

May 7, 2014

Project 615438

Executive Flight Centre
200, 680 Palmer Rd.
NE Calgary, AB T6E 7R3

ATTENTION: Wayne Smook, Senior VP Airport Services

REFERENCE: **Response to MoE Regarding Review of *Lemon Creek Spill: Environmental Monitoring Plan Interim Report***

As requested by Ministry of Environment (MoE), the Environment & Water business unit of SNC-Lavalin Inc. (SNC-Lavalin) has prepared this letter to address comments received by MoE on March 18, 2014 as it relates to the *Lemon Creek Spill: Environmental Monitoring Plan Interim Report*, dated February 14, 2014.

RESPONSE TO COMMENTS PROVIDED BY MINISTRY OF ENVIRONMENT

The following sections address comments provided by MoE in their review of the Lemon Creek Interim Report. The format follows the same outline as that provided by MoE and each bullet point under each section heading is addressed in the same order (e.g. the first bullet point under *General Comments* in the MoE review is addressed in the first bullet point under *General Comments* in the SNC-Lavalin comments).

1. General Comments

- **MoE comment regarding contradictory information provided about the persistence of Jet A1 fuel:** Based on the scientific literature, Jet A1 fuel is shown to persist for days to weeks under ideal environmental conditions. However, given that there are factors in play such as organism-specific mechanisms, climate, and/or the presence of organic material, which fuel product (or constituents) can bind to can cause potentially delayed persistence in the environment. Based on our understanding of the scientific literature regarding Jet A1 fuel, the product will eventually biodegrade. The Environmental Monitoring Plan (EMP) aims to assess the aquatic environment at different times of the year where environmental conditions (e.g., water levels, climate etc) vary that will hopefully liberate any remaining product.
- **Comment regarding supporting information explaining use of provincial standards and guidelines for benchmarks when BC and federal guidelines do not exist for certain contaminants:** Main components of Jet A1 fuel have provincial drinking water (DW) standards with exception to light extractable petroleum hydrocarbon (LEPH). For LEPH, a risk-based objective has been established. The predominant contaminant measured in surface water samples collected from the spill area is LEPH (C10-19); SNC-Lavalin has used Health Canada's litre-equivalent approach to derive a health-based guideline for LEPH.



- **Comment regarding the size of the figures in Appendix A-2:** The figures provided were created on larger size drawings; therefore, if printed on 11 x 17 sized paper (or smaller) the figures would be difficult to read. To arrange the data onto smaller drawings would take a considerable amount of time. To accommodate, SNC-Lavalin could provide a complete hard copy set of the drawings, if required.

2. Executive Summary

- **Comment regarding the executive summary being revised and updated in response to MoE feedback:** The executive summary has been revised and updated to reflect comments provided by MoE.
- **Comment regarding the executive summary being qualitative:** We typically provide an executive summary with more technical information, but given the audience, we have intentionally kept it qualitative. If people are interested in the quantitative information, they can review the pertinent sections of the interim report.

3. Water Quality

- **Comment regarding the addition of historical data for comparison purposes:** For the various sampling sites, collected as part of the EMP, SNC-Lavalin will add the historical data (collected immediately after the spill) to the analytical tables and drawings as part of the final report.
- **Comment regarding the next targeted sampling event:** The next event is scheduled for mid-May 2014 targeting spring freshet.
- **Comment regarding Table 3.1. and a noticeable hydrocarbon odour:** We have added a comment within the interim report: “Although, despite Lemon Creek being mostly frozen, a hydrocarbon odour was noted near the confluence with the Slokan River”.
- **Comment regarding the method detection limit (MDL):** Adjustments will be made within the body of the report, where appropriate, acknowledging the higher MDLs; however, it should be noted that lower MDLs were reported for samples collected during the most recent targeted November 2013 sampling event. Lower MDLs will continue to be reported, such that results are suitable for comparison to relevant standards and/or guidelines.
- **Comment regarding Objectives vs. Guidelines:** we will ensure appropriate terminology is applied.
- **Comment regarding detectable polycyclic aromatic hydrocarbons (PAH) in sample SW13-04 collected in Sept 2013:** The information will be added to Section 3.5.2. where SW13-04 had detectable concentrations of naphthalene (0.055 µg/L) and pyrene (0.015 µg/L), which are slightly above the MDLs of 0.05 µg/L and 0.01 µg/L, respectively, but less than the applicable standard and guideline.



