ARCADIS
Infrastructure · Water · Environment · Buildings

ARCADIS U.S., Inc.
695 North Legacy Ridge Drive
Suite 200
Liberty Lake
Washington 99019
Tel 509 929 3369
Fax 509 928 3075
www.arcadis-us.com

ENVIRONMENT

Carol Harrison
Office of Environmental Assessment
U.S. EPA, Region 10
1200 Sixth Avenue, Suite 900
Mail code: OEA-095
Seattle, WA 98101

Subject:
Comments to EPA Report *Relation Between Nitrate in Water Wells and Potential Sources in the Lower Yakima Valley, Washington* (EPA Report EPA-910-R-12-003), dated September 2012

Date:
November 28, 2012

Contact:
Kevin M. Freeman, PG

Extension:
211

Email:
Kevin.Freeman@
arcadis-us.com

Our ref:
SK030280.0001
SK030282.0001
SK030326.0000

Dear Ms. Harrison:

ARCADIS U.S., Inc. (ARCADIS) provides the following comments regarding the U.S. Environmental Protection Agency (EPA) Region 10 Office of Environmental Assessment (OEA) September 2012 report entitled “Relation Between Nitrate in Water Wells and Potential Sources in the Lower Yakima Valley, Washington”, EPA Report Number EPA-910-R-12-003 (the “Report”). The comments reflect ARCADIS’ observations and concerns based on our review of the Report, reference material associated with the Report, and ancillary documents and information as provided via the EPA internet website for “Lower Yakima Valley Groundwater”, located at http://yosemite.epa.gov/r10/water.nsf/gwpu/lyakimagw.

The following sections present general comments and observations for the Report. ARCADIS’ specific comments to the Report are presented in Attachment A of this letter.

Purpose and Study Design

The Report states that “The primary purpose of this study was to investigate the contribution from various land uses to the high nitrate levels in groundwater and residential drinking water wells, which is the predominant source of drinking water for many residents in the Lower Yakima Valley.” However, in the April 2012 *Quality Assurance Project Plan for Yakima Basin Nitrate Study, Phase 3 – Comprehensive Analytical Source Tracer Sampling, April 2012 Sampling Event, Yakima County, Washington* (the “QAPP”), the objective of the study “…is to conduct research/sampling under a RARE grant to test techniques which may improve our abilities to link specific human practices to high nitrate levels in groundwater and private wells." Based on work conducted in Phase 1 of the study, three specific human practices ("land uses") were identified for investigation (1) rural residential septic systems, (2) agricultural crop land sites, and (3) animal feeding operations. The Phase 3 QAPP identified a number of "potential tracing or linking compounds which may be traveling with the nitrate" including estrogens, androgens, veterinary and human antibiotics, agricultural chemicals, personal care products and human medications and compounds. Analysis of these compounds, particularly at "very-low" detection limits, was intended to provide information for a Phase 4 study that would "…determine next steps to better control nitrate contamination including potential enforcement actions." The data presented in the Report derived only from the Phase 3 sampling effort; no Phase 4 study was designed or implemented.

The data generated by the Phase 3 study <u>was not</u> designed to investigate the <u>contribution</u> from various land uses as stated in the Report. The sampled media, sampling locations, number of samples, sampling techniques, and selected analytes and analytical methods were designed only to investigate the <u>ability to link observed nitrate contamination</u> to various selected land uses based on the presence or absence of potential tracing or linking compounds. The data would "…then be used in determining flow within the aquifer and source characterization." The stated purpose of the Report extends beyond and is not supported by the study design and data quality objectives (DQOs) presented in the Phase 3 QAPP. Any conclusions regrading contribution of nitrate from various human practices/land uses to groundwater are not supported by the study design and lead to untenable assertions regarding contribution of nitrate to groundwater from specific sources. Specific comments regarding the Purpose and Study Design are presented in Attachment A.

Study Limitations and Uncertainties

EPA presents a number of significant limitations and uncertainties for the study, including:

- Water well samples were collected from existing wells and information on the depths and screened intervals of the wells is known only for about a third of the wells that were sampled.

