APPENDIX G

Responses to Workgroup Comments on the Draft Interpretive Report (August 2010)
IDEQ Comment Responses
Memorandum

To: Sean Covington, Formation Environmental
CC: Monty Johnson, Simplot; Barry Burnell, IDEQ
From: Don Essig, Michael Rowe and Lynn Van Every, IDEQ
Date: December 17, 2010
Re: Smoky Canyon Selenium SSC – Comments on Draft Interpretive Report

As promised, below are our more detailed comments on the Draft Interpretive Findings for Field and Laboratory Studies and Literature Review in Support of a Site-Specific Selenium Criterion, Smoky Canyon Mine (August 2010), summarizing your work on development of a site specific selenium criterion for the Smoky Canyon mine site. These supplement our major comments provided to you on November 23, 2010.

Also attached is a memo from Dr. Jeffrey Fromm, DEQ’s environmental toxicologist, which summarizes his review of Appendices G and H, regarding the Yellowstone cutthroat trout laboratory toxicity studies.

**General Comments**

Overall, we commend Simplot and Formation Environmental for a fine effort in conducting the scientific work to support a site-specific criterion for selenium.

The term “upstream location(s)” is used often. Are “upstream locations” and background locations synonymous? If so, please use background locations to be less confusing. If not, please define.

Response: Text has been revised as requested.

**Specific Comments**

Section 1.0, page 1. It is stated that source control action will not immediately reduce selenium concentrations and that in the interim a site-specific criterion is being pursued. It would be helpful to know the time frames to which you allude. How long is the interim in which a modification of the selenium surface water quality standard may be needed?

Response: The text in this section has been revised and the sentence suggesting that the SSSC is being pursued in the interim has been deleted. There is a projected period when the remediation
efforts at Pole Canyon Creek are expected to take effect; however, those time periods are being revised as new data become available.

Section 1.3, page 2, 4th full paragraph. We are pleased to see mention of EPA’s concept that a surface water value will be a ‘tier one value’ that if exceeded triggers monitoring of fish tissue. That is consistent with Idaho DEQ’s vision of a practical tissue criterion.

Response: Comment noted. Consistent with our understanding of the USEPA anticipated approach, a proposed aqueous trigger value will be used as a first level monitoring tool to determine whether more involved monitoring is required.

Section 1.5, page 9, 2nd full paragraph. Again, we are pleased to see mention of the need to understand if individual level effects from laboratory studies “… propagate to population-level effects.” We believe this to be an important part of the supporting material for a selenium site-specific criterion and therefore should be discussed in more detail in the Final Interpretive Report.

Response: Comment noted. Supporting materials throughout the document lend to the weight of evidence concerning whether the individual level effects measured for brown trout will yield an appropriately protective threshold. To that end, population data are compared in a number of different approaches to assess if changes observed may be tied to selenium concentrations. Population modeling based on individual level toxicity was not conducted due to the availability of empirical trout population data.

Section 2.1, page 12, 2nd full paragraph, also Section 2.4, page 15, 5th paragraph. It is stated that the primary areas affected by elevated selenium extend downstream in Crow Creek to the Idaho-Wyoming state line. As was brought to light in the Selenium Site-Specific Workgroup Meeting on December 2nd in Boise, both Wyoming and Idaho DEQ have recent data indicating selenium levels exceeding the current chronic aquatic life criterion now extend below the state line into Wyoming. We understand from that meeting Simplot also has data confirming this greater extent of elevated selenium levels and hope Simplot will address this in the Final Interpretive Report.

Response: Additional text and data have been included in the revised report to discuss the selenium levels measured near the Idaho-Wyoming State line. These data include more recent surface water quality monitoring data from several time periods that will allow for a better assessment of trends at the State line.

Section 2.2, page 13, bullet 4. The headwaters of South Fork Deer Creek contain spillover of waste rock from Georgetown Canyon Mine. The possible effect of this waste rock on SF Deer Creek and mainstem Deer Creek, including site DC-600, is unknown. Thus, DC-600 should not be classified as a background location unless more information is provided to indicate there is no impact from SF Deer Creek.
Response: Additional text has been included in the revised report to clarify why DC-600 is classified as a background location.

Since the inception of this project, Deer Creek has been agreed upon as a background location with naturally elevated background conditions due to exposed Meade Peak member surfaces that can be naturally leached in the environment. The Georgetown Mine has a 3-acre footprint in the extreme ephemeral headwaters of South Fork Deer Creek. Three locations along South Fork Deer Creek, downgradient of the Georgetown Canyon waste rock pile and upstream of background location DC-600 on the main stem of Deer Creek, were monitored between 2002 and 2010, with total selenium concentrations ranging from below detection limits to 0.002 mg/L. These data, together with monitoring data collected during this study, indicate that the Georgetown Canyon Mine waste rock pile on South Fork Deer Creek does not impact selenium concentrations on South Fork Deer Creek, the main stem of Deer Creek, or background location DC-600.

In addition to the surface water quality data, fish tissue and sediment chemistry data, albeit limited, are also available for South Fork Deer Creek. Selenium concentrations in three trout samples ranged from 1.9 to 2.7 mg/kg dw, and one sediment sample collected near the mouth of the South Fork confluence with the main stem of Deer Creek measured 0.76 mg/kg dw.

Section 2.3.1, page 14, paragraph 2. See previous comment in regard to classifying site DC-600 as a background location.

Response: Further discussion concerning the use of Deer Creek as a background location is provided in Section 2.3 (Background Locations).

Section 2.4, page 15, paragraph 6 (last). FYI. IDEQ has documented an exceedance of the Idaho surface water quality criterion for selenium in Crow Creek downstream of the Wyoming border in fall 2010. A report with that information will be available sometime in spring of 2011.

Response: A new section (Section 2.4) and additional graphics have been added describing the greater extent of elevated selenium levels (Wyoming data). Potential impacts in Wyoming and possible approaches to address these impacts are also discussed in a new section (Section 7).

Section 2.4, page 16, paragraph 1 (partial). Note that it is likely Crow Creek will be listed as being impaired by selenium on a near-future Idaho 303(d) list.

Response: Additional text has been added to Section 2.4 stating the likelihood that Idaho DEQ will list Crow Creek as impaired due to selenium on the State’s 303(d) list. Section 7 details an approach that will allow for listing, but also provides a mechanism by which to manage the process should the State of Idaho agree to list Crow Creek as a Category 4B status stream.
Section 2.5.5, page 20, paragraph 2. It seems that at least Sage Creek would provide sufficient habitat for dace. Is there any historic information from previous electrofishing sampling events to indicate presence or absence of dace?

Response: Additional text has been included in the revised report to discuss historic information regarding the absence of dace species. There is no historical evidence that dace have been present in Sage Creek. IDFG sampling records as far back as the 1970s have been examined and none of the data indicate the capture of dace species.

Section 2.5.5, page 20, paragraph 3. What is a typical benthic community for cold water streams? Although number of taxa were consistent across most locations, were the taxa themselves similar?

Response: The text has been revised to state that benthic communities found at monitoring locations included a diverse mixture of aquatic invertebrate families and were typically similar across locations, except for one location. The Hoopes Spring station (HS) is located at a spring headwater area that is very ecologically different from the other monitoring stations (all stream locations).

Section 3.1, page 22, paragraph 2. It is our understanding from an e-mail received 11-17-10 from Sean Covington (Formation Environmental) that the statements regarding the work of Besser et al. may be over-stated, and that this paragraph will be substantially revised or deleted from the interpretive report. Please revise accordingly.

Response: Statements regarding the work of specific authors (e.g., Besser) have been deleted.

Section 3.2, page 22, 1st paragraph in section. The project webpage is mentioned with no introduction or explanation of what it is. We believe it useful to mention the webpage in the report and encourage you to add more about this resource. We even suggest that the webpage may be a good vehicle for gathering together and delivering the documents and information that supports a site-specific criterion to a broader audience. Please revise accordingly.

Response: Section 1.1 introduces the project website and explains how it has been used to facilitate information transfer for the Work Group. The text in this section regarding the website has not been revised. At this time, access to the project website is for Work Group participants only.

Section 3.2, page 23, 2nd bullet from the bottom. It seems the 11 µg/l may be a typo; should this be 10 µg/l?

Response: The typographical error has been corrected.
Section 3.2, page 25, bullet 3. Please explain how the NOEC for larval deformities or mortality can be $>21 \, \mu g/g \, dw$ when in the first bullet selenium egg concentrations ranged from 8.7 to 81.3 $\mu g/g \, dw$ and there were no apparent effects on larval deformities or mortality.

Response: The text has been revised to clarify that “the NOEC for larval deformities or mortality based on the mean egg selenium residues from the exposure site was $> 21 \, \mu g/g \, dw.$”

Section 3.2, page 26, bullet 1, line 2. Please explain what is meant by “. . . mean ± standard error throughout) . . .”

Response: The text has been revised to read more clearly. Muscatello and Janz (2009) reported that data represent the mean ± standard error of the mean.

Section 3.2, page 27, bullet 5. Is it correct to assume that low exposure area discussed in this bullet is the same as moderate selenium exposure area in bullet 4?

Response: No. The bullets regarding the Golder 2009 (also published as McDonald et al. 2010) study have been significantly revised, and it has been made clear that char were collected from high, moderate, and low selenium exposure areas. The low selenium exposure area is an upstream reference area not affected by mine activities.

