East Waterway OU

Anthropogenic Background Small Working Group Meeting #3

Invitees: EPA, East Waterway Group (Port of Seattle, City of Seattle, and King County) Muckleshoot Tribe, Suquamish Tribe

November 20, 10 – 11:30 am

Agenda

1. PCB Aroclors
2. Fines normalization
3. Sediment traps
4. Weighting
5. Dioxins/furans
6. Work products for Meeting #4

Attachments

Small Group Meeting #3 presentation

Attendees

EPA

- Ravi Sanga
- Elizabeth Allen

USACE (on behalf of EPA)

- Bill Gardiner

Suquamish Tribe

- Alison O'Sullivan

East Waterway Group (EWG)

- Brick Spangler (Port of Seattle)
- Jeff Stern (King County)
- Debra Williston (King County)
- Pete Rude (City of Seattle)
- Merv Coover (ERM on behalf of the City)
- Dan Berlin (Anchor QEA on behalf of EWG)
- Greg Brunkhorst (Anchor QEA on behalf of EWG)
- Deb Chiavelli (Anchor QEA on behalf of EWG)

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Meeting Notes

Dan: Welcome, this is small group meeting #3. Greg, why don't you walk us through today's presentation.

Greg: [Slide 2] This presentation should move the conversation further from this past Monday and provides additional information EPA requested. The purpose today is to come to agreement on the dataset for the AB calculation, if we can. We have added total dioxin/furan concentration in addition to the dioxin/furan TEQ presented previously.

[Slide 3]: We plan to discuss the sensitivity analysis on December 4, discuss the memo on December 9, and move into the large group meeting on January 13.

[Slide 5]: This slide shows the same data on both plots plotting congeners and Aroclors, but on the right, non-detected Aroclors are removed. Congeners were always detected. The alignment of congeners to Aroclors is not perfect, but it is decent for environmental data.

Debra: on the lower concentrations, they line up quite well for environmental chemistry data. As we get to the highest concentration for Aroclor, it is pulling further away from the congener total.

Elizabeth: It seems that Aroclor may be overpredicting concentrations at the higher end, which is a bit surprising to me. But it may be due to method 8082 where you could get some overlap from weathered Aroclors in the environment. I don't have any heartburn on this, but I do have some questions on how much using Aroclor results adds to the conclusions. It doesn't change much of anything, and my take is to make it as simple and straightforward as possible, so the simplest way is the best way. The simpler way is to remove Aroclors but we can discuss this further.

Greg: It seems like Aroclor data could be removed for a simpler approach, but if we keep a weighting approach, it could add value to keep the data in. Maybe we could circle back to Aroclors when we discuss the weighting approach later.

Debra: as a dataset as a whole, it doesn't seem like Aroclor data are driving things one way or another, so whether they are in or out is not as important. For weighting, having a larger sample size helps with statistics. To me, it depends what approach is taken regarding whether it adds any value.

Elizabeth: I have some concerns about using the weighting approach, and prefer the simpler approach. If it doesn't make a difference, let's revisit after the weighted approach discussion.

Greg [Slide 7]: We have added total dioxin/furan to this table, which was presented on Monday.

Bill: Is the n for excluding the sediment traps 54 for dioxins?

Greg: yes, only 5 sediment traps were tested for dioxin/furan

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Debra: King County prioritized PCB congeners due to costs

Jeff: once we got every flow period, we didn't test dioxin/furan further

Greg: These are all bootstrapped UCLs.

Elizabeth: what stats program are you using, just curious?

Greg: Python or R

Elizabeth: I don't want you to get the feeling that EPA requires Pro-UCL

Greg: R package has the same tools as Pro-UCL. We can do Pro-UCL if needed. On the table, we see that concentrations do change somewhat between each row.

[Slide 8]: The suspended solids that make it to the East Waterway are fine-grained. On the left side, the orange line is the fines fraction at each river mile. It shows that as suspended sediment moves from the Turning Basin to downstream the sands fraction drops out and what is left is fines by the time sediment gets to the EW. This data is based on the LDW model combined with the suspended solids dataset. It's conceptual, but gives a pictorial representation of why we care about fines. The graphic on right is what we showed last time, showing suspended solids data fines content.