4. Porewater

- **Comment regarding “where and when” porewater samples were attempted along Lemon Creek:** A comment has been added to the interim report to state “attempts were made to sample porewater at all surface water and sediment sample locations along Lemon Creek as well as specifically adjacent to the shallow dug well owned by Mr. Russell Hulbert and three registered groundwater wells with well tag #s: 66324, 79310 and 79311, located downstream of Mr. Hulbert’s property”.
- **Comment regarding 2 samples with detectable PAHs added to the interim report:** A comment has been added to the interim report regarding “samples PW13-04 and PW13-702, which were collected during the September 2013 sampling event and contained detectable concentrations of PAH (i.e., specifically pyrene, acenaphthylene, fluorine, phenanthrene and fluoranthene) above the MDLs but less than the applicable standards and guidelines for the site. Subsequent porewater samples collected from these two locations in November 2013 contained non-detectable concentrations of PAHs.”
- **Comment regarding Mr. Dankev’s feedback about continued monitoring of all drinking water wells with the potential for contamination of the spill:** It has been agreed between the MoE and Executive Flight Centre Fuel Services Inc. (EFC), that SNC-Lavalin would further sample Mr. Hulbert’s shallow dug well. Whereas, the deeper DW wells located downstream of Mr. Hulbert’s shallow dug well have low potential for contamination from the spill (as per SNC-Lavalin’s *Technical Rationale for Modification of Environmental Monitoring Plan for Porewater Sampling in the Vicinity of Lemon Creek* dated January 23, 2014); thus, will not be further sampled. Sampling of the Mr. Hulbert’s well is subject to being granted access by Mr. Hulbert to his property. We would request support from MoE in facilitating this action.

5. Sediment Quality

- **Comment regarding sediment assessment should include total organic carbon and grain size on all samples:** It was agreed upon in the EMP that a variety of representative sediment samples would be selected and analyzed for grain size and total organic carbon (TOC). Depending on sample locations, all types of sediment except gravel and cobbles have been collected. As part of the freshet sampling program sediment samples will be analyzed for TOC and grain size.
- **Comment regarding concerns related to elevated heavy extractable petroleum hydrocarbon (HEPH) in side channel downstream of Lemon Creek:** As per email correspondence between MoE and SNC-Lavalin, dated November 15, 2013, it is our professional opinion that the elevated HEPH is not associated with Jet A1 Fuel (i.e., not detected in any of the samples collected to date, including product samples). This comment will be added to the interim report as requested.



6. Periphyton

- **Comment regarding the inclusion of Periphyton in the interim report:** A brief sub-section was added to the benthic invertebrate write-up of the draft interim report that provides a description of qualitative observations made during the fall field work.

7. Benthic Invertebrates

- **Comment regarding the importance of benthic invertebrate monitoring:** We agree that the benthic monitoring will be an important tool to document the aquatic recovery of Lemon Creek following the spill.
- **Comment regarding the status of the Columbia Reference model:** We have included a note in the interim report that the Columbia Basin Reference Condition Model will be updated in 2014 and data will be re-run with the updated model once available.
- **Comment regarding the abundance of invertebrates collected:** A thorough discussion of the difference in abundance among sites will be provided in the final report.
 - *Regarding Figure 9.2:* We have included a small comment in the main text that a very small number of organisms were collected at LCBI00 and LCBI01. The scale was used to accommodate the large number of organisms at the majority of sites, but in fact there are organisms caught at these two sites.
- **Comment regarding laboratory identification of invertebrates:** This point was addressed in the draft interim report. Oligochaetes were only identified to Class and these organisms were returned to the lab for more detailed taxonomic identification (Family level). Once these results are received, we will continue with data entry into CABIN and perform preliminary analyses.

8. Fish Tissues

- **Comment regarding objectives of the program:** Objectives have been articulated.
- **Comment regarding the number of MW collected:** The number of MW to be collected from the Slocan River and Brilliant Reservoir was revised to five (5) as stated in the approved EMP.
- **Comment regarding the collection site chosen and lack of “Reference site”:** As per the EMP, the intent was to collect Mountain Whitefish in Little Slocan River (Reference site). Due to a delay in commencing the monitoring program, Mountain Whitefish were unsuccessfully captured within the mainstem. Thus we adapted our sampling program while in the field and collected Mountain Whitefish at the Little Slocan River/Slocan River confluence, which we consider an adequate representative reference site (see Zajdlik et al. 2009). Zajdlik et al. (2009) asserts that in a gradient approach study design, “*comparison is not strictly with a reference condition but rather an implied reference condition defined by extrapolating the relationship between a measurement endpoint and some variable associated with the effluent*”. Given our understanding of the environmental fate of the spilled product, results from the SCAT report, results compiled from the sediment & water programs, and the distance between sites (Lemon



Pool and Little Slocan/Slocan confluence), it is our position that the use of the Little Slocan/Slocan confluence site as an implied reference site is well justified. We have included discussion in the interim report with respect to the implied reference site.