Section 3.3, page 28, paragraph 1. It is stated, “The range of species mean chronic values (EC$_{20}$s and NOAECs) in fish tissue presented in USEPA 2004 spans from 5.85 mg/kg dw for rainbow trout to 51.4 mg/kg dw for fathead minnow.” Are these figures for EC$_{20}$s and or “NOAECs?” Please expand on this sentence as it implies that EC$_{20}$s and “NOAECs” are similar.

Response: The following footnote has been added to the text to clarify the range: The USEPA 2004 Draft National Criterion, Table 4, presents compiled chronic test data that include EC$_{20}$ values, maximum allowable toxicant concentrations (MATCs), and NOECs for the endpoints measured, all of which are used in the derivation of species and genus mean chronic values. As noted in the 2004 Draft document, “When the data from an acceptable chronic test met the conditions for of the logistic regression analysis, the EC$_{20}$ was the preferred chronic value. When data did not meet the conditions, best scientific judgment was used to determine the chronic value. In this case the chronic value is the geometric mean of the NOAEC and LOAEC and termed the maximum allowable toxicant concentration (MATC). But when no treatment concentration was an NOAEC, the chronic value is less than the lowest tested concentration. And when no treatment concentration was a LOAEC, the chronic value is greater than the highest tested concentration.”

Section 3.3, page 28, paragraph 4. It is stated, “. . . prevailing scientific evidence supports the current thinking that fish are the most sensitive aquatic receptor.” This is an important statement, please provide references for this conclusion.
Response: References have been added to Section 3.3 to support the conclusion that prevailing scientific evidence supports the current thinking that fish are the most sensitive aquatic receptor.

Section 3.4, page 30, 3rd bullet. Please elaborate as to whether there were species differences, e.g., bluegill versus green sunfish. If so, that might indicate that one species was more sensitive, or less abundant, and might also indicate the less abundant species was affected at the Se tissue levels observed. What threshold is referenced in the brackets, is it Lemly's 3 µg/g?

Response: Information presented in the manuscript did not allow for an assessment of species differences, as all of the data for a single species were combined across sites, with the range presented for that species across multiple sites. The threshold referenced is actually 4 ug/g in whole body fish.

Section 3.4, page 31, last bullet. It is stated that the Colorado Water Quality Control Commission adopted water column selenium criterion based on the 85th percentile of ambient conditions. Please explain how this was justified as supportive of aquatic life.

Response: The following footnote has been added to the text to clarify the range: Existing ambient conditions are caused by natural sources. Ambient standards are adopted where natural or irreversible man-induced conditions result in water quality levels higher than table value standards. The Commission adopted a site-specific ambient-based selenium standard for this segment based upon information documenting both the natural sources of selenium in the basin and the lack of anthropogenic activity that might potentially exacerbate in-stream selenium loads.

Section 4.1.1, page 33, bullet 3. It is unclear looking at Figure 4-3 which sites were included in the dataset used to create the figure. Would inclusion of the background sites and Hoopes Spring skew these data? Would the data, and thus the conclusion, be different if the sites were examined individually?

Response: The bullet has been revised to clarify that aqueous selenium concentrations are seasonally variable and not necessarily related to the flow regime but related to discharge from Hoopes Spring. Figure 4-1 is now cited in addition to Figure 4-3. Figure 4-3 has also been revised and now specifies which locations were included in the dataset used to create the figure.

Section 4.1.1, page 33, bullet 5. An effect of sulfate in reducing selenium bioaccumulation is mentioned but it is unclear if this is based on published literature or a finding of the Smoky Canyon work. Please clarify.

Response: Additional text has been added to this bullet to direct the reader to Appendix A (Summary of Exposure Conditions – Surface Water, Sediment, Tissue) for additional discussion on sulfate and selenium relationships observed from various studies.
Section 4.1.3, page 34, bullet 3. As there is no figure to accompany this observation, please provide more information such as number of fish sampled during high flows and at which sites compared to fish sampled during low flows and at which sites.

Response: Section 4.1.3 has been significantly revised and all bulleted observations are supported by figures.

Section 4.1.3, page 34, bullet 4. Please indicate that the surface water was sampled concurrent with collection of fish for tissue analysis.

Response: The text has been revised to indicate that the surface water was sampled concurrent with collection of fish for tissue analysis.

Section 5.0, page 48, paragraph 3, sentence 1. Please explain to which “lake outlet” of the Snake River the statement refers.

Response: The sentence has been revised to state that the ELS study utilized YCT from an IDFG fish trap located at the Henry’s Lake outlet to Henry’s Fork. Additional text has also been added describing the fish from the Henry’s Lake outlet fish trap.

Section 5.0, page 49, top paragraph. Please state here that the YCT maternal transfer study and YCT ELS study results are reported separately and reference those reports.

Response: The text has been revised to state that the YCT maternal transfer study and the YCT ELS study report are presented in the Technical Support Document (formerly the Interpretive Report) as Appendix E and Appendix F, respectively.

Section 5.1, page 50, 1st full paragraph. We do not understand the statement “For the brown trout studies, the response observed at controls was adjusted to the response observed at background since true controls for this study were not practical.” Please more clearly explain your rationale here.

Response: The text has been revised to state that the EC_x values derived are based on the distribution of the field-collected data, which includes data from background locations as well as mine-influenced locations, and the response is based on effects relative to the background fish response (or those that exhibited no response). The background response was evaluated relative to the hatchery fish and determined to show no differences.

Section 5.2.1, page 54, bullet 1. Please indicate that these were maternal whole body selenium concentrations.

Response: The text has been revised as requested.

Section 5.2.2, page 57, 2nd bullet. It seems to us the sentence which begins “Despite these limitations …” should read, “Because of these limitations…” An overly steep but unrealistic
dose-response relation would yield narrow confidence limits, but such results may not be very reliable or reproducible. Please revise accordingly.

Response: The bullets in Section 5.2.2 have been revised and expanded in the revised draft. The text now states that 95 percent confidence intervals are tight around the predicted ECx values, most likely due to the steepness of the response curve. Further, there is adequate variability in the response at the upper egg selenium concentrations to consider that the ECx values predicted may be overestimating or underestimating effects at a certain level relative to background.

Section 5.3, Page 62, 4th bullet. While it is strictly true at p>0.05 there were no significant differences, the p value of 0.053 for survival from hatch to test termination was nearly significant and worth noting. We'd say there is an indication of a difference, just not a strong indication.

Response: The analysis was rerun using log-transformed data, and a significant difference was observed between controls and one treatment (20). However, a subsequent difference was not noted for the next highest nominal treatment at 40. The lack of a clear dose response suggests that some of the limiting factors that presented themselves during the test are influencing this observation.

Section 5.5, page 65, paragraph 3 (last). Are there data to indicate gender differences in whole body selenium concentrations?

Response: This paragraph has been removed from the revised version of the document.

Section 6.2, page 69, paragraph 2, line 1. Define SSD.

Response: The text in this section has been revised. The revised text spells out “species sensitivity distribution” the first time it is used.

Section 6.4, page 72, summary point 6. This is an interesting observation and may have to do with the mobility of brown trout leading to an average level of exposure less than if they stayed at a location with elevated selenium such as lower Sage Creek. It may also be due to the fact that young fish are less susceptible to the effects of high selenium if their parents (or mother) have had lower exposure. Please revise as needed.

Response: Rather than provide opinions on why populations of brown trout remain high despite elevated selenium concentrations at locations such as Sage Creek, we believe that the statement is supported by the previously presented data for field and laboratory observations.

Figure 2-4. Please indicate where sites CROW_US, LSV-2_2C, LSV-3, and CC-1A_1 are.

Response: A note has been added to Figure 2-4 to clarify that CROW_US includes Crow Creek locations upstream of Sage Creek (CC-7, SW-CC-100, SW-CC-300, SW-CC-50, AWI012-29, CC-300, CC-350, CC-75, and CC-150); all locations are upstream of SSSC location CC-350.
LSV-2_2C includes locations LSV-2 and LSV-2C; LSV-3 is on Sage Creek between LSV-2C and LSV-4, and CC-1A_1 includes location CC-1A at the Meade Peak Ranch and nearby historical location CC-1. Several of these locations were monitored one time or more frequently prior the SSSC studies which began in 2006.

Figure 4-10. Please give a general minimum size of trout and sculpin collected for the tissue Se concentration data.

Response: For brown trout, the smallest trout collected were about 50 mm. For YCT, the smallest trout collected were about 75 mm. Sculpin were generally greater than 45 mm in length.

Figure 5-13. Please indicate that these were maternal whole body selenium concentrations.

Response: This figure has advanced to Figure 5-14 and is now called YCT Adult Maternal Whole Body Selenium Concentrations Versus Log Egg Selenium Concentrations.

Editorial Comments

Response: In addition to the revisions described above, the suggested editorial corrections have been made and the authors have thoroughly reviewed the document and edited it for additional clarity.

General

The abbreviation for liter is most often capitalized, e.g., mg/L.

The first letters of Dolly Varden are generally capitalized.

Generally, there is a comma after e.g. or i.e. such as (e.g., HQI is based).

Specific

Section 1.3, page 6, paragraph 4, line 5. Move the closing parenthesis from directly behind EC\textsubscript{20} to directly behind EC\textsubscript{10} in place of the comma to read “. . . effects concentration (EC\textsubscript{20} and EC\textsubscript{10}) estimates . . .:”

Section 2.0, page 11, paragraph 1, line 5. Change Pruess to “Preuss.”

Section 2.1, page 11, paragraph 3 (last), line 3. Should the reference be to “Figure 2-2” rather than Figure 2-1?