[Slide 9]: If we fines-normalize, does that make sense? Are contaminants associated primarily with fine-grained sediment? In the USGS study, they tested bedded sediment samples that were both sieved and unsieved from Foster Links area. Unsieved is the blue box. Orange is the fines fraction after sieving. The sand fraction is back-calculated from the sieved and unsieved values that were analyzed in a laboratory. Unsieved samples were about 20% fines. We see an increase in fines concentrations when compared to unsieved.

Bill: So this is the bedded sediment for Foster Links. Is the intention that it is representative of a whole sediment sample that would be sorted before it flows downstream? Or is this just chosen as a good dataset to look at pattern/fractionation of contaminants between grain sizes?

Greg: I was thinking it is a good dataset for comparing fractionation as the same location as our suspended solids samples.

Debra: so the latter of what Bill said

Greg: yes

Debra: it's a way to help understand the relationship

Bill: I think this follows how we traditionally think of the distribution of contaminants by grain size, and it seems to follow the pattern of what we see in other sites.

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Greg: Yes, this is what we expected to see.

[Slide 10]: Fines normalizing does make sense because that's what's reaching the EW and most of the contaminants are associated with the fines fraction. It allows us to include all data in our sample population.

Bill: When you talk about fines-normalization, and you normalizing for every sample rather than screening our lower percent fines samples?

Greg: yes, that's correct, all samples. We presented a screening case, where you screen out samples with low fines, and a fines-normalized approach for all samples. We are suggesting that fines-normalizing is most representative.

Bill: is the normalization process linear for low percent fines as larger % fines?

Greg: I'm dividing by percent fines for every sample. The normalization assumes that all the contaminant is related to fines.

Bill: OK

Jeff: One method is to think about what is entering the EW, which fines-normalization does, and the other method is taking samples out that don't have high percent fines. We can't get up to 99% fines that the model is saying reaches the EW, as you would have no data remaining. So you are either culling the dataset or doing this other approach, which allows you to use the full dataset.

Bill: thanks Jeff

Greg: The percent fines for all samples is shown on slide 8 to get a sense of where the distribution lines up.

Debra: On slide 7, the screening we did for less than 60% fines removed around 12 samples

Greg: yes between 10 and 13 depending on contaminant. 60% is not a magic number, as there is not a specific breakpoint that is the most logical.

Bill: Is this a decision point, or are we saving that until the end?

Debra: I would suggest we move through and can decide after we look at the sediment trap data.

Greg [Slide 12]: This is the same as last meeting but we have added total dioxin/furan. The total dioxin/furan is similar to total PCBs shown in the last presentation. Overall, the distributions line up really well with each other.

Debra: The sediment traps fall in different locations once you do the TEQ calculation.

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Greg: Correct, the total will be very similar to the OCDD shape as that's most of this value.

[Slide 13]: this slide is repeated from above for the purpose of looking at fines-normalizing and considering what to do with sediment traps.

[Slide 14]: if we fines-normalize, it makes sense to include sediment traps, as they do line up with the rest of the data. For a weighting approach, the sediment traps don't have a place in any weighting approach, so they would be removed for that option.

Elizabeth: I have a question, but let's move forward.

Ravi: Allison, do you have any questions?

Allison: I am just interested to hear what Elizabeth has to say about this.

Greg [Slide 16]: this is updated with total dioxin/furan since last meeting

[Slide 18]: we added the total dioxin/furan bubble plot to this slide. Bubble size is concentration, x axis is Dam flow, y axis is precipitation, and color is season. When the dam is flowing higher, concentrations tend to be lower. When flow is lower, concentrations tend to be higher, and concentrations tend to be higher with precipitation, which is consistent with the CSM that runoff contributes contamination for PCBs and dioxin/furan, but arsenic is a bit different. The total dioxin/furan and dioxin/furan TEQ have a very similar pattern.

Bill: modeled sediment loading to the EW or lower part of the river system. When we met as a large group, I thought that the amount of sediment that's expected to contribute to the EW is low, I think 17% or less for base flow, and storm and dam release is the largest portion of solids. Is that right?

Dan: Looking back at the large group meeting 3 presentation, the significant dam release contributed 36% of the solids load, storm plus dam is 43%, storm without dam release is 11%, and baseline was 10%.

Debra: and that is a mix of sand plus fines

Greg [Slide 19]: This shows the highest 5 samples for each contaminant.

