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From: EDWARD HANLON
To: BOICE-RICHARD, BRADLEY-BRAD, CLARKE-ROSITA, HAHNEN...
Date: Tuesday, July 2, 1996 8:48 am
Subject: averaging at a site

Thank you for your responses regarding the lan message request for thoughts on averaging; attached FYI are the responses. a quick summary of issues and comments follows (listed in general order of frequency of comment):
-the assumption that no person has greater exposure in any one exposure area is specious and highly uncertain;
-if you make the boundaries large enough, high concentrations may be left - be careful how you determine exposure areas - if activities are concentrated in certain areas, then maybe these areas are separate exposure areas;
-to help offset uncertainties if a statistical averaging approach is followed, consider more conservative statistical applications (e.g., arithmetic mean, lognormal distributions, 95% UCL) or more conservative exposure scenarios (e.g., small exposure areas)
-consider a ceiling concentration never to be exceeded (e.g., 2-3 times the cleanup number);
-about 3-4 sites have applied an averaging approach, as noted;
-look at the 'attainment of cleanup standards' guidance;
-if leave a hot spot, it can recontaminate clean areas over time;
-look at ROD to see if an averaging approach is consistent with remedial action objectives;
-look at risk assessment to see how exposure scenario was set up
thanks again, edh

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From: EDWARD HANLON
To: RRB1-SF, RRB2-SF
Date: Monday, June 17, 1996 10:13 am
Subject: cleanup averaging

Has anyone used, or considered using, a statistical risk management approach to help determine which soil areas need to be cleaned up at a site to meet an 'average' concentration across the property? This approach is being considered at two of my sites. Your thoughts about this approach generally, or issues to be concerned about if used, would also be appreciated.

An example of this approach might assume the following:

- -an area of exposure (e.g., an industrial property) on which no one area on the property is assumed to have greater future exposure than another.
- -a cleanup number of, say, 10ppm for PCBs.
- -of 20 samples taken across the property (taken either random, grid or biased), if you remove anything above 20 ppm and backfill with clean fill, then the net surface soil average after cleanup will be 10ppm.
- -thus, you leave up to 20ppm on the property and meet your cleanup goal of 10ppm on average.

thanks for your help on this.

From: TIMOTHY PRENDIVILLE
To: HANLON-EDWARD
Date: Monday, June 17, 1996 10:43 am
Subject: cleanup averaging -Reply

Ed,

Just a quick thought on your message. I'd be interested in hearing how the discussion turns out.

My concern with this approach is that you could wind up with properties with hot spot areas untouched because you have other areas which are pristine, just because the "average" worked out, e.g. if your cleanup standard is 50, you could have 10 samples at 100, and 10 at non-detect and still be allowed to call it a day. I don't think we should be leaving pockets of contamination in place if we can help it. Down the road if these hot spots are left you might wind up with, through migration of the contaminants, recontaminated areas or newly contaminated areas where you weren't anticipating exposure to occur. At best, if I recall my stats classes, you could apply a weighted averaging technique, where the higher levels might play a greater role in the statistic, so that the odds of hot spots being left behind could be reduced, but my recollection of stats is shoddy at best.

One of your assumptions is that no one area is more likely to have greater future exposure. How valid is this assumption? Do

you know that one part of the operation might not become located in one contaminated corner of the property and several employees left to work there regularly?

From: DAVID SEELY
To: HANLON-EDWARD
Date: Monday, June 17, 1996 11:13 am
Subject: cleanup averaging -Reply

This would seem to me to be a partial containment remedy. (ie. just put clean soil on top and never have to remediate anything because now your average would meet your goal) Is this during your RA? What language does your ROD have? Permanence? Containment? The language that you have met your cleanup goals concerns me greatly. I think your cleanup goals have to be adjusted for this to make sense.

From: JAMES HAHNENBERG
To: HANLON-EDWARD
Date: Monday, June 17, 1996 11:21 am
Subject: cleanup averaging -Reply

Don't know if this helps - while I have not been involved in the averaging calculations you referred to, I do recall seeing a memo out of Region 1 concerning this matter. "Acute" chemicals were NOT averaged, but compounds with potential "chronic" effects were. The particular memo is probably buried in the Anderson Development Company site files (which has since been delisted).

From: ROSITA CLARKE
To: HANLON-EDWARD
Date: Monday, June 17, 1996 11:54 am
Subject: cleanup averaging -Reply

Unfortunately, I don't have a response to your question but, would like to know what people respond to you, if that is O.K? Thanks

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From: JMILTON CLARK
To: HANLON-EDWARD
Date: Monday, June 17, 1996 12:03 pm
Subject: cleanup averaging -Reply

One idea is to permit an average, but as you did in your example, permit the highest level to be only 2 or 3 fold above the average---a ceiling. Then you couple this with a percentage (10, with 20 maximum) of grides above your cleanup level, but not exceeding your ceiling. PRPs really seem to like this method, because it gives field flexibility. You can also specify that certain areas are not permitted to have the higher value---if needed.