Section 2.2, page 13, bullets 5-10. Delete (near field) and (far field).
Section 2.4, page 15, paragraph 5, line 7. Insert “and” between (ODA) and connected.

Section 2.5.4, page 18, paragraph 2, line 10. Delete the space between trampled and /failing to read “... trampled/failing banks ...”

Section 2.5.4, page 18, paragraph 2, line 12 (last). Change local to “locale.”

Section 3.1, page 21, paragraph 4 (last), line 7. Please identify the Lemly reference as to 1997a or 1997b.

Section 3.1, page 22, paragraph 1, line 1. Please identify the Lemly reference as to 1997a or 1997b.

Section 3.2, page 25, paragraph 1, line 2. Change Pike to “pike” and Uranium to “uranium.”

Section 3.3, page 28, paragraph 1, line 6. Should NOAEC be “NOEC?”

Section 3.4, page 30, bullet 6, line 2. Add “and” and a closing parenthesis to read “... (central stoneroller, sand shiner, and red shiner), one ...”

Section 4.0, page 32, paragraph 1, line 2. Add “and” between conditions and productivity to read “... selenium exposure conditions and productivity ...”

Section 4.1.1, page 33, bullet 1, line 7. Change it to “its.”

Section 4.1.3, page 34, bullet 2, line 1. Change sculpins to “sculpin.”

Section 4.1.3, page 34, bullet 2. Both Figure 4-8 and Figure 4-9 should be referenced for both trout and sculpin tissue selenium concentrations, respectively.

Section 4.1.3, page 34, bullet 3, line 3. Delete upstream.

Section 4.1.3, page 34, bullet 3, line 4. Change location to “locations.”

Section 4.1.3, page 34, bullet 3. Both Figure 4-8 and Figure 4-9 should be referenced for both trout and sculpin tissue selenium concentrations, respectively.

Section 4.1.3, page 34, bullet 6, line 1. Change sculpins to “sculpin.”

Section 4.1.3, page 35, bullet 2, line 1. Change cyprind to “cyprinid.”

Section 4.2, page 37, paragraph 1, line 1. Change sculpins to “sculpin.”
Section 5.1, page 50, paragraph 2, line 5. Change Effective to “Effects.”

Section 5.1.2, page 51, bullet 3, line 1. Insert “(15-Day Post Survival)” after trial.

Section 5.1.2, page 51, paragraph 3, line 12 (last). Should Table 1 be “Table 5-1?”

Section 5.2.1, page 55, bullet 2, line 3. Change where as to “whereas.”

Section 5.2.4, page 58, bullet 4, line 3. Change Fish to “fish.”

Section 5.3, page 60, paragraph 2, line 7. Change pre exposure to “preexposure.”

Section 5.3, page 60, paragraph 3, line 1. Delete (Oncorhynchus clarki) as it has been mentioned earlier.

Section 5.3, page 60, paragraph 4. Should Lumbriculous be “Lumbricus?” It should always be capitalized.

Section 5.3, page 62, paragraph 2, line 4. Change several to “severe.”

Section 5.5, page 65, paragraph 2, line 4. Move the beginning parenthesis behind x to read “Solving for x (which is . . .)”

Section 6.0, page 66, paragraph 2, line 4. Delete the space between and and /or to read “and/or.”

Section 6.3, page 70, paragraph 2, line 5. Change compliment to “complement.”

Section 6.3, page 71, paragraph 2, line 7. Change cyprind to “cyprinid.”
MEMORANDUM

TO: Don Essig
FROM: Jeff Fromm
DATE: December 17, 2010

SUBJECT: Review comments on the Yellowstone cutthroat trout adult reproduction and early life stage studies in support of a site-specific selenium criterion for the Smoky Canyon mine

Of the two laboratory studies on Yellowstone cutthroat trout, I did not find methodological problems in the YCT Adult Studies described in Appendix G. There are more issues with the YCT Early Life Stage Studies described in Appendix H. The main one is the study design, in that they were not able to use wild caught, selenium pre-exposed fish. Ideally they would have used two groups, hatchery fish and site fish, as in the YCT adult studies, so that early life stage diet and water exposure could be evaluated using eggs both with and without elevated selenium loads.

It is clear that maternal transfer is the exposure pathway associated with the most significant effects. However, it would be interesting to see if there is an additive or other kind of effect when egg exposure occurs together with ELS exposure. In Section 6.1 of the Interpretive Report, a case is made that YCT should be able to survive in higher selenium waters when excessive maternal transfer does not occur. This would be the case when adult fish spend most of their time in less-impacted water, and move into stream reaches with elevated selenium for spawning. There is greater uncertainty regarding effects when the entire life cycle occurs in water of elevated Se concentration.

The lack of brown trout ELS studies is another data gap, particularly since BT appear to be more sensitive to selenium than YCT. In Section 5.3 of the Interpretive Report, it is stated that widely diverging results have been found in bioaccumulation and effects in salmonid ELS studies. Hamilton et al. (1990) found an increasing relationship between whole body Se and reduced growth in Chinook salmon, but this was not the case in rainbow trout (Vidal et al., 2005). So it would be worthwhile to look at BT ELS exposure, both with and without maternal transfer 'pre-exposure.'

There were some other problems with the YCT ELS studies. Some of these are problems that commonly occur in studies of this type; these have to be dealt with on the fly in the best way the researchers can find. There was a prey size mis-matching issue, as well as other problems with the Lumbriculus diet. So there was the apparently size-related issue of worms stuck in gills or ruptured stomachs from overeating. Another issue, interestingly, was the prey-guarding and resulting under-nourishment of some fish. I wonder if the Se could have been administered in brine shrimp. There are probably reasons why this was not an option, but it appears that Lumbriculus might not have been the best choice for these ELS fish.

There was another problem with dissolved Se concentrations, as described in Section 3.2 of Appendix H. Again, they developed a method to deal with it. I don’t think any of these are fatal flaws, and the exposure pathways and minimal effects they addressed were less critical to quantify than maternal transfer and its resulting effects. The study did show clearly that diet is a more significant exposure pathway than aqueous exposure in contributing to body burden.

Overall, I think that the studies were conducted properly, and that they are a critical part of the multiple lines of evidence approach in developing the site-specific criterion. Taken together, the laboratory studies indicate that the timing of selenium exposure during development is critical; early developmental effects resulting from maternal transfer to eggs are most important. There is some uncertainty regarding the effects of subsequent (ELS) exposure, but it appears to be less important than the early developmental exposure.
Wyoming DEQ Comment Responses
From: Waterstreet, David [dwater@wyo.gov]
Sent: Monday, December 20, 2010 3:53 PM
To: 'scovington@formationenv.com'; Don Essig
Cc: Eddy, Tavis
Subject: Interpretive Findings Report Comments

Sean, per your request for comments on the Interpretive Findings report dated August 2010, I wanted to reiterate the points Tavis Eddy and I made at the last meeting on December 2nd, 2010 in Boise. As we indicated at the meeting, we have been sampling Crow Creek on the Wyoming side of the state line since 2008 and have noticed an increase of selenium concentrations. During our most recent sampling event in October of this year we had concentrations as high as 10 µg/L at our site near the state line. Other measurements at this and another monitoring station in June and October of 2010 exceeded our aquatic life chronic criteria of 5 µg/L.

Per your presentation at the December meeting and our limited review of the Interpretive Findings report we do not have any comments currently about the study design and implementation. The study design appears to be sound. It takes into consideration the chemical, physical and biological function of the drainage, and incorporates both the current literature and a comprehensive evaluation of the study area. We can appreciate the challenge of evaluating different methods for assessing the gathered data and understand the scrutiny you placed on this project. The limitations that I have observed with this study include using a dataset for calculating a site specific criteria that does not take into consideration the increasing fluctuations of selenium concentrations and the distance downstream from Sage Creek in Crow Creek where these increasing concentrations are currently being observed. We will continue to monitor our stations to see if these concentrations decrease as expected after the remedial efforts by Simplot take effect. We will also need to monitor the selenium concentrations in the Salt River, being the receiving stream of Crow Creek, to ensure our standards are being achieved.

I’m not prepared to give comments on the use of EC 10 or EC 20 in development of the criteria, but would only feel comfortable endorsing an EC which results in less stringent criteria if it’s fully understood that the low variability of the data indicates that a smaller margin of safety is justified. This goes without saying, and I believe your discussion on the topic was well presented; however, I would need to look at the data closer, and generally, we lean towards the more conservative approach unless there is high confidence that the associated protections of the new criteria are ensured.

We look forward to reviewing the implementation section of the report when it is completed. I will be interested in seeing how the selenium is being mitigated at the source area and the expected results and time frames for those efforts. At that point in time, Wyoming would like to sit down with Idaho DEQ, Simplot and Formation to discuss how to address the exceedances we are observing in Wyoming.

Response: We have added data to the report post-2008 to illustrate selenium concentrations at the Meade Peak Ranch in Idaho, as well as information on selenium concentrations measured by WDEQ at the State line from 2008 to 2010. In review of the data, it is clear that selenium concentrations measured at the state line are directly related to associated increases and decreases in concentrations in selenium at Hoopes Spring and South Fork Sage Creek Springs. This is similar to the response measured at the Meade Peak Ranch. Efforts to reduce selenium concentrations at Hoopes Spring and South Fork Sage Creek Springs are expected to have direct consequences on reducing selenium in Sage Creek and
Crow Creek. Simplot as conducted pilot-scale treatment options at Hoopes Spring and South Fork Sage Creek Springs as part of its ongoing efforts to reduce selenium concentrations from these source areas. The feasibility of operating the treatment options tested is being evaluated.