Debra: you get some different events on the high end. When you weight the dioxin/furan for TEQ, you do get some shifting of the top 5 compared to the dioxin/furan concentrations.

Greg: These tend to coincide with higher precipitation and low flow.

Merv: except for arsenic

Debra: Yes, for dioxin/furan and PCBs

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Greg: for Arsenic, you tend to get higher concentrations for low to no precipitation.

[Slide 20]: the pattern is similar for total dioxin/furan and dioxin/furan TEQ concentrations.

Merv: For arsenic, the bottom row should be 2 excluded

Greg: correct, that's a mistake

Dan: we'll send out an updated presentation after this meeting with a few edits we caught after we sent it around this morning

Greg [Slide 22]: We selected 0.25 inches/day for precipitation and 2,000 cfs for Howard Hanson Dam to break the samples into bins representative of the different flow conditions. We estimated the frequency of how many days each quadrant occurs in the historical dataset from 2001 to 2019. We also calculated the summary statistics for each bin. We then calculated a time-weighted average concentration for each bin.

Elizabeth: Is the relative weighting for time related to the size of the Ns on the previous graph?

Greg: On the next graph, we'll see how often each bin is coming up, so I think that gets answered shortly.

[Slide 23]: The purpose is to group the samples by flow condition and to weight samples by frequency that those flow conditions occur. Some of the drawbacks with weighting is how to handle the statistics in a regime like this is an open question that we haven't fully answered. So that potentially points to this as a line of evidence to support the analysis. But this approach is consistent with the EW physical conceptual site model.

Debra: When you weight, it's weighted on flow and rain correct?

Greg: Correct, river conditions is more accurate. In slide 23, it would be more accurate to say "river conditions" or "hydrodynamic conditions" rather than "flow conditions".

Merv: we were doing this to explore whether it has any value with estimating AB and what effect it could have. So the question is what do we do with this?

Greg [Slide 24]: These quadrants are consistent with the quadrants you were seeing previously. Each quadrant shows the N (both number and percent of all samples), the mean, and the duration of the percent of days that this condition is occurring.

Jeff: Can you clarify what period of time that percent duration represents?

Greg: That is the number of days in the 2001 to 2019 dataset that this condition occurred. For higher flow and higher precipitation, the sample size N is 7 with a duration of 3% of the time. With high

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flow and low precipitation, we have 8 samples, with duration of 7%. In the low flow with low or no precipitation, 78% of the time the river is in this condition (this is duration). Ecology PCB Aroclor data are included in these plots and occur in the low flow with low precipitation condition.

Bill: What we're trying to understand is are there certain flow conditions that are responsible for most of the sediment load that's entering the EW? Is the concentration that's within that sediment load dramatically different than what we'd see if we just did a straight calculation? And even if we had enough information to demonstrate a possible difference, do we have enough information to do this calculation? I would start thinking about sediment load. That 78% represents a relatively small fraction of sediment load, so sediment load filters in here as well.

Greg: yes, the sediment load would shift around those percentages a little bit.

Jeff: Yes, that's a good point. So instead of a time weighting approach, that's a mass weighting approach. We spent some time looking into that, but we're not convinced we are able to use it in a meaningful way. What happens in these high flow periods is they are taking the bedded material and scouring it. The TSS concentrations coming out of Howard Hanson is low, so the high flow events mobilize Green River bedded sediment. Much of that deposits in the LDW but we didn't model what happens to the material that gets out the end of the LDW. But we do know that most is transported during the highest flow periods, which has the shortest residence time in the EW due to higher velocities. Unfortunately, we never did that modeling in the EW, so we can't get a handle on how much does it contribute or not contribute (settle in EW).

Bill: it's not necessarily scouring of the Green, as a high flow event you don't see concentrations rise. But during a precipitation event, you see high concentrations from the Black River. When you look at data between flaming geyser and the bridge, you don't see a difference, but the concentrations go up during a storm event from the Black River. This tells us a bit more about where to look for source control upriver, but we don't have a weighting approach that we can apply widely for AB.

Greg: EWG is not dug in on this, this is sort of intellectual curiosity and also a possible line of evidence.

Bill: I think it's important to have thought through it, particularly when communicating to Ecology and the public. It's important to incorporate into the document. After going through this, I was thinking a weighting approach would be useful, but I see the complications and am wondering whether it makes sense to use a weighting approach.

