This document was assembled by the Montana Department of Environmental Quality Site Response Section (DEQ) to formalize technical direction for conducting data validation. Data validation is a standardized review process for judging the analytical quality and usefulness of a discrete set of chemical data and is necessary to ensure that data of known and documented quality are used in making environmental decisions.

While these guidelines are generally used by DEQ, there may be circumstances that warrant a higher level of data validation review and DEQ reserves the right to require additional validation. For investigations where XRF or other field screening equipment is used, an evaluation including the comparison and correlation of field screening data to laboratory confirmation data must be also be included in the data validation discussion (please see DEQ’s frequently asked questions at http://deq.mt.gov/StateSuperfund/FrequentlyAskedQuestions.mcpx for specifics associated with the use of XRF equipment and data collection/evaluation).

A separate data validation report must be completed for each sample batch/group. A brief summary of this validation report and the usability of the data should be included in the text of the project report with the validation report included as an appendix. The data validation should include an assessment of data using the precision, accuracy, representativeness, comparability, and completeness (PARCC) parameters:

**Precision:** The degree of mutual agreement between individual measurements of the same property under similar conditions.

- Combined field and laboratory precision is evaluated by collecting and analyzing field duplicates and then calculating the variance between the samples, typically as a relative percent difference (RPD). Laboratory analytical precision is evaluated by analyzing matrix spike/matrix spike duplicate (MS/MSD) samples and using the results to calculate an RPD.

**Accuracy:** The degree of agreement between an analytical measurement and a reference accepted as a true value.

- The accuracy of a measurement system can be affected by errors introduced by field contamination, sample preservation, sample handling, sample preparation, and analytical techniques. Analysis of MS/MSD samples, laboratory control spikes (LCS) or blank spikes, surrogate standards, and method blanks are typically used to calculate the percent recovery (%R) for evaluating accuracy.

**Representativeness:** The degree to which sample data accurately and precisely represent the characteristics of a population, variations in a parameter at a sampling point, or an environmental condition that they are intended to represent.

- Typically, representative data will be obtained through careful selection of sampling locations and analytical parameters; proper collection and handling of samples; and through use and consistent application of established field and laboratory procedures. Evaluation of field and laboratory blank samples for presence of contaminants can be useful in evaluating representativeness of sample results.

**Completeness:** A measure of the percentage of project-specific data that is valid.

- Valid data are obtained when samples are collected and analyzed in accordance with quality control (QC) procedures outlined in the SAP, and when none of the QC criteria that affect data usability are exceeded. Once data validation is complete, the number of useable sample results is divided by the total number of sample results planned for the investigation to determine the percent completeness. A completeness goal should be developed for each project (i.e., 100% completeness for residential samples to ensure that all properties requiring sampling are sampled).
Comparability: Expression of the confidence with which one data set can be compared with another.

- Comparability of data is achieved by consistently following standard field and laboratory procedures and by using standard measurement units in reporting analytical data.

DATA VALIDATION REPORT

1. Please provide the following information at the beginning of the data validation report:
   - Project name
   - Name and Date of approved Quality Assurance Project Plan (QAPP), Sampling and Analysis Plan (SAP), or other applicable document
   - Laboratory Name
   - Laboratory Project ID
   - Sample Matrix
   - Sample Start and End Dates
   - Parameters Included (e.g., volatile organic compounds using EPA Method 8260)
   - Date Validated
   - Name of Validator

2. Please include a description of the data validation criteria used. These data validation criteria should be outlined in the appropriate QAPP, SAP, or other applicable document. For example:
   - USEPA Region 1 Laboratory Data Validation Function Guidelines for Evaluation of Organic Analysis, December 1996.

3. Please include a table or list identifying all samples evaluated in this validation report. Please provide the associated laboratory sample identification numbers if different than the project sample ID/name.

4. Please include a description of the acceptability and usability of the data, including any qualified data. Please explain data qualification flags or any other notes used by the laboratory. Please identify and explain any exceptions (i.e., rejected data) to the acceptability and usability of the data. Also include a cross reference where data qualified by the laboratory is discussed. For example: Based on a data validation review, the data are acceptable as delivered with the exceptions noted below as rejected data. Data qualified by the laboratory are discussed in Section #2 [of the project report].

5. Please include a description of the data qualifiers used during this validation. For example: J - estimated concentration; UJ – estimated reporting limit (for non-detect results); or R - rejected, data not usable.

6. Does the laboratory case narrative note any nonconformance issues with the analytical data? Please identify the nonconformance issues.

7. Were sample chain-of-custody (CoC) forms complete? Please describe. For example: The CoC records from field to laboratory were complete, and custody was maintained as evidenced by field and laboratory personnel signatures, dates, and times of receipt.

8. Were detection limits in accordance with the project requirements? If applicable, discuss how this relates to method selection, screening levels, and matrix interference. Please explain, and include discussion of how this affects the data.
9. Were the requested analytical methods in compliance with project requirements (i.e., QAPP, SAP)? If not, please explain, and include discussion of how this affects the data.

10. Were samples received in good condition within method specified requirements? Please explain any exceptions, and how sample condition may affect the results. For example: Sample collected and listed on CoC; however, lab noted sample not received in shipment. No qualification necessary.

11. Were samples analyzed within method specified or technical holding times? Please explain any exceptions, and how this may affect the results.