As part of the implementation process included in Section 7 of the Technical Support Document, three different approaches are proposed to document meeting a future criterion given current sources. These approaches may be used independently or in combination. For example, as suggested by WDEQ, Simplot may wish to explore the concept of extending the current proposed SSSC into Wyoming, following more detailed discussions with WDEQ on process and the timeframe for such an action. Simplot may also pursue a petition for Category 4b status of Crow Creek in Wyoming should WDEQ decide that Crow Creek downstream of the state line warrants listing as a 303(d) stream for TMDL development. Under such a scenario, a Category 4b petition would include documentation of the current and future efforts to reduce selenium concentrations in Hoopes Spring and SFSC springs. Simplot will be contacting WDEQ to discuss these options and potentially other options.
USFS Comment Responses
September 8, 2010 e-mail from Steve Bauer to Sean Covington

Hi Sean,

It looks a huge effort to put this report together - great job on the flow of document and appendices.

Question on Table 4 and 7 of Appendix A. These tables show the Z-value for the statistical test. To make these comparison’s meaningful it would be useful to know what the grouped Means are that the Z-values refer to. This would just be 6 values per table.

Protocol-wise – I just plan to send you questions directly. If that’s not appropriate let me know.

Thanks, Steve

Response: The requested adjustment to these tables has been made to further clarify what mean values are being compared.
Revised Forest Service Comments
Draft Interpretive Findings for Field and Laboratory Studies and Literature Review in Support of a Site-Specific Selenium Criterion, Smoky Canyon Mine (dated August 2010)

December 21, 2010

Mary E. Kauffman
U.S. Forest Service, Caribou-Targhee National Forest
Remedial Project Manager, Smoky Canyon Mine

Comments provided by Steve Bauer (Watershed Professionals Network, LLC) under contract to the USFS.

Interpretive Report (IR):

General Comments:

There appears to be some inconsistency within the report and Appendix A regarding significant differences in trout and sculpin selenium fish tissue concentrations from fish collected from the natural background and the reference background locations (see comments below). This inconsistency or interpretation could become important when evaluating whether or not sculpin could serve as an indicator or surrogate species for trout in monitoring efforts.

Formation concluded that macroinvertebrate and fish population studies did not show obvious effects from selenium. These conclusions regarding “obvious effects” are likely appropriate but are not currently supported by the presentation of the information in the appendices. It is important to fully disclose how accurate/precise these kinds of studies are, and their ability to detect differences between sites versus the naturally high variation in the system. Revising Appendix B, C, D, and E into a technical report would likely clarify these issues.

Response: Inconsistencies have been reconciled and Appendix A has been revised. Clarifying statements have been added to allow for a more clear understanding of the analyses conducted.

Specific Comments:

Page 2, Last Bullet (and bullet on following page): The Brown Trout Lab Studies are listed as Draft. It is recommended that these are finalized as supporting documents to the SSC final report along with a comment and response memo that would accompany finalization of this report.

Response: The Brown Trout Laboratory Study was finalized as part of revising supporting documentation and the final revised document is presented as Appendix D of the Technical Support Document (TSD, formerly the Interpretive Report).

Page 3, 1st paragraph: The top of the page references the sequence of reports. The Interpretative Report precedes completion of the YCT studies. It is recommended that these reports be completed as technical reports and then sections of the IR that summarize the YCT lab studies be revised accordingly. In addition to reporting test outcomes, the IR summary of the YCT studies should fully disclose the problems encountered in conducting the tests, and explain how these problems (e.g. poor egg to hatch
survival in the hatchery fish controls) do or do not influence the test outcomes. For example, there was a discussion at the December 2, 2010 meeting led by Charlie Delos about the ASTM standards and what is considered the acceptable range of mortality for these toxicity studies.

Response: Comment acknowledged. Both the Adult and Early Life Stage YCT Reports have been drafted as complete, stand-alone documents that cover all facets of each of the respective studies. These documents are included as Appendix E and F, respectively, of the TSD.

**Page 3, Section 1.2, 3rd sentence**: The sentence refers to “no explicit indication that the aquatic community is impaired”. This statement is out of sequence in this report. The project incorporates both benthic community and fish community metrics to determine if there are effects. The evaluation of effects should come out of the benthic and fisheries studies, not be stated in the introduction as an apriori assumption.

Response: This sentence does not represent an *a priori* assumption of no effects, rather it refers to the fact that exceedance of a standard does not necessarily mean that effects are occurring and/or that the community is impaired. To clarify this statement, the following language has been added in this section: “While concentrations of selenium exceed the surface water standard, there is no explicit indication that the aquatic community is impaired or that some exceedances of the standard represent toxic conditions. This is recognized in Idaho’s Water Quality Standards (IDAPA 58.01.02 - Section 275), where it states that the water quality criteria adopted in these standards may not always reflect the toxicity of a pollutant in a specific water body.”

**Page 4, 1st bullet on the page**: The bullet refers to trout species in Crow Creek as being less sensitive to selenium than species used to derive the current standard. Given the importance of this issue, recommend revising to clarify that this is referring to trout vs warm water species, and not that the trout in Crow Creek are particularly less sensitive than other trout. Also provide reference to a specific section so the reader can find the section.

Response: Comment acknowledged. The bullet has been revised.

**Page 6, 3rd paragraph**: Please clarify if EPA has explicitly recognized that the McIntyre et al. (2008) study corrects/updates the Lemly's 1993 criterion recommendation for bluegill – from 7.9 to a range of 9.5 to 14.02 mg/kg dw.

Response: A footnote has been added to this section for further clarification. It states, “Whether or not the USEPA is using this study as a replacement or augmentation to the bluegill response data will not be clear until the Revised Draft National Criterion is released. Presentation of these data here simply indicates that in revisiting Lemly's WSS studies, different results were found for bluegill sunfish responses.”
Page 8, 2nd paragraph, 1st sentence: As written, this sentence is convoluted and difficult to understand. Recommend revising for readability and clarity.

Response: Comment acknowledged. This section has been revised as follows:

Acceptable procedures for the modification or development of a site-specific criterion, as defined in IDAPA 58.01.02 - Section 275 of the Standards, include:

- Recalculation procedure;
- Indicator species approach;
- Resident species approach;
- Water effects ratio; and
- Other scientifically-defensible procedures, such as relevant aquatic field studies, laboratory tests, biological translators, fate and distribution models, risk analyses, or available scientific literature.

Of the five acceptable procedures noted above, Other scientifically-defensible procedures (such as relevant aquatic field studies, laboratory tests, biological translators, fate and distribution models, risk analyses or available scientific literature) are utilized as part of this study to develop a SSSC. Section 1.5 below identifies the components of the approach, or lines of evidence that comprise the scientifically-defensible procedures.

Page 9, 1st full paragraph following the bullets: The conceptual basis in McDonald and Chapman (2007) refers to the need for both lab toxicity studies and population studies. Meeting the requirements of this conceptual foundation focuses an emphasis on the robustness of the population data – both the benthic invertebrate and fish population studies. This is the primary reason for recommending that the current Appendices B, C, D, and E attached to the August 2010 IR be rewritten as standalone technically sound reports. The reports need to fully discuss sources of variability (within site variation, method variability, seasonal variability, etc.) and how this affects the interpretation of the results – that is, can the authors draw the conclusion of no obvious effects from selenium given the degree of accuracy/precision of this kind of data.

Response: Comment acknowledged. These appendices have been revised and combined. Appendix B is now a complete appendix that includes a Summary of the Biological Populations and Communities. It includes the old Appendix D (Ecoregional Trout Population Analysis) and more detail on data collection methods. The new Appendix C (Analysis and Interpretation of Trout Standing Crop and Habitat Relations) includes information from the old Appendix C, as well as information from the old Appendix E, which included the PHABSIM assessment data. Methods and interpretations for these data have been added to provide a more complete appendix.

Page 16, Section 2.5.2: It appears that the reference to Figure 2-5 should be to Figure 2-4. Please revise accordingly.

Response: The reference has been updated to cite the correct figure.
Page 21, Section 3.0: The literature summary is well done and helpful. However, it is recommended that EPA and DEQ provide some structure as to the appropriate quality of reference material for this type of project. For example, the Golder Associates 2009 study (Development of a Site-Specific Selenium Toxicity Threshold for Dolly Varden Char) is a report from a consulting firm to the mining company. It is not currently available on the project website for review. There is no information on how or if this study was independently reviewed and evaluated. Pending review by DEQ and EPA, deletion of this discussion and reference may be warranted. Another example is the GEI Consultants Report (2007), another grey literature consultant report.

Response: The Golder Study has since been published in a peer-reviewed journal, and the citation (McDonald et al. 2010) is listed in this section. The GEI (2007) report, while not published in a peer-reviewed journal, was presented to the State of Colorado in support of ambient based standards. As such, the report was critically reviewed by the Department of Public Health and Environment as they weighed its merit as the basis for adoption of ambient standards.

Page 29, Section 3.4: May et al. (2001). This study collected samples across the exposure media of water, sediment, and fish over a 2 year period. The primary fish species collected were sunfish, redhorse, gizzard shad, and carp. The range of selenium in tissues was lower than the range of selenium in fish tissues in the Crow Creek drainage. In general, they were using a screening concentration of 4 ug/L in fish tissue as the indicator of expected reproductive effects. The referenced study does not appear to be relevant to the current work in the Crow Creek drainage due to the following reasons: 1) This is an entirely different non-salmonid fish community, 2) The study’s indicator of no impact was that they observed young of the year fish when tissue concentrations exceeded 4 ug/L, 3) Based on Lemly’s (1993) proposed criteria of 7 ug/L and McIntyre et al. (2008) of 9.5 to 14.02 mg/kg dw, one would not expect an effect on reproduction at the tissue levels reported in this study. The values in the fish were lower than the now generally accepted range of effect, which is higher than the 4 ug/L tissue threshold used in the referenced study.