From: JAMES CHAPMAN
To: HANLON-EDWARD

Date: Monday, June 17, 1996 12:25 pm
Subject: cleanup averaging -Reply

There is guidance that addresses your question:

USEPA. 1989. Methods for Evaluating the Attainment of Cleanup Standards, Vol. 1: Soils and Solid Media. EPA 230/02-89-042.

USEPA. 1994. Statistical Methods for Evaluating the Attainment of Cleanup Standards, Vol. 3: Reference-Based Standards for Soils and Solid Media. EPA 230-R-94-004.

From: ANDREW PODOWSKI
To: HANLON-EDWARD
Date: Monday, June 17, 1996 12:32 pm
Subject: cleanup averaging -Reply

Superfund's risks are based on 95% UCLs, therefore, the cleanups should also be based upon 95% UCLs. Therefore, if you want an average of 10 ppm for PCBs as cleanup, this 10 ppm should actually be the 95% UCL. Thus, when you collect, say, 20 samples after cleaning up the site, the 95% UCL should be 10 ppm or less, and the calculated average should be definitely less than 10.

From: DION NOVAK
To: HANLON-EDWARD
Date: Monday, June 17, 1996 10:30 am
Subject: cleanup averaging -Reply

A hot spot removal approach was taken at the Reilly Tar site, and used statistics to achieve a final residual cleanup number.

From: PATRICIA VANLEEUWEN
To: HANLON-EDWARD
Date: Monday, June 17, 1996 1:17 pm
Subject: Ed

Ed

I have seen a number of approaches used, but usually the result is that all areas/sub-areas with contamination over the cleanup level are cleaned. The approaches are used to further define the areas that need to be remediated.

You did not say if your sites are residential or industrial. If they are residential, then it is really hard to justify not cleaning up some properties. If the sites are industrial, then it may depend on future use. The bottom line is how the exposure scenario was developed in the risk assessment. Did you have a worker who is exposed to an average site contaminant level at a very small site? Then the cleanup level may be protective if the exposure is averaged over the site. However, if the worker activities are concentrated in certain areas of a large

site and the exposure is predominantly to the area contaminant concentrations, the worker may be at risk to advers health effects if the area in which he works exceeds the cleanup level. In this case, the use of a site average would not be protective for the described worker.

I guess what I'm saying is there is really no area "average" cleanup level unless the USER of the area can be shown to be exposed to EACH part of the area for an EQUAL amount of time. This is not usually the case in a residential or occupational exposure, but may be possible in a tresspass or recreational exposure.

If you want to discuss this further, give me a call at 6-4904.

Pat Van Leeuwen

From: FREDRICK MICKE
To: HANLON-EDWARD
Date: Monday, June 17, 1996 3:23 pm
Subject: cleanup averaging -Reply

We are doing something along these lines at the Ottawa Radiation removal action. The cleanup standard is 5pCi/g over background and we use a 10 meter grid (100 square meters) to do the sampling. Five (5) samples are taken in the grid and analyzed. The overall average of the 5 samples is used to determine if the grid is clean. If you need more info, please ask!

From: STEPHEN PADOVANI
To: HANLON-EDWARD
Date: Monday, June 17, 1996 3:32 pm
Subject: cleanup averaging -Reply

I haven't used that approach, but I'm intrigued. If such a proposal goes through, a brown bag talk would be great...

From: FRANK ROLLINS
To: HANLON-EDWARD
Date: Tuesday, June 18, 1996 7:00 am
Subject: cleanup averaging -Reply

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You may not get many OSC responses...most are out of the office. Let me know if you do get any "yes" replies because there are none that I am aware of.

From: BERNARD SCHORLE
To: HANLON-EDWARD

Date: Tuesday, June 18, 1996 8:38 am
Subject: cleanup averaging -Reply

Have you looked at "Methods for Evaluating the Attainment of Cleanup Standards. Volume 1: Soils and Solid Media" (February 1989, EPA 230/02-89-042)? This might address what you are considering. The Table of Contents indicates it looks at statistical concepts, and it has something on hot spots.

It would be best to use procedures that have been used before.

From: PATRICIA VANLEEUWEN
To: HANLON-EDWARD
Date: Tuesday, June 18, 1996 10:17 am
Subject: Ed

Ed, There doesn't seem to be a lot written on the subject of "averaging" as such in the guidance. This may change. HQ continues to be concerned that some parts of a site may contain lethal concentrations of a contaminant, but the average concentration may be acceptable. The PRPs know this and like to make the boundaries large enough so that the average comes out in their favor. You might also try calling Paul White (202/ 260-2589) the ORD statistician in the SF Exposure Assessment Group. He is very knowledgeable and usually quite helpful. Another good source is Janine Dinan, who is also with the Exposure Assessment Group in HQ.

