



July 19, 2012

Dear Adriane Borgias and David Moore:

I would like to start my response to your 34 page Ecology critique of the Phase I BAP study I directed by making a few general points. First, in my 30 year scientific career I have never been involved in a case where the science has been this hopelessly entangled with policy considerations. For example, in a July 16<sup>th</sup>, 2012, memo authored by Kelly Susewind of Ecology, it was stated that "any future [BAP] studies should address how the data will be used for . . . eventual permit modifications". I was contracted to do a scientific investigation of the biogeochemical attributes of phosphorus in Spokane region wastewater treatment plant effluents and it is highly inappropriate that the merits of our study are being judged from the perspective of the policy decision-making process.

Second, I am very disappointed that Ecology has spent two months working on their critique of my study and apparently only intended to notify me of, and consult with me regarding, this critique the afternoon before it was to be delivered. Ambush is the most polite word I can think of to describe the way this was handled. There have been high-level communications between personnel at UW and Ecology expressing UW's frustration with the way this matter was handled by Ecology.

Third, it is the University of Washington's opinion that this project is complete and I am under no obligation to respond to Ecology's comments 18 months after on the final report. Eighteen months ago Ecology paid off all final expenses for our project after undergoing a detailed comment process for our project. At no point then did any person within Ecology (David Moore was the oversight person for this project) express any concerns about our final product. In fact, a little more than 3 weeks after we turned in our final report (i.e., on March 18<sup>th</sup>, 2011), David Moore sent me an email that stated "**For the record, the work [you] have done is outstanding and really moves the ball forward on our understanding on BAP in effluent**".

If Ecology personnel had concerns about our study when we turned in the final report, they had a professional responsibility to get their concerns to me regarding our final report in a timely manner. Ecology failed to do that. The fact that Ecology told us "**for the record, the work [you] have done is outstanding**" suggests your retrospective analysis of our study has other purposes. Had we received the comments Ecology is sending us (18 months after the fact) in a timely manner, 90% could have been resolved in a single afternoon. It really seems as if the merit of our BAP study is being judged primarily on how our outcomes mesh with Ecology's policy goals and not the rigor of the science itself. The retrospective QAPP review process also appears to be a rather transparent attempt to block the dissemination of scientific information without a scientifically valid justification.

On the following pages, I will detail my response to Ecology's key criticisms of our Phase I study. I will do this sequentially.

Sincerely,

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*Point #1: [Ecology concerns] "IEP: Removal performance is based on the result from only one influent sample."*

Response: we were not contracted to provide phosphorus removal estimates for the facilities we tested. We provided this information (when we had access to suitable influent samples) as courtesy to the entities that funded our study.

*Point #2: "No locations were sampled in accordance with the QAPP schedule" [to] "determine if the bioavailability of phosphorus from Spokane area wastewater discharges varies seasonally."*

Response: in the next sentence of their critique, Ecology notes that we did show the BAP and phosphorus composition of summer and winter discharges was very different. Apparently a comparison of winter and summer scenarios does not count as a seasonal study. We disagree.

*Point #3: "Coeur d'Alene (nomenclature confusing), Zenon membrane filter, Zenon membrane system . . . Ecology stated that because of this "It is not possible to determine if these systems were tested".*

Response: the various systems studied at Cd'A were clearly described in Figure 8 of our final report.

*Point #4: "A parallel study at Northwestern University is being implemented to conduct detailed phosphorus speciation analysis of effluent samples from the same WWTPs. Not addressed in the report. If there is collaborative data, it should be provided. **This is a major omission in the study that should be explained.**"*

Response: the Northeastern study was solely funded by WERF. Ecology provided no financial support for this research project. Furthermore, the Northeastern study was completed more than one year after our study so we did not have access to their results in any form at the time our final report was submitted. This WERF funded study final report is currently out for external review and will be available from WERF later in 2012.

*Point #5: Project schedule start date: Sampling begins, July 2009; Project schedule end date: Final report, July 2010. . . There were numerous deviations from the schedule, which were not explained. See Table 2 at end of this report."*

Response: the time line indicated by Ecology above is incorrect. Due to various delays in receiving final funding approval, UW did not received a final signed agreement from Ecology for this project until mid September, 2009. The original end date for this project was Dec. 31, 2010, but this was extended with Ecology's approval to June 30, 2011. It is frustrating that Ecology cannot get something as basic as the project start and end dates correctly. Table 2 of the ecology critique mentions several deviations between our preliminary and actual sample collection schedule during August 2009, during a time when our project was not yet funded.