Greg [Slide 25]: These are the same plots for total dioxin/furan concentrations and dioxin/furan TEQ.

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[Slide 26]: arsenic demonstrates a different pattern, with the base flow condition containing a greater impact. Low flow conditions generate higher concentrations for arsenic, and if anything concentrations come down during precipitation events.

[Slide 27]: These are straight averages. The top 2 rows include Ecology Aroclors and sediment traps. The bottom 2 rows include centrifuge and filter samples (including Ecology Aroclor data) binned as shown in the previous figures. They line up pretty well. Arsenic does see a high base flow and has a higher concentration for the weighted approach. For the organic contaminants, the concentrations line up really well.

Elizabeth: that's a really high arsenic concentration

Jeff: it is isn't it?

Elizabeth: didn't Ecology say the average concentration in soil in Washington is 7 ppm?

Debra: Yes, it is 7 ppm based on EPA's Puget Sound natural background value. We are in the Asarco plume but I believe geochemist from Anchor said there is also a naturally occurring arsenic vein that is present in the Green River.

Greg: we think there's some erosion from natural source that's contributing to the base flow that is different than the natural source that's from the Howard Hanson source. And there's a runoff source, which means 3 sources: Howard Hanson Dam sediment, a vein contributing to baseflow, and runoff.

Jeff: And arsenic has complex geochemistry that can change significantly once it's deposited

Ravi: this is inorganic arsenic correct?

Debra: this is total arsenic. We have only analyzed for inorganic arsenic in biota for the LDW and EW.

Ravi: does that make a difference Elizabeth?

Elizabeth: I don't mean to question any of this data and it seems higher than what I have seen elsewhere for arsenic background when comparing to what Ecology tends to use. I have never been a fan of establishing background on a state-wide basis.

Greg: that's all the slides. Debra was going to talk about dioxin/furan quickly, and hopefully we can come up with a path forward for next meeting.

Debra: let's discuss Ecology Aroclors first. In Monday's presentation, we know using Aroclor data doesn't change the number much. Greg, did we do weighted approach with and without for fines normalized?

Greg: I think it's a very similar difference.

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Debra: It doesn't look like it changes the story, and on the weighting, it's just about weighting the sample size, and as Greg said, the Aroclor data falls into the low flow/low precipitation quadrant. Would it change the number more than what we see here?

Greg: it's a very similar number. It could probably bump it by 1 ppb for PCBs.

Debra: We want to understand what to do about dioxin/furan. I am aware of lab data testing and reporting methods.

Elizabeth: not to imply you weren't

Debra: I'm struggling to visualize how to get to AB. I'm struggling how it is used, compared to how we have used for risk or natural background in FS. For risk, the RI, and the FS, everything is presented as a TEQ, along with Dredge Material Management Program (DMMP) which uses a TEQ, the LDW ROD, and we're all used to thinking about it in that fashion, and I'm struggling with using an AB number as a total dioxin/furan concentration. Either way we calculate TEQ seem to match up pretty well. The TEQ is a really a weighted sum that factors in toxicity. I'm concerned we lose the TEQ comparisons if we move towards a total concentration perspective. How will public and others relate to total concentration when everything has been as TEQ.

Elizabeth: I was never proposing calculating a total dioxin/furan background. I was advocating doing a calculation for each specific congener. I was less concerned about how that gets used for post-remedial monitoring. Whether you'd look at each individual congener regarding how well the site is approaching each individual congener AB value or whether you'd look at TEQ. I know you're comfortable with using TEQ, but I have never done that over 30 years. It doesn't make any sense to me since the data come as individual values. I understand that the information shows that congener concentrations aren't independent variables, but depending on source, they could vary. I struggle to see what problems concentration proposed creates.

Debra: I'm concerned if we went away from a TEQ approach, which is weighting concentrations to think about risk perspective. I'm concerned we're not thinking about risk.

Merv: is the disconnect about not calculating cleanup levels? Can't the cleanup level be the TEQ that is obtained from the statistics we generate on the congeners? So cleanup level is a TEQ?