Response: Please note that we caveat the presentation of this and other population studies presented in this section in the first paragraph of Section 3.4, where we state, “Review of the studies listed below does not imply that these environments are similar to the cold water environment of this Site, but rather suggests that few large-scale population studies have been undertaken to evaluate selenium effects. These studies do provide evidence that site-specific conditions play a role in the level of effects observed using the metrics investigated by the individual authors.” Furthermore, the study investigated both lentic and lotic environments from 1997 to 1999, with lentic work being done in 1999, while the lotic work was conducted between 1997 and 1998. Prior to this work, the authors also did some preliminary investigation work from 1994 to 1996. This is a long-term study and at some locations, selenium concentrations in surface water exceeded the hazard thresholds of Lemly, as well as the current State of Idaho and National Criterion value. Fish tissue concentrations from several species exceeded the current Draft National Criterion value as well as the thresholds established for bluegills from the McIntyre study. Several species were shown to have elevated selenium in their tissues, and yet the expected result of reproductive failure was not found based on the presence of young of the year, despite the previous selenium exposure. We agree that the thresholds used as screening values
are not supported by the current state of the science, but the data presented in the May et al. (2001) study provides unique insights for a large river and reservoir system with a history of elevated selenium exposure and fish population and community characteristics.

**Page 32, 2nd paragraph 2, 4th sentence:** This sentence describes the basic premise that population and community data is being collected to “... generally evaluate whether there are obvious impacts to the aquatic biological system due to selenium (emphasis added)”. The question that needs to be addressed is if the methods are robust enough to detect differences if they occurred. The Appendices (B, C, D, E) were written as data transmittal memos, and not as scientifically defensible technical reports. The presentation of the data provides little confidence that differences in macroinvertebrate or fish populations could be detected if there were differences.

Response: These appendices have been revised to include more complete documentation of methods and conclusions.

**Page 33, Section 4.1.1, last bullet:** Please provide citations for the effect of sulfate on reducing selenium bioaccumulation.

Response: Discussion of the role of sulfate on selenium bioaccumulation is presented in Appendix A, and the reader is directed there for more information. In addition, we are aware of additional studies in progress for the Elk Valley Selenium Task Force, focused on evaluating selenium bioaccumulation relative to sulfate concentrations in diet and water. Preliminary information indicates that with increasing sulfate concentrations, bioaccumulation in Daphnia is consistently reduced relative to diet and water combinations with lower sulfate concentrations. Because these studies are in their infancy and not yet published, they are not included in the TSD.

**Page 34, Section 4.1.3, 1st bullet:** The text states that “With few exceptions, concentrations of selenium in both trout and sculpins tissue from upstream Crow Creek and Deer Creek locations (background) are not significantly different from the reference location tissue concentrations.” Yet Table 4, Appendix A indicates a statistically significant difference in selenium concentrations in trout fish tissue samples between samples collected from natural background vs. the reference location. Additionally, text on page 6, Appendix A, states “The reference location has significantly lower fish tissue selenium than trout tissue from other grouped locations.” Recommend revising for consistency among the report, appendix text and appendix tables.

Response: Text has been revised for consistency among the report, appendix text, and appendix tables.

**Page 35, Section 4.2:** This section relies on data and interpretation extracted from Appendices B,C,D,E. As previously noted, it is recommended that these appendices are revised into technical reports. Additionally, fish population data from 2009 and 2010 were presented by Simplot in their presentation on Dec. 2nd. Please clarify if these data sets be incorporated into the report.

Response: Refer to the previous comment response related to revisions of the appendices. Results from the fish population data from 2009 and 2010 are included in additional analyses conducted as part of revising the Interpretive Report, now called the TSD.
Page 36, last bullet, second sentence: Recommend deleting. This statement oversimplifies a positive relationship between sculpin density and selenium, when the most plausible relationship is density and better habitat. It’s doubtful that the effect of selenium (either positive or negative) could be detected through simple population metrics.

Response: The second sentence has been deleted.

Page 51, last paragraph: Please change the reference to Table 1 to Table 5.1.

Response: The reference to this table has been deleted.

Page 54 – Page 62, YCT Studies: According to information presented at the Dec 2, 2010 meeting, Appendix G and H will be rewritten as stand-alone technical documents and that this section will be revised accordingly.

Response: Appendices G and H of the August 2010 Draft have been expanded into stand-alone documents and are provided as new appendices to the TSD: Appendix E (Yellowstone Cutthroat Trout Adult Laboratory Reproduction Studies for Developing a Site-Specific Selenium Criterion) and Appendix F (Yellowstone Cutthroat Trout Laboratory Early Life Stage Studies Conducted in Support of Development of a Site-Specific Selenium Criterion).

Appendix A, Specific Comments:

Page 4, last paragraph, last sentence: The text states “A significant relationship was shown to exist between acute selenate toxicity to aquatic organisms and ambient sulfate concentrations (Brix et al. 2001a).” However, from page 1043, Brix et al 2001, the text states “Although a sulfate-dependent acute criterion for selenate seems appropriate, extending this relationship to a chronic selenate criterion does not seem appropriate for several reasons. The chronic water quality criterion is based on observed reproductive effects to centrarchids in Belews Lake (NC, USA) [3,31]. These effects seem largely due to dietary exposure, rather than aqueous exposure as for acute toxicity, in which inorganic selenium (predominantly selenite) was biotransformed to organo-selenium compounds and moved up the food chain [32].” This reviewer’s interpretation of the Brix et al. statement is that since diet is the primary pathway for selenium accumulation in maternal tissues, the importance of sulfate in ameliorating selenium for chronic toxic effects may be a moot point since the pathway for acute exposure is uptake from the water column vs the diet pathway for chronic effects. Given the differences in interpretation of Brix et al, 2001, it is recommended to delete the sentence identified in the comment.

Response:

This sentence from the above mentioned published resource was included as part of the weight of evidence that sulfate may play a role in reducing selenium bioaccumulation and toxicity. In this study sulfate was shown to affect selenite toxicity, albeit in an acute exposure. Additional text has been added to augment the assertion that it may also play a role in chronic dietary exposures as well.
Page 8, 1st full paragraph, last sentence: The text states “Observations for sculpin confirm the observations made about trout tissues (i.e., that reference and background tissue concentrations are not substantially different) and therefore migration between downstream locations and upstream background locations does not affect these results.” This statement appears to conflict with the trout tissue interpretations made earlier on page 7, “Given that background and reference trout tissue concentrations are different, one might conclude that natural background conditions in the Crow Creek drainage within the phosphate patch are higher than locations outside the phosphate patch and influenced by trout movement.” Also, Table 4 is a statistical table that shows a significant difference between reference and background values for trout tissues. Recommend revising for clarity and consistency.

Response: Text and tables have been revised for clarity and consistency. Tables 4 and 7 of Appendix A have been revised to include the grouped means referred to by their z-values.

Appendix B General Comments

Results for a number of Trout Population metrics are presented without a description of methods or adequate presentation of data - standing crop, Habitat Suitability Index, condition factor, growth rates, age class structure. This data is in Appendix C, but the methods and their ability to detect differences between sites are also not discussed in Appendix C. As noted previously, it is recommended to present the information contained in the appendices as stand-alone technical reports.

Response: Information presented in the revised appendices includes methods for data collection and a more thorough description of how metrics were examined.

Appendix B Specific Comments:

Page 4, Section 1.2, 2nd paragraph, last sentence: To state that sculpin are “thriving at locations where selenium exposure is highest” seems to be overstating the interpretation and implies a bias not supported by the data. The data indicate that there is no difference in sculpin populations between selenium influenced and non-influenced sites. Habitat is most likely the primary factor affecting differences in density. Recommend revising to reflect the technical neutrality of the data.

Response: This text has been revised and is presented in Section 3.7 of Appendix B.

Figure 7: The figure would be much improved by including confidence limits, the number of data points and the within-site variability.

Response: This figure has been revised to include standard deviation of the population estimate and the n value for the number of seasonal population estimates conducted. In the revised version of Appendix B, this figure is now Figure 18. Note that units for the revised figure had also been changed from #/Km to #/m², which we believe provides for a more representative metric for sculpin due to their small home range.
Page 7, top of the page: The text states “The numbers of tricoptera and EPT taxa were both significantly related to aqueous selenium concentrations, with decreasing taxa numbers found at increasing selenium concentrations.” Please include the figure number that corresponds to the data discussed here.

Response: These data are now presented in Section 4.1.1 and the correct figure citations (Figures 36 and 38) are provided.

Page 7, Section 1.3.3, 2nd paragraph, 5th sentence: The text states that “Only one metric out of the 11 evaluated yielded a significant linear relationship to selenium concentrations in surface water. The number of predator taxa was negatively related to selenium concentrations in surface water (R2 = 0.318, p = 0.0022). It is important to recognize that the lack of significant relationships (10 of 11) is potentially as important as finding one relationship.” The R^2 value in the text does not match the R^2 value of .01255 in the predator species figure, Attachment 4, Page 1. Recommend reconciling for consistency.