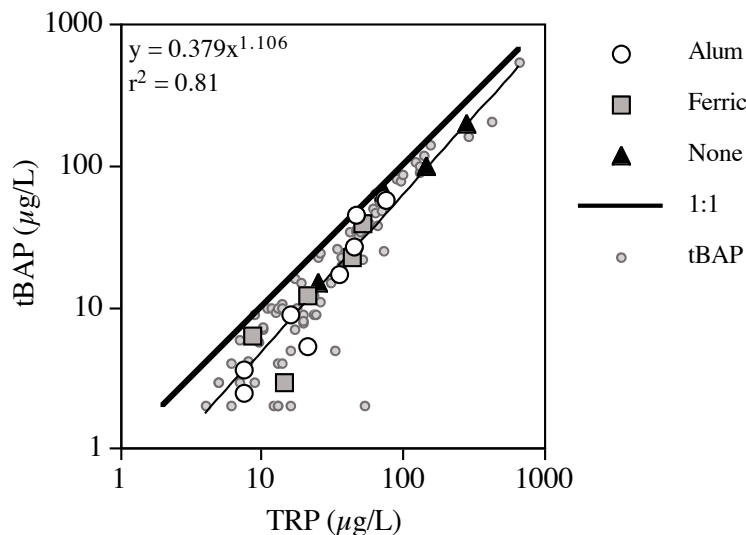
As explained in numerous meetings regarding this project (that were attended by David Moore), it was commonly the case that the pilot plants we intended to sample were actually off-line when the "preliminary schedule" in the QAPP

suggested they would be sampled. We only sampled plants that we believed to be operational at the time. This was discussed extensively in project related meetings.

We also feel it is disingenuous for Ecology to complain that we did not sample some systems when indicated in the preliminary schedule because we were contracted to provide data for 41 samples and we ended up providing data for 148 samples. That is, we provided three times more data than promised at no extra charge! Ecology never once thanked or even acknowledged us for doing this extra work, but they have the temerity to complain that some samples were not collected according to the preliminary schedule when the pilot plants were most likely offline anyway.

*Point 6#: "Of TP, TDP, and SRP, the only parameter that was measured was TP."*

Response: our QAPP states "Other analysis such as SRP will depend on project funding." We did a small number of SRP analyses during the project but did not report these in the final report because the SRP data were fragmentary compared to the 148 samples we processed for TP, TRP, and BAP. Our QAPP stated that our phosphorus analyses would be based on "raw . . . unfiltered and untreated samples of water" and it also states that we would be doing TP and TDP characterizations. Since TDP is based on filtered samples, there is a contradiction in the QAPP. Because determining the attributes of the effluents that would actually be discharged was the paramount project objective, we resolved this contradiction by analyzing for TRP instead. TRP data were presented at all project meetings and nobody from Ecology ever expressed a concern in this regard during the project or during preparation of the final report. Our recent WERF project shows TRP is by far the best predictor of total BAP for a wide range of advanced P removal systems ( $r^2 = 0.81$ ).



A comparison of TRP and tBAP concentrations from a recent WERF funded project (Li and Brett, unpublished).

*Point #7: "The report does not make a clear distinction between "samples" and "sampling events".*

Response: Samples were collected during sampling events. If multiple systems were in operation at a single site (i.e., City of Spokane or Cd'A), multiple samples would usually be collected during a single sampling event.

*Point #8: "There was no discussion regarding deviation from the proposed monitoring schedule. Scope and schedule are an integral part of the QAPP. Any deviations from the QAPP must be explained".*

Response: we only collected samples when they were available. We did not sample pilot plants that were offline.

*Point #9: [The QAPP indicated] "Five replicates each of seven standards (0, 10, 20, 35, 50, 75, and 100 µg P/L) are incubated simultaneously to establish a "standard curve." Was this method used? If not, was there sufficient explanation? No. Standard media with a known concentration series of KH<sub>2</sub>PO<sub>4</sub> (0, 5, 10, 15, 20, 25, 30, 40 and 50 µg P·L<sup>-1</sup>) were incubated in triplicate to obtain a standard curve for algal growth yield."*

Response: we used a narrower range of PO<sub>4</sub> concentrations for our BAP standard curves to improve our method sensitivity. This change could only have had a positive impact on our analytical outcomes.

