation assumes that only the floor is contaminated?
   - the ingestion rate you used incorporates the FTSS values, accounting for less than 100% surface to hand transfer?

3. You mentioned needing to make a distinction/assumption about whether the hand to surface event was always on a contaminated surface or sometimes on a clean surface. Don't the calculators assume that every hand to mouth event is on a contaminated surface?

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From: Dolislager, Fredrick <dolislagerf1@ornl.gov>
Sent: Thursday, February 4, 2021 10:20 AM
To: Praskins, Wayne <Praskins.Wayne@epa.gov>; Walker, Stuart <Walker.Stuart@epa.gov>
Subject: RE: Dissipation factor

FYI, the numbers below assume linear decay and a k can't be calculated that would be used in the BPRG tool.

Here is rough and quick. I used the room sizes from the 3D model. I used the annual ingestion rate for resident from the BDCC. If you want to determine the dissipation constant (k), LMK. There are no assumptions about recontamination from a source. There are many assumptions inherent to the numbers below that were discussed previously.

	A	B	C	D
1	Room size (ft)	Room size (cm2)	Annual cm2 ingested resident*	years to remediate the room
2	10x10	92,903	123,025	0.755155456
3	50x50	2,322,576	123,025	18.87889453
4	100x100	9,290,304	123,025	75.51557813
5	200x200	37,161,216	123,025	302.0623125
6	400x400	148,644,864	123,025	1208.24925
7				
8	*BDCC IFD value			

fred d.

From: Praskins, Wayne <Praskins.Wayne@epa.gov>
Sent: Wednesday, February 3, 2021 5:31 PM
To: Walker, Stuart <Walker.Stuart@epa.gov>; Dolislager, Fredrick <dolislagerf1@ornl.gov>
Subject: [EXTERNAL] RE: Dissipation factor

Fred – Rough and quick would be fine. I'm interested in the result and, in brief, the basis for the result. I'm curious how you relate the ingestion rate in units of area/time to the source.

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From: Walker, Stuart <Walker.Stuart@epa.gov>
Sent: Wednesday, February 3, 2021 2:17 PM
To: Praskins, Wayne <Praskins.Wayne@epa.gov>; Dolislager, Fredrick <dolislagerf1@ornl.gov>
Subject: RE: Dissipation factor

Fred, real rough and quick.

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From: Praskins, Wayne <Praskins.Wayne@epa.gov>
Sent: Wednesday, February 03, 2021 5:05 PM
To: Dolislager, Fredrick <dolislagerf1@ornl.gov>; Walker, Stuart <Walker.Stuart@epa.gov>
Subject: RE: Dissipation factor

Fred - Can you do a rough calculation to see if the dissipation factor is significant enough to matter?

I was thinking you need some measure of the source term to do the calculation, and you could use the Ra-226 BPRG for that purpose. But sounds like that may not be the case.

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From: Dolislager, Fredrick <dolislagerf1@ornl.gov>
Sent: Wednesday, February 3, 2021 1:04 PM
To: Praskins, Wayne <Praskins.Wayne@epa.gov>; Walker, Stuart <Walker.Stuart@epa.gov>
Subject: RE: Dissipation factor

Wayne,

Mathematically, yes that dissipation rate can be calculated based on the inputs to the hand to mouth exposure route. A distinction/assumption would have to be made if the hand to surface event was always on a contaminated surface or sometimes on a clean surface. If the surface area available for contact in the room was known and the surface area of the skin known, you could effectively determine the rate. Basically you are remediating by ingestion. That would be an interesting study. Don't forget the surface to hand transfer isn't 100%. Another consideration is if the hand can be loaded multiple times. There would need to be an assumption that maxes or limits the hand dust loading prior to the hand to mouth event. Also what if a dirty hand recontaminates a clean surface?

Too many variable too late in the day.

You don't need the Ra-226 PRG do you? You just need to know the half-life of dust being present on a surface.

fred d.