Response: The R^2 values have been reconciled for consistency. We agree that the lack of a significant relationship is as important as the presence of a relationship, particularly when multiple community metrics were evaluated to assess the potential for relationships.

Page 10, top of the page: The text states “SMI scores for each location and community evaluated during the three fall periods were evaluated against total aqueous selenium concentrations. Log-transformed data were utilized. SMI scores were significantly related to selenium in surface water with deceasing SMI scores (R2 = 0.324, p = 0.002) present at higher aqueous selenium concentrations. One-way ANOVA indicates that the mean SMI scores are significantly different between upstream and downstream locations (p=0.0068).” There was no figure for these relationships. Please provide a figure to depict the relationships described.

Response: Figure 45 has been added to illustrate this relationship.

Appendix C General Comments:

This analysis is relatively critical to the overall report since it is either stated or implied that habitat is a more critical predictor of fish populations (standing crop as one measure) than selenium concentration. If the statement regarding effect/lack of observed effect is going to be accepted, documentation of the methods and/or approach needs to be included in this appendix. References are made to HQI, SRI/CSE, and HIS models with no literature citations or minimal explanation of these methods. For the Habitat Suitability Index, data is found in an Attachment without explanation or reference in the results section. The document jumps into a discussion of model results. The Summary of Key Findings on page 7 cannot be readily tracked to results and discussion. Recommend revising to include an explanation of methods and approach.

Response: The appendix has been revised to be a stand-alone document that includes an explanation of methods and approach. The new Appendix C consolidates the above-mentioned analyses as well as the PHABSIM analyses.
Appendix C Specific Comments:

Page 7, Key Findings #2: Given the statement that the four habitat models varied widely in estimating standing crop, it is not clear to the reader which standing crop measure was eventually used to discuss results (back to Appendix B and the Interpretative Report) and why that method should be relied on as having provided an estimate with some level of confidence. Please clarify.

Response: Appendix C has been expanded to include methods and the data used for the analysis for a more complete assessment document.

Page 7, Summary of Key Findings, #5 & #6: These summary statements regarding potentially limiting factors were not discussed in the results. Recommend including brief supporting interpretations of the information in the results section.

Response: The text has been revised to include brief supporting interpretations of the information in the results section.

Appendix D, General Comments:

As with Appendix C, if this appendix is to be used as more than miscellaneous information, it is recommended that the document be formatted as a report with sufficient presentation and discussion of results.

Response: The ecoregional trout population assessment previously presented as Appendix D has been included with Appendix B (Summary of Biological Populations and Communities) to provide greater continuity with the trout population data collected and the analyses conducted.
EPA Comment Responses
EPA’s Draft Comments on Formation’s August 2010 Draft Interpretive Findings for Field and Laboratory Studies and Literature Review in Support of a Site-Specific Selenium Criterion, Smoky Canyon Mine

December 21, 2010

The overall study is comprehensive and provides information needed to assess the nature of the selenium toxicity problem and determine the selenium effects concentration threshold in eggs, with potential to translate that to water concentrations, when the project reaches that stage.

Toxicity Study Conduct

Maternal Transfer Reproductive Studies (with offspring of wild-caught brown trout and Yellowstone cutthroat trout) – We have not identified any issues with the conduct of these studies.

We have incorporated the brown trout data in our internal draft national criterion document. This study is of outstanding quality in terms numbers of individual fish, comprehensiveness of endpoints evaluated, and chemical measurements taken. Although the more recent cutthroat trout study appears to be of comparable quality to the brown trout study, we have not yet had time to consider it for the national document, and as a result, our review of that data has not been as thorough as for the brown trout study.

Non-Reproductive (Non Maternal Transfer) Early Life Stage Survival – Yellowstone cutthroat trout only. Control survival, measured from start to finish, was low. If we were to assume that dissolved selenium has little propensity to enter eggs, such that hatchability is not an issue, survival is still somewhat low, around 70% measured from Day 6 (hatch) to the end of the test.

We have evaluated the results as Day 71 (end) survival divided by Day 6 (hatch) survival, as well as Day 71 divided by Day 38 (Se diet start) survival. Although survival at all Se-spiked exposures were lower than for control, there was no recognizable response to incrementally increased selenium concentrations over a 16 fold range, and no ECs can be calculated. It appears that the threshold for Se effects to this life stage, sans maternal transfer of Se, is higher than the highest tested concentration.

Our hypothesis prior to this test was that it would not involve a sensitive endpoint, and the results do not counter the hypothesis. This test, in spite of its difficulties with the health of the controls, probably should not be considered an issue.
Calculation of Brown Trout Effect Concentrations

Formation examined a number of different effects and chose survival from hatch to test end (Formation's Figure 5-5) as the best endpoint for deriving a criterion. Examining the graphed data independent of the fitted line, we agree with this choice. This is the endpoint we selected in the internal draft national criterion document. In contrast, the high background response variability at low selenium exposures makes total survival including hatch (Formation's Figure 5-4), facial-cranial deformities, and skeletal deformities (Figures 5-7 and 5-8) less desirable. Fraction normal (Figures 5-11 and 5-12), finfold deformities (Figure 5-9), and survival 15-days post feeding (Figure 5-6) show less effects at around 20 mg/kg, suggesting that they are slightly less sensitive measures. Edema (Figure 5-10) shows a pattern similar to survival from hatch to test end, but its measurement is more subjective. Because the test was so long, the concern about irreversible edema is already accounted for in the measurement of survival at test end. Consequently, independent of particular estimates of EC10s for all these endpoints, the data themselves favor survival to test end (Figure 5-5) as the endpoint of concern.

Formation used EPA's TRAP program to calculate the ECs. TRAP's help screens provide the following guidance for its application:

In the end, to effectively use this (or any similar) program, the user should examine the fitted curve relative to the data and decide if the various parameter estimates and confidence limits appear reasonable. The value of this type of toxicity relationship analysis is to provide some quantitative objectivity and assessment of uncertainty to the estimation of parameters of interest that the user already can approximate by inspection of the data. The computed toxicity relationship should be close to what someone could get by just "eyeballing" the data; otherwise, some aspect of the data, model, or analysis might be causing problems. This kind of analysis demands some judgment from the user - if the results don't look good, they probably aren't and more evaluation is needed.

TRAP has many options for calculating the EC, and Formation presented the one option that is the same as what EPA used in the internal draft national criterion document: nonlinear regression comparing the untransformed effect with the log of the exposure concentration, and fitting to a logistic S-curve. For this application there are nine options that could be considered: three options for transforming the effect scale, times three options for the generic shape of the fitted S-curve. The logistic S-curve that EPA commonly uses for calculating the ECs of various pollutants is ordinarily the most environmentally conservative approach because it has a long and relatively thick tail that never reaches zero effect – there is always some effect at any nonzero concentration. The other two shapes available are "threshold sigmoid" a curving S-shape with a nonzero threshold, and "piecewise linear", more commonly called hockey stick. The non-zero threshold of these latter two shapes might be more consistent with idea that selenium is a necessary nutrient.

The EC50s, EC20s, and EC10s for these nine reasonable options are shown in Table 1. The values for $R^2$ should only be compared for the three Curve Shapes within Effect Transform groups, not between groups.
Table 1. Summary of alternative TRAP analyses for fitting the all brown trout data for Crow Creek and Lower Sage Creek (and excluding hatchery fish per both the Formation report and the EPA internal draft national criteria document).

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<th>EC50</th>
<th>EC20</th>
<th>EC10</th>
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<td>1.063</td>
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</tbody>
</table>

All nine models fit the complete dataset reasonably well. The EC50s vary negligibly. The EC20s vary slightly, with Max 6% greater than Min, and the EC10s vary slightly more with Max=20.31 mg/kg being 15% greater than Min=17.67 mg/kg. The EC10 presented in the Formation document is the most environmentally conservative choice. Its graph is presented in Figure 1.
Figure 1. Brown trout nonlinear regression, logistic curve, effect not transformed, EC10=17.67 mg/kg.

The Figure 1 curve can be seen to slightly overstate the observed effects at y-values near 90% (10% effect). In contrast to the line there is a point showing 8% (Abbott adjusted) reduction from background survival at a concentration of 20.5 mg/kg (log=1.3), whereas the curve yields 10% reduction in survival at 17.67 mg/kg.
Figure 2 shows the curve yielding the highest EC10 in Table 1. Examining the data points nearest the beginning of the downward effect on survival, its fit to the observed data points is better than that shown in Figure 1, and likewise better than any of the other Table 1 models.

Figure 2. Brown trout nonlinear regression, piecewise linear (hockey stick) curve, square root effect transformation, EC10=20.3 mg/kg.

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<td>25.1</td>
<td>31.6</td>
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</table>
It should be noted that the TRAP program does not know what percent effect the user is interested in: e.g., EC10, EC50, or EC90. In attempting to fit all the points as well as possible, it compromises the fit in the region we are most interested in, 15-30 mg/kg (log=1.2-1.5). Consequently, one additional approach for estimating the EC10 is worth noting. Eliminating the three points above 30 mg/kg (log>1.5) allows TRAP to focus on the threshold region we are interested in, as shown in Figure 3. This yields an EC10 of 20.7 mg/kg, thus indicating that the Formation’s EC10 of 17.7 mg/kg is environmentally conservative.

Figure 3. Brown trout nonlinear regression, sigmoid threshold, effect not transformed, observations above 30 mg/kg (log=1.5) ignored. EC10=20.7 mg/kg. Replacing the sigmoid threshold shape with the logistic shape yields an essentially identical curve, with EC10=20.8 mg/kg.