*Point #10: "Determining the soluble reactive phosphorus will provide a base for comparing of the results of the somewhat tedious bio-available phosphorus test with the traditional analytical measure of biologically active phosphorus. Was this objective achieved? If not, was there sufficient explanation? No."*

Response: we did not receive funding to do systematic SRP analyses and this was clearly articulated in the QAPP. We did do TRP analyses on every sample. TRP equals SRP plus the particulate phase of P that is deemed "reactive" according to the acid-molybdate method. As noted previously, our recent research shows TRP is by a large margin the best predictor of total BAP. It is disingenuous to judge our project on the basis of an analysis that we were not funded to carry out on a systematic basis.

*Point #11: "Were laboratory measurements made in accordance with the parameters in Table 7? 1. Samples were not collected in accordance with the QAPP schedule. 2. Total P and BAP exceeded the expected range of results."*

Response: this comment suggests the Ecology personnel who prepared the critique of our Phase I BAP report are unfamiliar with basic wet chemistry methodologies for nutrient analyses. Common colorimetric nutrient analyses have upper thresholds because the color development saturates absorbance at high concentrations. For example, if a concentration of 300 µg L<sup>-1</sup> gives an absorbance of ≈ 100%, it is not possible to directly measure concentrations higher than this. All labs resolve this problem by diluting their samples. Our TRP and TP standard curves only included phosphorus concentrations up to 200 µg L<sup>-1</sup>. When we report concentrations above 200 µg L<sup>-1</sup>, these were always for diluted samples.

This is something everybody who has ever done these types of analyses already knows.

*Point #12: "Were 10% of the samples duplicates? **No.** Scope and schedule are an integral part of the QAPP. Any deviations from the QAPP must be explained. The researcher must prepare procedures to ensure that the QAPP requirements are met."*

Response: Ecology is correct, we did not replicate 10% of our samples. In fact, we replicated 100% of our samples. So is Ecology upset that we provided 9 times more replicates than promised or is Ecology actually unaware that we replicated every sample? Further, because we replicated every sample, as opposed to every 10<sup>th</sup>, we effectively delivered 90% more data than promised over and above providing data for three times more samples than promised.

*Point #13: "Are the field and laboratory data on the excel spreadsheets available? If not, was there sufficient explanation? (QAPP, July 2009, p 14). **Not provided.** Raw data (field and laboratory data, chain of custody forms, QA/QC charts) should be provided as an appendix to the report."*

Response: our final report included a detailed Appendix that included the means and standard deviations for every one of the 148 samples processed during our study. We had no inkling that Ecology was not satisfied with this level of detail on the data. Had Ecology requested this data in a different format in a timely manner, we would have honored their request within hours.

*Point #14.1: "Request that comments on this study by other Spokane River stakeholders (dischargers, environmental groups, tribes, etc.) be made available for public review. (ECY 1/20/2011; p 1). The comments made to this study were to be collected and added as an attachment to the Final Report. Comments and response to comments should be an integral part of the final report."*

Response: at the time we completed our final report we had received no formal comments from dischargers, environmental groups, tribes, etc. The comments we did receive from the various dischargers were entirely editorial in nature and were in all cases addressed in the revised report. For example, they pointed out typos and more appropriate terminology for their pilot systems. There were no comments from the dischargers that raised concerns about any aspect of our study. This is all spelled out very clearly in an email from myself to David Moore sent Feb. 24<sup>th</sup>, 2011; i.e., I stated "[Ecology's] comments were the only formal comments we received to the final draft." The dischargers sent us mostly editorial suggestions".

*Point #14.2 (regarding comments made in a phone conversation and follow up email from Adriane Borgias dated July 18, 2012): "Dr. Brett, I am not sure I understand your question since I don't know exactly what you heard on the phone. But I will clarify the information in the document: Column 1 is a quote from the Department of Ecology comments dated 1/20/2011 p. 1. Column 2 is the response from UW to the Department of Ecology dated 2/11/2011. It is quoted directly below: 'Thanks for the suggestion! We will collect the comments made to this study as an appendix attached to the final report.' The*