From: Praskins, Wayne <Praskins.Wayne@epa.gov>
Sent: Wednesday, February 3, 2021 2:59 PM
To: Walker, Stuart <Walker.Stuart@epa.gov>; Dolislager, Fredrick <dolislagerf1@ornl.gov>
Subject: [EXTERNAL] RE: Dissipation factor

Fred – Nice analogy. Unlike your desk, let's assume there is no reservoir of contaminated dust. Is it possible to account for loss through ingestion to estimate a dissipation factor? I was thinking you would use the default ingestion rate in the BPRG, and the Ra-226 dust PRG of 1.2 dpm/100cm2 as the source concentration.

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From: Walker, Stuart <Walker.Stuart@epa.gov>
Sent: Wednesday, February 3, 2021 11:27 AM
To: Dolislager, Fredrick <dolislagerf1@ornl.gov>
Cc: Praskins, Wayne <Praskins.Wayne@epa.gov>
Subject: RE: Dissipation factor

Thanks Fred.

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From: Dolislager, Fredrick <dolislagerf1@ornl.gov>
Sent: Wednesday, February 03, 2021 1:55 PM
To: Walker, Stuart <Walker.Stuart@epa.gov>
Subject: RE: Dissipation factor

Stuart,

I do not know of such a technique other than the malathion study the pesticide folks did with the aerobics/yoga folks in Tyvek suits. In my work office, I know the dust layer gets pretty thick on the back of my desk. The front of my desk stays perfectly clean because it all gets on my skin and clothes. So the back of my desk proves that a reservoir exists to supply plenty of dust despite me taking away 100% of the dust from front of my desk every day. It's rather disgusting to think about. When I do wash the back of my desk it makes mud.

fred d.

From: Walker, Stuart <Walker.Stuart@epa.gov>
Sent: Wednesday, February 3, 2021 1:22 AM
To: Dolislager, Fredrick <dolislagerf1@ornl.gov>
Subject: [EXTERNAL] FW: Dissipation factor

Wayne asked me if we knew of a technique for determining the amount of dissipation rate that was solely from transfers to skin/clothing (see yellow highlight portion of the first paragraph from the screenshot of the WTC document below). I told him that you and I would discuss it.

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From: Walker, Stuart
Sent: Tuesday, February 02, 2021 12:40 PM
To: Praskins, Wayne <Praskins.Wayne@epa.gov>
Subject: RE: Dissipation factor

Source loss from transfer to skin and clothing was included in the WTC dissipation rate

See section 4.3.8 in the BPRG User Guide (which I copied most of below with some yellow highlighting that is relevant to this discussion) followed by some key language in the WTC document. The transfer to skin/clothing is mentioned in first paragraph for WTC below.

4.3.8 Dissipation Rate Constant (k)

In some circumstances, the load of dust on a contaminated surface to which receptors are exposed may decline over time. Dissipation of dust may result from cleaning and transfer to skin and clothing. Different surfaces may be cleaned at different rates, and any dissipation rate used should consider a representative cleaning frequency. To determine whether dissipation is a factor at a given site, the site manager should establish whether a significant reservoir of contaminated dust is present. Such reservoirs may function as sources of dust and negate the impacts of dissipation mechanisms. In fact, indoor concentrations of contaminants may be enhanced above their original outdoor source levels after repeated transfer inside (Paustenbach et al). The recommended first step in identifying the presence of a reservoir is to examine site history. If a waste site was created through disposal, deposition, or equipment leaks over an extended period of time, then the contaminant may have seeped deep into the surface. Porous surfaces such as cement or wood are also more likely to have subsurface contamination. When reservoirs are less likely to exist, such as at sites where contamination is the result of a single spill, dust cloud, or event, it may be more important to account for dissipation of surface loads. For fixed contamination in building materials or on material surfaces in the 3-D equations, the dissipation term is not included as dissipation is not expected.