Also look at "Supplemental Guidance to RAGS: Calculating the Concentration Term", May 1992
Examples and Highlights 7 and 8. Are your PRPs using a normal or lognormal distribution to calculate the "average"?

From: PATRICIA VANLEEUWEN
To: HANLON-EDWARD
Date: Tuesday, June 18, 1996 10:34 am
Subject: Ed

Ed, Sorry, I hit the wrong key and sent the message before I finished. Also look at RAGS. There are lots of sections that discuss "hot spots". You might look at section 6.5.3. If you define your area of concern by contaminant level, it does not makeany sense to average contaminated and uncontaminated areas. Uncontaminated areas are used as background areas for specific contaminants at some sites and thus would not even be considered in the remediation strategy.

In general. the cited guidances are aimed at improving the risk assessment, not the risk management. However, if the risk management strategy follows the risk assessment strategy, it should be possible to develop a remediation plan that will not leave any potential receptors at risk. Pat

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From: janine dinan

To:
R5WST.R5WASTE(HANLON-EDWARD),RTPMAINHUB.WPXGATE(CL...
Date: Wednesday, June 19, 1996 9:01 am
Subject: Re: cleanup averaging -Forwarded

Ed, Of course, there is no simple answer to your question. We do have evidence from other sites that if you use a clean-up level as a "not to exceed" level, the residual average is usually well below that value. However, it all depends on the concentration of contaminants around the "hot-spots" you are planning to remediate.

Have any statistical simulations been done on the data at the site?? It would seem that the theory could be tested by replacing the high values you plan to remediate with "clean" levels, then re-running the numbers to estimate the residual average. Can your contractor do this?? Janine

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From: RICHARD BOICE
To: HANLON-EDWARD
Date: Wednesday, June 19, 1996 2:42 pm
Subject: cleanup averaging -Reply

Use of geometric mean concentrations or the geometric mean risk value for a cleanup criteria was considered (but ultimately not accepted) for the Midco I and Midco II Sites. A problem with use of the geometric mean is that some very low concentrations can hide the risks from hot spots (for example, a sample at 100 times the acceptable risk can be completely off-set by a sample at 1/100 of the acceptable risk). This is not the case if the arithmetic average is used (for example one sample at 100 times the acceptable risk could only be off-set by 99 essentially clean samples). I would suggest that since our guidance advises use of the 95% UCL of the arithmetic mean for estimation of actual risks, that the 95% UCL of the arithmetic mean should be acceptable for use as a cleanup criteria, if the site is then to be available for future development.

In the case of Midco, EPA accepted treating only the principal threats and leaving contaminants on-site above the acceptable risk level on-site under a cap.

From: MATTHEW MANKOWSKI
To: HANLON-EDWARD
Date: Thursday, June 20, 1996 11:18 am
Subject: cleanup averaging -Reply

Ed:

I am doing something similar at South Point in Ohio. However, I am not really averaging and the risk assessment has been completed. We have decided to use some principals of averaging to define portions of the site that may be removed. These principles will mostly be used during design sampling.

Regardless, South Point may have some similarities with your sites in that an industrial scenario is the primary scenario and we have deviated from traditonal risk-based cleanups to get a remedial solution. So, given that, I think the approach you described, depending on site-specfic conditions, probably is reasonable and has merit. In other words "GO FOR IT!". If you feel like you need more details let me know.

From: LARA PULLEN
To: R5WST.R5WASTE(HANLON-EDWARD)
Date: Wednesday, June 19, 1996 3:02 pm
Subject: cleanup averaging -Forwarded -Reply

We can talk about this more if you want. I think that sending out the question was a good idea. The big thing is assuring that no one site is more likely to be frequented than any other (by even one single individual). I think it is also important to assure that hot spots are removed so that they don't recontaminate the site.

I think I agree with most people's responses. I didn't understand Andrew's response, however.

I'd also like to see what headquarters has to say.

>>> EDWARD HANLON 06/17/96 01:45pm >>>
Forwarded Mail received from: EDWARD HANLON

Lara, FYI (sent this to those in superfund (you might not be on the grouping)); also, attached are a few of the responses. any comments? also, i sent the attached lan inquiry to the following hq risk types i know or have dealt with (karen hammerstrom, janine dinan, bruce means, david cooper, sara levinson). thanks, edh

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From: MARK JOHNSON
To: HANLON-EDWARD
Date: Friday, June 28, 1996 8:35 am
Subject: cleanup averaging -Reply

Ed

I don't think that the issue is the average over an entire site, but rather the average for what would be considered an "exposure area". The size of an exposure area would depend on the activity, whether residential, industrial or recreational. A large site may have many exposure areas, each of which would need to meet the cleanup objective. The approach that you described may leave behind hotspots in small areas that may pose an unacceptable risk for exposure.

I would be interested to know how your fellow RPMs responded to your question. Thanks. Mark

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