*February 2011 Final Report, which was the version that was reviewed, does not have an appendix attached to it. There is no appendix listed in the Table of Contents. Column 3 is the agency expectation with regard to this item. Comments and response to comments should be an integral part of the final report. If your question is as to why this is viewed as important there are these reasons: 1) The ability to view the comments received by the other Spokane River stakeholders and the response to those comments is an important aspect of peer review and public communication. 2) An appendix was either not prepared or not included as promised. 3) If the appendix was prepared then it has for some reason been separated from the report, which is exactly the reason why the expectation is that it be an integral part of the report".*

Response: in an email dated Feb. 24, 2011, I asked David Moore how he would like us to include our response to Ecology comments in our final report. In an email from the same date David Moore stated "You can attach the response as an appendix or however you prefer". On Feb. 25<sup>th</sup>, 2011, we submitted our final report and response to Ecology comments as separate PDF files in an email to David Moore and other Spokane TMDL stakeholders. Our responses to both Ecology and EPA documents have also posted on the web and are readily available to any interested parties (at [www.spokaneriver.net](http://www.spokaneriver.net)).

I think it is quite telling that Ecology seems to be totally unaware of communications, between myself and David Moore, that clearly explained this matter at the time that we submitted our final report. This is one of many cases where you have made blatantly false criticisms of our BAP study because you failed to properly research this matter.

*Point #15: "All information available on the operation of the treatment process (effluent flow rates, chemical dosage rates, unusual operation conditions, etc.) of the facilities should be included in the report. (ECY 1/20/2011; p 1). This information has not been provided. Process conditions, and any deviations from normal operating conditions, must be fully explained within the report.*

Response: we put considerable effort into obtaining as much "process information" as possible from the pilot plants we studied. Our final report included all of the information that we were able to obtain for the systems we studied.

*Point #16: "Please explain the significance of using KCl instead of K<sub>2</sub>HPO<sub>4</sub>. Is this a deviation from the standard methods? (ECY 1/20/2011; p 3, paragraph 2) Reason provided is that this substitution (to create P-starved algae prior to the start of the experiment). Did not address the deviation from standard methods. Scope and schedule are an integral part of the QAPP. **Any deviations from the QAPP must be explained.**"*

Response: The use of P-starved algae was not a deviation from our QAPP! Our QAPP very clearly stated "The test algae will be deprived of phosphorus prior to incubation in order to stimulate the production of alkaline phosphatase enzymes which are used by algae to convert organic forms of P to inorganic P from the algae's environment". It is not possible to deprive algae of P if K<sub>2</sub>HPO<sub>4</sub> is used

in the growth media. Algae also need a potassium source, hence the KCl substitution. This was explained in our responses to both Ecology and EPA.

*Point #17: "It is unclear what the significance of the sample variability divided by the square root of the number of replicates processed is. Is this a standard way of showing low analytical uncertainty? (ECY 1/20/2011; p 10, paragraph 1). No explanation was provided. Provide further discussion in the QAPP (in the context of method and data quality objectives) regarding how data will be statistically evaluated for precision, accuracy, and reproducibility."*

Response: the sample SD divided by the root of the sample size is otherwise known as the "Standard Error" of the mean, and it is the classic means of expressing uncertainty around mean point estimates. The Standard Error is explained in the first chapter of every freshman level statistics textbook. Scientific documents don't generally explain terms that can be assumed to be general knowledge for persons with technical backgrounds.

*Point #18: Our responses to EPA comments were not always satisfactory (I am paraphrasing several Ecology comments).*

Response: our QAPP states we are obliged to respond to the comments of those who funded our study. I.e., "a draft report will be circulated among and reviewed by all funding agencies". EPA played no roll in the development of this project and provided no funds for its execution. Despite this we gave EPA two months to provide us feedback on our final report. EPA submitted their comments to us several hours after we completed our final report. In an email to David Moore dated Feb. 25<sup>th</sup>, 2011, I stated "we received some comments from EPA this afternoon, note these comments arrived after we prepared the final draft (and without prior warning). I will prepare a response for EPA, but we are not going to attempt to address these points in the now completed final report."