The recommended default value for the dissipation rate constant, 0.0, assumes that a contaminant reservoir is present. This variable is adjustable in the recommended BPRG calculator. If a dissipation rate constant is used, it is generally assumed that the dust was deposited as a one-time event (i.e., dust cloud). Also, if a dissipation rate is applied, it is assumed that it is applicable from recommended BPRG calculation time onward. The discussion below provides a review of the literature related to this issue and provides an alternative dissipation rate constant value. Site specific dissipation rate constants can be used. This equation is for values of k that are greater than 0; when k=0, the dissipation term is not quantified to avoid division by zero. See the following text.

Based on many studies presented in EPA 2003 (pg. D-5), there is strong support for considering dissipation in setting criteria for building clean-ups. A study of the Binghamton State office Building found that dioxin has dissipated over time, according to first order kinetics, with a 20 to 22 month half-life. This dissipation is thought to occur from a combination of cleaning, resuspension, and dilution with uncontaminated dust (and possibly some volatilization). These same physical dissipation processes would apply to other compounds addressed in this study as well. Therefore, the other compounds were assumed to dissipate at the same rate as dioxin. In summary, a 22 month half-life (dissipation rate constant of 0.38 yr^{-1}) was adopted. Exposures were calculated in a series of time steps, where the residue level was assumed to dissipate according to first order kinetics:

Word Trade Center benchmark document, see pages D-5 to D-8, below are some of the key text on how they set a dissipation rate at WTC. While after the WTC incident, there were benchmarks for dust outside they did not have any for final benchmarks so tracking new contamination indoors was not a problem.
https://archive.epa.gov/wtc/web/pdf/contaminants_of_concern_benchmark_study.pdf

3.3 Dissipation

The surface loading of the contaminant in the dust is likely to diminish over the 30 year exposure period as a result of volatilization, chemical degradation, surface cleaning and transfers to skin/clothing. While some redeposition will also occur, the net long term effect should be a gradual decline. The discussion below provides a review of the literature related to this issue.

Several studies indicate that the main source of new dust indoors is track-in from footwear. Thatcher and Layton (1995) found a mass increase on tracked but not cleaned/vacuumed floor surfaces of 0.01 grams/day-m^2 for linoleum, 0.15 for upstairs carpet and 0.31 for downstairs carpet. They reported a value for the front doormat of 6.2 grams /day-m^2. Allot (1992) also indicated that the main mechanism for introduction of dust indoors is tracking by footwear and noted a smaller contribution from deposition dust particles suspended in air. Without regular indoor cleaning the dust inputs would accumulate. With time, they would likely become noticeable or objectionable to the inhabitants, prompting cleaning. Lioy (2002) indicates that in a survey of 36 homes, an average time since the last cleaning was 14.2 days (range 1-150 days). Roberts et al. (1999) determined that the median value of dust loading on 11 carpets before cleaning was 1.3 g/m^2. This agrees with Camann and Buckley's (1994) estimate of the

If cleaning occurred on a periodic basis as it normally does, newly tracked-in dust would continually be mixed with and removed by cleaning with dust in the carpet from previous tracking events. With continued cleaning eventually the dust reservoir (from past tracking events) would be replaced with newly tracked-in dust. This means that any initial, residual load of dust containing contaminants in a carpet would be gradually removed over time with periodic cleaning and no new significant input of contaminated dust. Roberts et al. (1999) determined that the residual lead loading in carpets could be reduced by 90 to 99% in 6 months by removing shoes on entering (lead was being tracked in from the outside), use of a doormat, and use of an efficient vacuum twice a week. They determined that vigorous vacuuming was efficient in removing the contaminated dust reservoir from carpets. If a carpet is initially loaded with a contaminated dust, a half-life for its removal can be calculated assuming 90% removal in 6 months using the Roberts et al. (1999) data. This results in a 2-month half-life for dust removal from carpets using vigorous cleaning by vacuuming. It would take roughly 12 months to reduce the initial contaminant load by 99.9% using the above scenario. With no new, significant inputs of contaminated dust to a carpet an initial, residual load would be reduced over time with regular vigorous cleaning.