X-Axis Log Scale Translator:

<table>
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<th>Value</th>
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<tr>
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<tr>
<td>1.2</td>
<td>15.8</td>
</tr>
<tr>
<td>1.3</td>
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</tr>
<tr>
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<td>1.6</td>
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</table>
Translation to Whole Body Concentration

For translation from egg to whole body, Formation used log-log regression: log(Egg Se) vs. log(Whole Body Se), for combined brown and cutthroat trout, excluding hatchery fish. Because the log-log slope is slightly different from 1.0, the relationship is not quite a direct proportion, and the Egg/WB ratio varies slightly, from 1.53 to 1.54 in the range of the brown trout calculated EC10 and EC20.

For brown trout in the current internal draft national criteria document, we used the Smoky Canyon brown trout data, including hatchery fish, plus a few other measurements from elsewhere. We used arithmetic scale (not log scale) single-parameter regression (where the regression slope is estimated after forcing the line through the origin). We thereby obtained an Egg/WB ratio of 1.74, which yields a slightly more conservative WB tissue criterion translation. For application to Smoky Canyon, Formation’s log-log approach might well be judged as good or better than the linear approach we used. However, the combining of brown and cutthroat data might or might not be viewed as appropriate, since the WB translation yields a slightly lower value using brown trout alone than using the combined data, although there are advantages to increasing the number of data points in the analysis. Considering other strains of cutthroat trout, external to the Smoky Canyon dataset, there is no evidence that mixing in cutthroat trout data would inherently bias the translated WB benchmark upward, since egg/WB ratios implied by the Hardy, Kennedy, and Rudolph data would tend to lower the WB translated benchmark.

Translation to Water

EPA is unable to comment on the water translation until the work progresses to that stage.
USEPA Draft Written Comments on the Interpretive Report

On December 22, 2010, written comments from USEPA were sent in a letter addressed to Don Essig (IDEQ) from Lisa Macchio (EPA Region 10). The entire letter is provided for the reader to review the content of EPA’s comments. The responses herein are directed at the major sections of EPA’s letter and the intent of the comment provided.

Comment: In the 4th paragraph of the cover letter, EPA recommends consideration be given to use of an EC10 vs and EC20 and provides rationale for their recommendation.

Response: In the Draft report, a number of strong arguments were presented as to why an EC20 was appropriate for this Site. However, to accommodate USEPA policy and to provide an additional margin of safety, the proposed criterion for this site is based on the EC10. Simplot revised its threshold value based on some of the comments provided later in USEPA’s letter.

Toxicity Study Conduct

Comment: Maternal Transfer Studies - No issues were identified with these studies.

Response: Comment acknowledged.

Comment: Non Reproductive Early Life Stage Studies – EPA noted the low survival for the ELS studies, but also noted that there was no dose response for the range of exposure treatments evaluated. They suggested that it appears for ELS YCT, the threshold for effects is higher than the highest treatment evaluated. EPA goes on to note that the initial hypothesis for the ELS studies was that this life stage was not a sensitive endpoint and suggest that the results of the study to not counter this.

Response: We agree that this life stage does not appear, based on these site-specific studies, to be a sensitive life stage in the absence of maternal transfer.

Calculation of Brown Trout Effects Concentration

Comment: EPA offered a lengthy assessment of the threshold originally developed as part of the Draft Report. Please see the original letter and comment.

Response: The following text was added to Section 5.1.4 of the TSD:

The brown trout data presented in the Draft Final Brown Trout Laboratory Reproduction Studies Conducted in Support of Development of a Site-Specific Selenium Criterion (NewFields 2009) were submitted to USEPA for use in their derivation of the National Criterion. Their subsequent review of these data submitted as part of formal comments (December 21, 2010) on this Interpretive Report
suggested some alternative evaluations may be practical. USEPA’s review of these data indicates agreement with the selection of the endpoint for survival (hatch to test end). As noted earlier in this section, the TRAP software includes two additional non-linear models, threshold sigmoidal and piecewise linear models. USEPA’s comment letter illustrated an investigation of each of these models relative to the logistic model used as part of the brown trout studies presented above, and found that the projected ECx values are likely conservative. As part of the USEPA’s evaluation, another alternative examined exclusion of data points that exceeded 30 mg/kg dw in eggs, due to the fact that effects were already occurring between 15 and 30 mg/kg dw. This approach was investigated as a means of optimizing the model output. By eliminating the three highest data points, the logistic model is able to focus on the region of interest (i.e., between 15 and 30 mg/kg dw egg selenium). Using this approach, the logistic model run using log-transformed exposure data (egg selenium concentrations) versus survival (hatch to test end) results in a model with a $R^2 = 0.99$ (Figure 5-13). Confidence intervals derived for the estimated ECx values are also tight about the estimates and the standard error of the model is low. This improved model results in an EC20 equal to 23.1 mg/kg dw egg selenium and an EC10 equal to 20.8 mg/kg dw.

**Translation to Whole Body**

Comment: EPA commented on the Draft Report derivation of an egg to whole body translation that included using both brown trout and Yellowstone cutthroat trout data as part of the egg to whole body relationship. Please see the letter for the entire context of the comment:

Response: In considering EPA’s comment, as well as the fact that species differences do occur with regard to habitat, diet, and location, Simplot opted to evaluate brown trout and YCT separately to develop the egg to whole body translator.

From a location perspective, YCT are mixed in presence in Sage and Crow Creek, but are the only trout species found in Deer Creek. Based on diet, which certainly does affect uptake and accumulation of selenium, both have different feeding mechanisms, although as adults, both species are likely opportunistic feeders, with brown trout being more opportunistic than YCT. These differences and consideration of EPA’s comment led us to derive egg to whole body translators for each species independent of one another. As more data are gathered on the egg to whole body relationship for each species, we may very well find that combining these data is practical.

**Translation to Water**

Comment: EPA was not able to comment on this phase of the project as work was still in progress on the approach for translating the effects criterion into an aqueous monitoring value.
Response: The TSD includes a complete approach and assessment for translating the effects threshold to an aqueous trigger value. As noted in the TSD, the aqueous trigger value is not developed to replace the tissue criterion value, but is proposed as a practical means for monitoring and decision making.
Conference call: March 30, 2011

Meeting attendees: Don Essig (IDEQ), Sean Covington (Formation), Steve Bauer (WPN/USFS), Mary Kauffman (USFS), Kim Raby (Formation), David Waterstreet (WDEQ), Charlie Delos (EPA), Lisa Macchio (EPA), Mike Rowe (IDEQ), Lynn Van Every (IDEQ), Jim Lazorchak (EPA), Tavis Eddy (WDEQ), Burt Shephard (EPA).

EPA provided additional comments on the Interpretive Report verbally during a March 30, 2011 conference call. Some of the verbal comments repeated those comments provided via the December 22, 2010 letter. Burt Shepard and Charlie Delos of EPA provided the majority of these verbal comments.

General Comments

Burt began by explaining that EPA’s comment letter has multiple authors, and that the primary author of each comment will explain the comment and address questions regarding that comment. He also stated that unfortunately, Gretchen Hayslip, a bioassessor and aquatic ecologist from his office (Office of Environmental Assessment in Seattle) is not on the phone to provide more detail on her comments. Burt then divided EPA comments into three sections: (1) site data collection and interpretation; (2) conducting and interpreting toxicity testing; (3) derivation of a site-specific selenium criterion. The key issues/general comments identified and provided by EPA are:

(1) EPA did not interpret field data to support all conclusions in the report, and suggest that habitat differences alone do not appear to explain species richness differences; some of these differences may result from mining activities and are confounded by grazing.

Response: Additional assessments of the biological community data, and a more thorough discussion of species richness differences, factors thought to affect those differences, and more thorough reference to sections in Appendix B are provided in the TSD which we expect will further support the conclusions drawn.

(2) The current proposal targets protection of brown trout as the most sensitive fish species, leaving questions about protection of non-fish members of the aquatic community. Although brown trout are probably one of the more sensitive species in the system, the criterion must demonstrate its protectiveness of an assemblage of aquatic species.

Response: An additional species sensitivity analysis was conducted that included benthic organism responses to selenium body burden. This assessment required comparisons be made in the context of whole body concentrations and included two trout species, and a number of benthic invertebrates that had been exposed to selenium for extended periods (life cycle). The results indicated that using this approach, the majority of benthic invertebrates were still not as sensitive as the fish species utilized. Only one species had a population-level effect (as reported by the study author) that resulted in a concentration close to that of the response concentrations in fish.

(3) Use of an EC_{10} in derivation of a proposed site-specific criterion is more appropriate than an EC_{20}. EPA believes that an EC_{10} is more protective and defensible for derivation of a tissue criterion. While recognizing that there is no precedent set for using an EC_{10} instead of an EC_{20}, this change would not overly modify the final criterion value.

Response: See response to similar comment in EPA’s written comments.
**Detailed Comments**

**Burt** proceeded to list the more detailed comments on site data and collection and interpretation:

(1) Background and reference locations (p. 13-14): the upstream locations CC-75, CC-150, CC-350, and DC-600 were selected to represent non-mining conditions, but still are not pristine due to impacts from grazing. This makes comparisons to downstream locations more difficult. South Fork Tincup Creek location SFTC-1 does not represent minimal human disturbance and therefore is not really a reference location but rather simply an impacted non-mining location.