12. Were reported units appropriate for the associated sample matrix/matrices and method(s) of analyses? Please explain.

13. Do the laboratory reports include all constituents requested to be analyzed on the CoC or under the QAPP, SAP, or other applicable document? Please explain.

14. Was there indication from the laboratory that the initial or continuing calibration verification results were within acceptable limits? Please explain. For example: Initial and continuing calibration data were not included as part of this data set; however, these data are assumed to be acceptable as the laboratory did not note any calibration results that were outside of QC limits.

15. Was the total number of method blank samples prepared equal to at least 5% (1 in 20) of the total number of samples, or analyzed as required by the method? Please explain.

16. Were laboratory blank samples free of analyte contamination? Please explain, and include discussion of how this affects the data. For example: The method blank samples were reported to be free of analyte contamination with the following exceptions: MADEP VPH - the analyte naphthalene was detected at 0.0256 mg/Kg in the method blank prepared for batch X. As naphthalene was not detected in the associated samples, no qualification of data was required.

17. Was the total number of matrix spike samples prepared equal to at least 5% of the total number of samples, or analyzed as required by the method? Please include a discussion of the project samples used to prepare the MS and MSD samples, if applicable. Please explain, and include discussion of how this affects the data. For example: The total number of MS/MSD samples was equal to at least 5% of the total number of samples for each analysis and batch, with the exception of pesticides by Method 8081A batch X, where the laboratory indicated with a MNR1 qualifier that sufficient sample volume was not available to perform matrix spikes. These data were evaluated using other laboratory QC data. Additionally, no matrix spike samples were analyzed for percent dry solids as it is not required by the method.

18. Please include a discussion of the project samples used to prepare the MS and MSD samples, if applicable.

19. Were MS/MSD percent recoveries and MS/MSD relative percent difference (RPDs) within data validation or laboratory QC limits? Please explain, and include discussion of how this affects the data.

20. Was the reference material used for the laboratory control standard (LCSs) the correct matrix and concentration? Please explain, and include discussion of how this affects the data.

21. Was the total number of LCSs samples analyzed equal to at least 5% (1 in 20) of the total number of samples, or analyzed as required by the method? For example: The frequency requirements for laboratory quality control samples (1/20) were met.
22. Were LCSs prepared in the same way as the associated samples? Please explain, and include discussion of how this affects the data.

23. Were LCS/LCSD percent recoveries and LCS/LCSD RPDs within laboratory QC limits? Please explain, and include discussion of how this affects the data.

24. Were surrogate recoveries within laboratory QC limits? Please explain and include a discussion of how this affects the data. **For example:** In sample A, the surrogates 2-fluorobiphenyl and 2-bromonaphthalene were recovered outside the laboratory QC limits of 40-140% at 143% and 151%, respectively. As a result, the detection for the analyte C19-C36 aliphatic hydrocarbons was qualified as J in this sample due to possible high bias.

25. Were the number of equipment, trip, or field blanks collected equal to at least 10% of the total number of samples, or as required by the project requirements, QAPP, or SAP? Please explain, and include discussion of how this affects the data.

26. Were the trip blank, field blank, and/or equipment blank samples free of analyte contamination? Please explain, and include discussion of how this affects the data.

27. Were the field duplicates collected as required by the project requirements, QAPP or SAP? Please explain, and include discussion of how this affects the data. Also, please provide a summary or a table identifying primary and duplicate sample pairs.

28. Were field duplicate RPD values within data validation QC limits (generally soil 0-50%, water 0-30%, or air 0-25%, or otherwise specified in the QAPP/SAP)? Please explain, and include discussion of how this affects the data.

29. Were laboratory duplicate RPD values within laboratory-specified limits? Please explain, and include discussion of how this affects the data.

30. If any data was qualified, please provide a data qualification summary or table that includes the analyte, sample ID, laboratory ID, laboratory result, validator qualifier, and reason for qualification (and include how data is affected/biased). **For example:**

<table>
<thead>
<tr>
<th>Analyte</th>
<th>Sample ID</th>
<th>Laboratory ID</th>
<th>Laboratory Result</th>
<th>Validator Qualifier</th>
<th>Reason for Qualification</th>
</tr>
</thead>
<tbody>
<tr>
<td>C5-C8 Aliphatic Hydrocarbons</td>
<td>All Samples</td>
<td>Lab-01 through Lab-14</td>
<td>Detects and Non-Detects</td>
<td>J for detections or UJ for non-detections</td>
<td>The RPD for the MS/MSD or LCS/LCSD was greater than the acceptable difference indicating poor repeatability. The MS and/or MSD recovery(ies) were below the acceptable limits indicating possible matrix interference.</td>
</tr>
<tr>
<td>Benzene</td>
<td>All Samples</td>
<td>Lab-01 through Lab-14</td>
<td>Detects and Non-Detects</td>
<td>J for detections or UJ for non-detections</td>
<td>The RPD for the MS/MSD or LCS/LCSD was greater than the acceptable difference indicating poor repeatability. The MS and/or MSD recovery(ies) were below the acceptable limits indicating possible matrix interference.</td>
</tr>
</tbody>
</table>

31. If DEQ collected split samples, explain how those results compare to the natural sample.

32. Please provide any other general comments or other observations.