*Point #19: "[The data suggests that] low carbon content for the advanced treatment effluents, which can influence algae growth in bottle tests, and effluent micronutrient concentrations are unknown. The report should acknowledge the possibility on non-P nutrient limitation in undiluted, low-P samples from both advanced wastewater treatment effluent and from the river. (EPA 2/25/2011; p 2 paragraph 3). [UW's initial response: Algae in closed bottle tests might be carbon (CO<sub>2</sub>) limited, but for this experiment the bottles were open and continuously shaken. (UW, 2/28/2011 paragraph 5)]. Noted and acknowledged by EPA. (EPA 3/10/2011, paragraph 3). While low N and C concentrations and toxicity can influence algae growth in bottle tests of undiluted samples, the effluents will be diluted by the receiving water, and natural processes can compensate for deficiencies if N and C in lakes and reservoirs . . . these factors, which may have influenced assay results, will not be present in the environment. Therefore, the possibility of limitation by nutrients other than P or the presence of toxicity in undiluted effluents from advance treatment facilities must be ruled out or controlled for before the results of this study could be used to inform regulatory decisions. (EPA 2/25/2011; p 3 paragraph 3)"*

Response: Ecology's comments indicate they do not understand the technical issues being debated here. EPA suggested that the algae in our experiment might have been carbon (CO<sub>2</sub>) limited due to the low carbon content of some of the effluents we tested. In our response, to EPA we pointed out that CO<sub>2</sub> limitation of algal growth in our experiments was inconceivable because we conducted our experiment in stirred beakers that were open to the atmosphere. In any reasonable world this would resolve this comment. The EPA personnel who assessed our final report were apparently unfamiliar with the EPA protocol we used for our experiments. Ecology's comments above suggest they are unfamiliar with the conditions under which CO<sub>2</sub> limitation of algal growth would even be possible.

*Point #20: Ecology included several pages of critical comments related to studies carried out by Inland Empire Paper company in the Ecology assessment of our study.*

Response: not sure where to start here. We played no role in the EIP studies Ecology is criticizing here. To repeat, I have zero knowledge of what was done or not done in these studies. To me it is unimaginable that Ecology would include these points in their critique of my research project. I brought this problem to Ecology's attention and they refused to change this aspect of their critique. I am astonished that this would be included in their critique of my study - this seems like something straight out of the Soviet Union.

#### **Other issues:**

On July 2<sup>nd</sup>, 2012 I received an email from the Spokane River Forum indicating "Ecology staff has completed review of BAP Phase I issues. The memo will be released after discussing with senior management next week". This was the first time I had heard of this critique of my project. I immediately contacted David Moore of Ecology and Adriane Borgias responded to my email. In a phone conversation with Adriane Borgias that afternoon, she indicated that she was very concerned that our final report did not include a Chain-of-Custody section and she commented "how could Ecology be certain that the samples [we] reported on were even collected?" When I informed Adriane Borgias that UW in fact played absolutely no role in sample collection (we were after all based in Seattle and these samples were collected in the Spokane region) and named the third party who Spokane County sub-contracted with to collect these samples, Adriane Borgias was amazed and said "this is the first time that I have heard that you did not collect the samples or [the name of the sub-contractor who did]." This is disconcerting because Adriane Borgias was charged by her supervisors with doing a line-by-line analysis of our QAPP and final report. The fact that a named third party would collect all samples and transport these to the UW campus was very clearly laid out in the original QAPP. How could this person fail to notice such a critical detail of the project she was asked to do a line-by-line analysis of? Why did her supervisor at Ecology (David Moore) not alert her to her very serious mistake?

After the Ecology critique picked up some momentum, Professor David Stensel (a co-PI on this project) alerted me that Ecology had described its goals for their critique in a June 19<sup>th</sup>, 2012 presentation to the Spokane River Forum (and these goals were available on this website). Subsequently, on July 16<sup>th</sup>, Ecology sent me a five page memo outlining in



very general terms their concerns regarding my original project. This document also contained a statement of the analysis' goals. These goals were quite different from those described to the TMDL stakeholders in the Spokane River Forum on June 19<sup>th</sup>.

Phase I BAP critique goals as articulated by Ecology June 19<sup>th</sup>, 2012:

1. Did the original study meet the goals of the QAPP?
2. Were the comments submitted by Ecology and EPA adequately addressed?
3. Have Ecology's requests for data been met?

These were very easy questions to answer. The original goals of this project were very clearly spelled out in the QAPP. These were: *"The Spokane regional wastewater phosphorus bio-availability study has three primary goals: 1) Determine the fraction of total phosphorus in effluent from Spokane area WWTP pilot tertiary treatment processes that is biologically available, 2) Determine how advanced phosphorus removal technology affects the BAP of the effluent, [and] 3) Determine if the bio-availability of phosphorus from Spokane area wastewater discharges varies seasonally"*. I think there is no question that we more than exceeded these goals by any objective measure. Further, a research paper summarizing our results from this project was recently published in a high caliber peer-reviewed environmental engineering journal.