The above analysis deals with a carpeted surface that can act as a dust reservoir and which is a difficult surface to clean. Non-porous surfaces such as floors and tables, etc. don't have the same degree of storage potential for dust and are easily cleaned. These surfaces will have a faster removal half-life than the approximately 2 months for carpets calculated above. However, they may get re-contaminated from dust re-suspension from the carpets (carpets become the source of contamination) until the carpet contaminant load is reduced.

Further data concerning the removal half-life of dioxins in indoor dust is available from the study of the Binghamton State Office Building (BSOB) (NYSDOH 2002). The building had closed in February 1981 after an intense transformer fire spread an oily soot contaminated with polychlorinated biphenyls (PCBs), polychlorinated dibenzo-*p*-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) throughout the 18-story structure. After extensive decontamination, testing and reconstruction, the BSOB was reopened late in 1994. Pre-occupancy sampling in July 1994 found that PCB and PCDD/F levels in air and on surfaces in workspaces were considerably less than the guidelines set for reoccupancy. In fact, they were similar to levels found in buildings that have never experienced a transformer fire. Seven rounds of dust wipe sampling of tops of in-ceiling light fixtures were performed post-occupancy. PCDD/F levels on the tops of in-ceiling light fixtures averaged 1.1 nanograms per square meter at the final round of sampling, less than any previous measurements. The seven dust wipe sampling rounds indicated a gradual decline of PCDDs over-time on the light fixtures (see Figure 1). Since reoccupancy, surfaces above the ceiling were cleaned twice, once before the March 1997 sampling and again before the sixth round of sampling in August 1998. Since reoccupancy, average PCDD/F levels in dust on light fixtures have declined steadily by about one-half every 20-22 months (a half-life of 20-22 months).

Based on the above discussion, there is strong support for considering dissipation in setting criteria for building clean-ups. The recently completed study at the Binghamton State office Building described above found that dioxin has dissipated over time according to first order kinetics with a 20 to 22 month half life. As discussed above this dissipation is thought to occur from a combination of cleaning, resuspension and dilution with uncontaminated dust (and possibly some volatilization). These same physical dissipation processes would apply to other compounds addressed in this study as well. Therefore the other compounds were assumed to dissipate at the same rate as dioxin. Note that this leads to some overestimate of risk for the organic compounds with higher volatility than dioxin. In summary, a 22 month half life (decay rate constant of 0.38 yr^{-1}) was adopted here and assumed to apply to all contaminants. Exposures were calculated in a in a series of time steps where the residue level was assumed to dissipate according to first order kinetics:

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From: Praskins, Wayne <Praskins.Wayne@epa.gov>
Sent: Monday, February 01, 2021 10:05 PM
To: Walker, Stuart <Walker.Stuart@epa.gov>
Subject: RE: Dissipation factor

How would translate the loss of your source term due to ingestion into a dissipation factor?

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From: Walker, Stuart <Walker.Stuart@epa.gov>
Sent: Monday, February 1, 2021 6:38 PM
To: Praskins, Wayne <Praskins.Wayne@epa.gov>
Subject: RE: Dissipation factor

I ran BPRG about 2 weeks ago and put in the dissipation rate used at WTC and it increased the concentration about an order of magnitude.

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From: Praskins, Wayne <Praskins.Wayne@epa.gov>
Sent: Monday, February 01, 2021 3:02 PM
To: Walker, Stuart <Walker.Stuart@epa.gov>
Subject: Dissipation factor

Stuart –

I may have asked you this before. Can't remember. Especially for a low BPRG, like Ra-226 removable fraction (1.2 dpm/100cm2 with defaults).

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