Response: We agree that the background locations and the reference location are not representative of pristine conditions. The intent for location selection, as agreed to during discussion with the SSSC Workgroup, was to discern impacts due to mining and specifically, selenium. Background locations selected are not impacted by mining, may have some naturally elevated selenium concentration but are impacted by other non-mining factors. The reference location selected is not impacted by mining or selenium. We believe this makes the comparisons all the more valid, as all the locations suffer some level of grazing impacts, as well as other physical habitat limitations. The primary difference between the locations is the concentration of selenium in the environmental media of each location. If significant negative differences are found at locations where selenium concentrations are highest, and habitat factors play no role in the observed difference, then one might conclude selenium could be a factor in the observed difference.

(2) Biological and physical characteristics (p. 19-20): EPA has no issues with using non-native brown trout, but would like the report to include a mention of whether there exists a history of stocking brown trout in creeks within the watershed. Also, Paiute sculpin were identified with more accuracy over the course of sampling events, but other sculpin captured were identified by genus only (i.e., just “sculpin”). Different species of sculpin are known to have different tolerances to some metals and thus may for selenium as well, although this is not known for selenium.

Response: The data show that during the first monitoring event in fall 2006, sculpin were identified by genus only, but the rest of the time (i.e., during the other four sampling events) sculpin were identified to species. The sampling crew began to look much closer and even collected voucher specimens for identification confirmation in 2007. Efforts were made to examine differences between sculpin species; occasionally a mottled sculpin would be identified but the majority of the sculpin captured were Paiute. Text has been added to the TSD to clarify.

(3) Fish population and biological communities (p. 35-40): (a) EPA would like more discussion of mountain whitefish; (b) EPA reiterates the need for further examination of the different sculpin species and their respective tolerances to selenium; (c) EPA does not find it surprising that cyprinids and catostomids are found at certain locations due to differences in habitat, but there appear to be more of these species at upstream locations, and insufficient evidence exists to conclude that selenium concentrations are not influencing this distinction; and (d) Regarding benthic macroinvertebrates, population density is a notoriously variable measurement, and percent metrics (such as ephemeroptera percentage, plecoptera percentage, etc.) were not adequately evaluated.

Response: Jim responded that this information is in an appendix, and Burt suggested to add some short upfront discussion to the text and to refer to the appendix. Burt then stated that there is general consensus that as a group, invertebrates and aquatic plants are more tolerant to selenium than fish, and chose to move past the functional feeding group comments to the next set of comments. Additional language has
been added to the TSD to direct the reader to Appendix B, as well as to provide more information up front related to these species.

(4) Summary of field findings (p.46): (a) EPA questions whether enough data exist to say with certainty what is accounting for changes in fish populations (could be habitat); and (b) The State of Idaho needs to consider exactly where to apply the site-specific criterion. EPA suggests the criterion should be applied to the stretch from Hoopes Spring to the confluence with Sage Creek, and from the confluence of Hoopes and Sage to the confluence of Sage Creek and Crow Creek. Jim explained that these boundaries are based on selenium concentrations in compliance with existing criteria elsewhere, and that biological data justify limiting application of the criterion to this area.

Response: This comment generated much discussion, the summary of which is provided herein. Jim and Don agreed that the transition to downstream ramifications in Wyoming also needs to be taken into account. Don commented that a SSC is likely applicable to the entire study area (which would include Crow Creek). Dave commented that if the criterion was applied to Crow Creek downstream of Sage Creek, it would make things easier for WDEQ, but they would still have to address concentrations across the State Line. Mary mentioned that Simplot was going to contact WDEQ regarding monitoring the Crow Creek locations in Wyoming currently sampled by WDEQ, and that these data will be incorporated into the RI/FS. Tavis added that WDEQ is planning to collect high flow samples in June. One participant mentioned that more recent data (Fall 2010) collected by both WDEQ and IDEQ show exceedances of the current water column criterion in Crow Creek below Sage Creek, and those preliminary data were shared with the workgroup during the meeting in Boise in December. Mary said that Simplot’s mine manager knows the Wyoming landowners at the sample collection locations and that Simplot would be collecting samples in June as well. Don then asked Lynn and Mike whether IDEQ has found similar results on Crow Creek in Idaho just upstream of the State Line, and they replied that they have and that Simplot has asked to accompany them during future monitoring. Burt reiterated that the goal of the overall process is to derive a site-specific criterion but that it needs to be bounded, and that the purpose of this comment is to spur discussion of the exact boundaries of where the SSC will apply, and that appears to have been successful. Sean thanked Burt for the comment and reminded the group that Simplot/Formation produced a technical memorandum about three years ago that delineated the boundaries of the criterion in great detail, and that part of the technical memorandum resurfaces in the Draft Interpretive Report. Burt recommended that any boundaries be data-driven. In the TSD, Simplot proposes a geographic range of applicability for the criterion to the State.

Burt proceeded to the next set of EPA comments involving toxicity testing:

(1) EPA did not identify any issues with how the maternal transfer tests were conducted. In fact, the brown trout tests have been incorporated into the EPA’s draft criterion. The YCT tests were done using similar methods, but EPA has not reviewed these as thoroughly at this time.

Response: Please see EPA’s written comments.
(2) EPA commented on the control fish survival in the early life stage YCT study, concerned that the 72% hatch reported is less than the 80% survival recommended in ASTM standards. EPA suggests that the report provides additional information about what may account for the lower than 80% hatch.

Response: **Sean** replied that the ASTM standards he reviewed recommended 70% hatch survival. **Burt** said that depends on which standards you consult, and that the ASTM 2005 standards (E1241-05) are the most recent and they recommend 80%. **Sean** indicated that the standard would be re-checked. Follow-up note: The ASTM E1241-05 standard was checked again after the call; it states the following:

X1.2.4 In actual practice, >80 % survival of control embryos from fertilization to hatching is frequently achieved when gametes are obtained by experienced personnel, embryos are maintained under controlled conditions, and tests are initiated within a few h after the fish are stripped. However, a number of factors such as age and condition of brood stock, methods used, time elapsed in transporting gametes prior to fertilization, and handling and transport of embryos can cause considerably lower survival of embryos, particularly during the pre-eyed stage. Therefore, when the eyed stage is first discernible, all dead embryos should be counted and discarded. At this time, surviving embryos should be randomly thinned to the desired number per treatment (see 11.5).

X1.2.8 An early life-stage test with a salmon, trout, or char is unacceptable if survival of the controls is less than 70 % from thinning of the embryos (see 11.5) to test termination.

(3) EPA had a comment regarding the calculation of a brown trout effects concentration, but this was part of the earlier set of comments that everyone has seen (EPA comments dated December 22, 2010), so there is no need to reiterate it here unless anyone has questions. **Sean** agreed that everyone has been privy to the comment, and **Burt** made sure the workgroup knows that EPA is in agreement with how the effects concentration was calculated.

**Burt** moved on to the last set of EPA comments regarding the proposed derivation of a site-specific criterion:

(1) Species sensitivity distribution (p.69): The text states that the EC₂₀ for brown trout falls between the 10⁻¹ and 20⁻¹ proportion of species affected. EPA asserts that using an EC₁₀ would substantially increase the defensibility of the site-specific criterion.

Response: Please see the response to EPA’s written comments. Simplot has subsequently adopted the use of an EC₁₀ as the criterion value.

(2) General approach for calculating the site-specific criterion (Figure 6-1): EPA requests that the title of this species sensitivity distribution figure be changed from “cold water” to “cold and cool water” species because the White Sucker and Northern Pike are cool water species.

Response: Comment acknowledged, the requested changes will be made.
(3) EPA does not want to derive a criterion to protect only fish; rather, the criterion should be protective of an aquatic community. In this study, the most sensitive fish species is assumed to be the most sensitive overall species. However, this criterion could even possibly be adjusted upward to account for insensitive invertebrate species. Don restated this point to say that the 5th percentile most sensitive species (fish only) is likely a lower concentration than the 5th percentile of all species. Steve B. asked whether this comment implies that EPA agrees with the use of the most sensitive fish species or if EPA is requesting additional laboratory work for invertebrates. Burt replied that no additional lab work is being requested. However, because invertebrates and plants are more tolerant than fish, their addition to species sensitivity distribution would actually move the 5th percentile effects concentration upward. Don added that a recalculation could be performed acknowledging that these other species are present. Charlie specified that if a recalculation is performed, one may come to the conclusion that protecting brown trout protects all other species and the entire aquatic community, but this should not be a foregone conclusion or assumption. More information may need to be added here to clarify that protection of brown trout likely protects at least 95 percent of the whole community; the analysis needs to be done and this conclusion must be reached independently. Burt said that EPA is happy to discuss this point further as necessary.

Response: Please see the response to comment number 2 provided above in the general comments.

(4) Translation from egg to whole-body concentration: this comment has already been discussed and was in EPA’s original December 22, 2010 comment letter. EPA cannot comment on the translation to a water criterion until that step has been completed.

Response: Please see the response to EPA’s written comments for this topic.

(5) EPA requests that a section of the report be devoted to documenting changes between planned activities in the project Work Plan and actual activities conducted. EPA recognizes that not many modifications were made, but would like deviations from the Work Plan documented.

Response: Each of the documents prepared to summarize the different activities, whether it be for the field data collection or the laboratory studies, included information about deviations from the Work Plans. Additional effort to describe deviations from the Work Plans was not included in the TSD.

(6) EPA suggests that dry weight and percent moisture be presented in all data tables to facilitate conversions between wet weight and dry weight concentrations when comparing results to other data.

Response: Where practical in the format of the data tables presented, both wet weight and dry weight data are provided as requested.