- **Comment regarding the statistical analyses:** Sample size of five (n=5) (Lemon Pool) and three (n=3) (Little Slocan confluence) was the target number of MW in the approved EMP (biological programs). The target was achieved for these two sites. Given the observed low levels of phenanthrene detected in fish tissue and evaluated against the collective line of evidence (environmental fate of product, SCAT results, PAH analytical results from sediment & water, ecology of Mountain Whitefish, metabolism effectiveness of teleost fish, riverine distance between fish sampling locations, supporting historical information regarding phenanthrene levels in fish tissues) it is our professional opinion that the weight of evidence strongly supports our original position that there are no concerns with respect to fish toxicity levels or consumption. Thus, additional analyses are not necessary.
 - **Comment regarding the use of T-Test and Analysis of Variance (ANOVA):** A T-test has been used to replace the one-way ANOVA and is now included in the report. Note that even though only two means are being compared, the use of the one-way ANOVA is still appropriate.
 - **Comment regarding the hypothesis being tested:** One of the objectives of the program was to determine if PAHs associated with Jet A1 fuel were found in fish tissue. If present, PAH levels were compared to determine if there is a significant difference between impact and implied reference sites. If PAHs were present in fish tissue, it was then determined if there was a significant difference in PAH levels. Even though Mountain Whitefish can be a mobile species, the scientific literature detailing Mountain Whitefish life-history indicates that prior to the seasonal spawning migration, Mountain Whitefish typically move short distances within their foraging area. As such, fish collected during the fish tissue program were caught prior to their seasonal spawning migration and, thus, are most likely foraging residents of the areas they were collected (i.e. likely no migration between impact and implied reference site).
- **Comment regarding US EPA document:** The statement comparing to the US EPA study was just an example that small sample sizes have been able to assist with distinguishing impact and non impact sites.
- **Comment regarding conclusion of PAH levels:** We have taken a weight of evidence approach and based on the environmental fate of the product, results obtained from the SCAT report and sediment and water programs, as well as the riverine distance between sites, it is our professional opinion that Little Slocan/Slocan confluence is a justified reference site. Results suggest that PAH levels are similar between Lemon pool (impact) and Little Slocan/Slocan confluence site located ~30km downstream. Based on literature, teleost fish are capable of metabolizing PAHs readily and this can be supported by laboratory results that clearly show multiple non-detect and/or very low PAH levels in the fish tissues. Furthermore, fish in the Slocan River system have also been subjected to other 'historical' inputs as evidenced by the documented HEPH data (which is not associated with Jet A1 fuel). Even with historical inputs and the presence of Jet A1 fuel, PAH levels remain low, which indicates: (1) fish that were not



acutely affected by the initial spill have not ingested any Jet A1 fuel by-product (PAHs) that may have potentially remained in the system; or (2) fish have readily metabolized any negligible uptake of PAHs.

With respect to phenanthrene, its presence in tissue samples analyzed may negligibly be attributed to the spill but is much more likely an historical remnant in the system. Phenanthrene is a compound that occurs naturally and levels recorded in Mountain Whitefish from the Slocan River are the same as natural levels documented in Liard River (see Taylor et al. 1998). Given that phenanthrene levels are similar among the impact, implied reference, and a reference site used in another study (Liard River- see Taylor et al. 1998), it is our position that the observed presence of phenanthrene is not of concern to fish health or fish consumption.

- **Comment regarding fish tainting not being addressed:** It is of our professional opinion that fish tainting was appropriately addressed in the draft interim report. Hydrocarbon tainting potential was considered based on the presence of PAHs in fish tissue that would ultimately affect the taste. However, given that PAHs were mostly below detection limits and phenanthrene levels were just slightly above (and are likely of historical presence), we believe that tainting is not a concern based on the fish we have analyzed. The interim report further applies a weight of evidence where we discuss the ability of teleost fish to readily metabolize PAHs as well as referenced studies, which have indicated PAH detection limits for salmonid tissues by human sensory test (taste panel), and the levels in the fish samples analyzed as part of this monitoring program were consistently below those thresholds.
- **Comment regarding number of fish caught:** The EMP was approved by MoE. With the exception of Brilliant Reservoir, the number of fish collected followed the approved plan.
 - Five (5) fish were caught at Lemon Creek pool, there was one missing fork length in a table. This information has now been added into the table containing fish lengths.

9. Fish Communities

- **Comment regarding studies to be conducted in 2014:** A Lemon Creek fish community program will commence in summer 2014. The mark-recapture program will continue later in 2014.
- **Comment regarding Umatilla Dace and Shorthead Sculpin:** Umatilla Dace and Shorthead Sculpin may have only been captured opportunistically during the mark-recapture (M-R) program. The objective of the M-R program was to collect MW and not the above species. Since we did not target these two species, information gathered during the program does not necessarily reflect "true" abundance and density of the species and thus inference to changes in spatial distribution is not possible. Porto and Lawrence (2012) collected both species in the Slocan River and determined that numbers captured were considerably lower in the fall than the spring or summer. From all sampling gear used in the study, minnow traps were responsible for catching a significant portion of the total catch.



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10. Human Health

- **Comment regarding to IHA's comment regarding further observation should be conducted during spring (including at the Hulbert Property) to confirm the clean-up was effective:** As noted above, and as part of the approved EMP the next sampling event is planned for mid-May 2014 to target freshet flows.

CLOSURE

We trust this meets your current requirements. Should you have any further questions, please feel free to contact one of the undersigned.

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