Elizabeth: the risk based TEQ was calculated as a TEQ. I'm not recommending we go back and redo the risk assessment on a concentration basis. But you could have calculated an exposure-point concentration for each congener and then applied the TEQ for each congener to evaluate risk. The risk-based concentration is a TEQ. Our cleanup goal will be AB.

Merv: Cleanup level or cleanup goal?

Elizabeth: The ROD will state that the goal is to clean-up to AB. So I don't see a disconnect. For communication to the public, anyone can calculate a TEQ based on this and you can show based on the information you have that total concentrations and TEQ match each other. So the inputs to this system are relatively consistent. But I am at a loss why this is such a difficult concept.

Debra: so are you saying a TEQ that relates to these AB numbers would be presented?

Elizabeth: in risk communication, you would do that, but I am not convinced that we should present a dioxin/furan TEQ as a cleanup goal that's based on background.

Debra: so you would not be opposed to the ROD having these AB concentrations but also the TEQ?

Elizabeth: no I would not be opposed. It could be opposed by someone, and it's not ultimately my decision.

Ravi: why would you compare the TEQ to natural background?

Debra: No, it's just for perspective, because otherwise, we're dealing with a number of 1,400 ng/kg, but the NB value is 2 ng/kg TEQ. It's hard to know how different these numbers are to a risk number or the numbers being used in the LDW. It feels confusing.

Elizabeth: I understand where you're coming from. When we have internal discussions about what goes into the ROD, I'll make the argument that the cleanup goal as AB numbers should not be a TEQ. I would support individual AB concentrations and can agree to calculating TEQ based on these concentrations. That's important for public participation. I don't really much care for Ecology's natural background value.

Debra: Ultimately we're trying to reduce risk, and we calculate a TEQ from the 17 congener AB values. Let's say it's 6 or 7 ppt TEQ. If we do monitoring and we get improvement on the more toxic ones, and you meet the TEQ, would we be losing that if we have 17 AB values? We could get hung up on an individual congener that doesn't matter much for risk?

Elizabeth: The TEQ is always there to calculate. During monitoring, if congeners that are coming into the system are similar to risk based levels, that will be really impressive.

Debra: There are a portion of those which have low toxic equivalency factors (TEFs) that could minimally affect TEQ. We'd lose this perspective if focus on concentrations rather than TEQ.

Bill: OCDD and some more ubiquitous dioxin/furans don't change over time but more toxic fractions could change over time. If that's happening, we may be under the impression that the site hasn't met it's cleanup goals or reduced risk if we're concerned about something like OCDD but TCDD and

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TCDF have gone down. So if we don't have a regulatory level for TEQ, we can't say we've achieved our cleanup goal or reduced risk because we have not met OCDD or something else.

Debra: exactly

Elizabeth: there's a lot of this information that is lost in this whole analysis when you are just doing a TEQ. At Portland Harbor, when we looked at what was driving dioxin/furan, almost all of the risk was coming from only a few congeners. So we didn't calculate background for all 17 congeners, we calculated background for those most prevalent in conjunction with the risk. It doesn't matter what the risk is as we're comparing to the risk of things coming into the system. We can track the ones that really matter. So there's no information being lost here.

Debra: OK we can move on

Dan: Can we take a minute to review what EPA's position is on the elements we covered today?

Elizabeth: I'm agnostic on whether we use the Aroclor data. It's noise, so when it's noise, I tend to not argue. If you want to include that data, I don't have any significant objections. I did look at the concept of whether we need to include outliers in the analysis you did. There is more than 1 distribution. When I do a cumulative probability plot, there's 3 populations but mostly 2, which is indicative of how the concentrations change with rainfall and everything else. With the analysis you presented, the influence of those higher values is negligible, and if including them doesn't change the outcome, the influence is such that it's not worth having a lengthy discussion about them. If your recommendation is to keep them in, I'm fine with that. It speaks to how good the dataset is.

Ravi: I agree

Merv: what about fines normalizing?

Elizabeth: it's not a huge change on the result, so I'm not sure you're getting much one way or the other. Sediment traps, the fines are low, more like bedded sediment that is not getting to EW. Better logic may be to cutoff samples with <60% fines. It is easier to justify.

Debra: that is more about representativeness and may not be what is getting to EW

Elizabeth: I could go with screening at 60% fines; the most adjustments we make, the more complicated it gets.