Did we meet the second goal? Absolutely, we provided very detailed responses to Ecology and EPA's comments to our final report, which are also available on the web (see [www.spokaneriver.net](http://www.spokaneriver.net)).

Did we meet the third goal? Easy, Ecology never requested any data from us (beyond the data we provided without them requesting).

What were the critique goals as stated in the memo Ecology sent to me on July 16<sup>th</sup>, 2012? Goals 2 and 3 were similar to the original 2<sup>nd</sup> goal. However, the first goal had no been changed to "Compliance of the study with the terms of the Quality Assurance Project Plan (QAPP)". When I asked Adriane why these goals had changed since she presented them to the Spokane River Forum, she stated that the original first goal "was too vaguely worded". I was incredulous. In what world<sup>1</sup> is "Did original the study meet [its] goals" more vague than "Compliance of the study with the terms"? Again, this seemed like an encounter one might have with Soviet-style bureaucracy. Did Adriane Borgias change the goals of her critique of my study at her own discretion, or did somebody within Ecology direct her to do this? On July 3<sup>rd</sup>, 2012, I directly asked Adriane Borgias for internal Ecology documentation describing her agency's goals and proposed methods for their analysis of my study. Adriane Borgias told me no such documentation existed. She stated she was informed of the critiques' goals in a phone conversation with one of her supervisors (Kelly Susewind). [Did she not take notes during this conversation?] Her statements regarding a lack of written documentation were clearly not true since somebody within Ecology had created a Power Point document (that Adriane Borgias presented) which summarized Ecology's goals and this

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<sup>1</sup> Perhaps Orwell's Oceania

document is available on the internet at <http://www.spokaneriver.net/?p=6729>. The version of this document that I was able to download was electronically dated July 2<sup>nd</sup>, 2012, i.e., one day before I made the request for this information and was told it did not exist.

### **Summary Points:**

I have serious concerns about many of the key points in Ecology's critique of my research project. These include:

- Telling us that we did an "**outstanding**" study and then 18 months later ambushing us with a 34 page critique of our final report. This included providing no forewarning that this critique was imminent.
- Not reading the QAPP closely enough to realize that UW collected none of the samples analyzed for this report. These samples were all collected and transported to Seattle by a third party subcontractor to Spokane County as very clearly indicated in the QAPP.
- Misstating our projects actual start and end dates, and criticizing us for not collecting samples when we were not yet funded.
- Claiming that we failed to duplicate 10% of our samples when in fact we duplicated 100% of our samples.
- Claiming that we reported nutrient concentrations that "exceeded the expected range of results" when any person vaguely familiar with the nutrient analyses we carried out would know that samples with high concentrations are diluted prior to analysis.
- Claiming that we failed to do a seasonal study, but acknowledging that we did report extensive comparisons of summer and winter effluent properties.
- Claiming we failed to provide the comments to our report when we previously indicated to David Moore that we only received formal comments from Ecology (by the time we completed our final report) and the Ecology comments were responded to in their entirety.
- Claiming that we failed to provide the data from this project when in fact we did provide the mean  $\pm$  SD for every single sample in an Appendix, and Ecology never requested further detail on any of these data.
- Including a multi-page critique of studies we played no role in their critique of our study. (and not disclosing that this was done).
- Changing the goals of the Ecology analysis of our study between June 19<sup>th</sup> and July 16<sup>th</sup>, 2012.

- Dissembling when I directly asked Adriane Borgias if internal documentation of her critique's goals existed.
- Failing to do due diligence; multiple points raised in this critique were directly addressed in email communications between myself and David Moore at the time that we submitted our final report. Ecology failed to take this information into account when preparing this critique.

Ecology's retrospective analysis of our "**for the record, . . . outstanding**" study has the hallmark's of a hatch-job intended to suppress science. In many cases, Ecology's lack of professionalism in the execution of this analysis is stunning. This QAPP/Final Report critique does not appear to be intended to improve BAP experimental design, but rather to muffle inconvenient scientific information. Agency personnel should not confuse science and policy or let one interfere with the other. It is my opinion that Ecology's conduct in this regard is not serving the best interests of the citizens of the Spokane region or the State of Washington.