Bill: I'm hoping we have gotten to a decision point on these things. The sediment trap data to me doesn't seem to add a lot, but the analysis you did is a good sensitivity analysis tool. A lot of discrete measures of concentrations is roughly similar to what you would do in fines-normalization and what you see in a long term collection in the waterway. So if it's not used in a dataset, it's a good

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sensitivity analysis tool. Same with Aroclors. Generally total PCB Aroclors are similar to congeners and makes a nice sensitivity analysis tool. I do think the weighting for the storm events is another thing to discuss and to acknowledge that those variations based on flow events do occur and you've thought about it, so the possible weighting strategies doesn't seem to change a lot.

Merv: so should we take these thoughts and issue a joint statement of what we have decided?

Dan: yes, I would suggest we circulate these meeting notes but also produce a summary of what we have agreement on, how we would calculate AB, and also what methods we would propose could be presented to support the sensitivity analysis.

Bill: that would really help so we are all on the same page going forward

Elizabeth: I really appreciate all the analysis, especially what you did between Monday and today. It was useful to see. This is a pretty good dataset, although there was some argument at HQ on whether that was true. The system will not care what we calculate; the remedy is independent of what we decide AB is. What we will achieve with the remedy seems to be quite a bit different than what will be AB, so those other inputs matter. We should measure what's happening with the EW but also what's happening in the system where we decided to calculate AB to see if that remains the same over time. Whatever flows past Foster Links to some degree affects what flows into the EW. This system will be a dynamic system, and as time marches on, we should be supplementing the dataset to see if what we did in 2020 makes sense in 2050. I tend to look at remedies from a more practical sense.

Dan: I think that for the December 4th call, we will plan to repackage much of the analyses we have already presented and summarize what is the proposed method for estimating AB and what analyses would be sensitivity analyses.

Elizabeth: we've largely done the hard work. For some things, we may or may not be in agreement. Do you need to know today which data are in or out and we could concur at next meeting?

Debra: that seems like a good approach

Jeff: We can continue the analysis and confirm the decisions next meeting, which will support the sensitivity analyses.

Elizabeth: we are ahead of the timeline we set up originally, which is a testament to the work you're done. Doing calculations is not a particularly difficult task. If you want to discuss Aroclor and fines normalizing or greater than 60% fines, you might have internal feelings among that. Were you hoping to have that decision today?

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Debra: I think we're all on the same track on the Aroclors in that it's fine if they're included or excluded. But I'm not clear on your preference on whether to use the sediment traps for sensitivity analysis or use all data with greater than 60% fines. I think I heard your preference Elizabeth that you'd prefer a cutoff. Do you need another few days to settle on a decision?

Elizabeth: I settled on a preference but that may not be EPA's decision

Debra: and that was?

Elizabeth: using a 60% cutoff. What was your recommendation?

Debra: we are recommending fines normalizing for all data. I heard Bill saying that thought sediment traps could be used for sensitivity analysis. Is that right?

Bill: For using sediment traps, I'm OK using them as long as they're either fines-normalized or using a percent fines cutoff. I think fines normalizing the data is a good idea and it makes sense. Sediment trap data could be included or could be used as a sensitivity analysis. I don't think there's a lot of data there, so it doesn't affect the bottom line very much.

Elizabeth: Bill, Ravi, and I will have a discussion on this in the next few days.

Ravi: I think we're heading in the right direction

Elizabeth: I think that we're discussing arcane points at this time, which is an indication that we have accomplished a lot.

Ravi: I'm not sure how much it would change the final number, but we need to make a decision that's scientifically based. Everything is going into the administrative record, including the presentation and materials and minutes.

Debra: Greg deserves many thanks for his ability to do so much in a short amount of time

Ravi: we'll pick up here on discussions on December 4th

Greg: we've done a lot of the work, so next meeting could be leaner than these meetings. The summary tables we've already presented will be repackaged and we'll highlight the main number we are going towards with the other analyses that could be used for sensitivity.

Debra: yes, but after we hear back from Elizabeth, Bill, and Ravi. Can we get that next week?

Ravi: Yes, we'll get back to you by Tuesday or Wednesday. Let's meet this afternoon.

Debra: Allison do you have any thoughts?

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Allison: I want to see the meeting summary when it comes out and we'll go from there.

Ravi: Allison, can you join our EPA call this afternoon?

Allison: yes

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