- Local groundwater flow direction, including upgradient and downgradient conditions, is based on regional groundwater flow data from the United States Geological Survey (USGS).

- EPA lacks complete information regarding the dairies in this study. EPA referenced general information regarding dairy operations, and specific information regarding the dairies in the Yakima Valley to the extent it was available.

- EPA has limited information about the irrigated crop fields in this study. EPA included information about the crop fields to the extent it was available.

- The irrigated crop fields are surrounded by similar agricultural uses, and many are situated downgradient of dairies, making more difficult EPA's ability to discern the source of nitrate in drinking water wells downgradient of the irrigated crop fields.

Specific comments regarding the Limitations and Uncertainties of the Study are presented in Attachment A; however ARCADIS identified the following (but not limited to) additional major limitations and uncertainties:

- The selection of wells, and thus the areal and vertical limits of the hydrogeological investigation, were "targets of opportunity" and not selected based on hydraulic, geologic, or hydrogeologic conditions of the study area. Limited information regarding well construction and completion depth does not allow for consistent or accurate comparison of groundwater quality or chemistry data within the underlying aquifer or aquifers. While it is acceptable to use regional groundwater flow directions to evaluate and describe general conditions, this information cannot be used to evaluate or assign contribution from potential specific sources, particularly when localized groundwater conditions can be affected by specific conditions such as canal infiltration, irrigation, and withdrawal from groundwater wells.

- Significant limitations exist with respect to the nitrate budget determined via soil sampling from irrigated fields. The collection depth of the samples (zero to 1 inch) is more indicative of field application amounts than nitrate concentrations passing though and beyond the root/uptake zone. These concentrations should not be used to calculate or extrapolate a nitrate application infiltration budget for the area as they are still subject to uptake by seasonal cropping.

- The inferences made regarding dairy operations based on EPA's general reference information do not appear to be consistent with full conclusions of the utilized reference material.

- No analysis was made regarding absorption or degradation of organic compounds, particularly veterinary pharmaceuticals and hormones, analyzed as part of the study or the relationship of absorption and degradation effects on organic compound concentrations observed in sampled wells.

- Significant limitations and uncertainties are present in the study regarding investigation and analysis of nitrate contribution from onsite wastewater treatment systems (OWTSs), specifically residential septic tanks, to residential drinking water wells. These uncertainties are related to lack of construction information for the drinking water well, location and condition of the OWTS, and quantity and quality of the effluent produced by the OWTS. Lack of this information does not allow for full or accurate evaluation of the residential septic system human practice/land use contribution.

- Limitations and uncertainties with respect to key analytical data are present, including:

  - USGS National Water Quality Laboratory (NWQL) – Trace organics reported values should be used only as a screen. Data reported can only be used for information purposes.
  - University of Nebraska, Lincoln (UNL) Water Sciences Laboratory – Data should be considered for informational purposes only (not enforcement) and biased high for veterinary pharmaceuticals and steroid/hormone analyses.
  - USGS Chlorofluorocarbon Laboratory (Reston) – SF_6 data may be compromised by the volcanic terrain and sediments present in the local aquifer area.
  - EPA Robert S. Kerr Environmental Research Center (Kerr) – Significant differences between Kerr analytical results and UNL analytical results for same hormone compounds in same samples at same locations.

The Report contains significant and serious uncertainties and limitations (as noted by EPA, by ARCADIS above, and in the specific ARCADIS Report comments), yet the Report presents definitive conclusions regarding specific human practice/land use nitrate sources and the nitrate contribution to groundwater from these specific sources. This unqualified linkage of sources and contribution is made in the Report regardless to how these conclusions are affected by the limitations and uncertainties.

Specific comments regarding limitations and uncertainties of the Report are presented in Attachment A.

Study Results

ARCADIS presents the following general comments with respect to study results presented in the Report. Specific comments are presented in Attachment A.

Dairy Facilities

- EPA either dismisses or makes no effort in the Report to evaluate upgradient conditions and potential sources of nitrate as related to the dairy facilities. These actual possible sources are either not quantified or ignored. The effect of this lack of evaluation is clearly demonstrated when information regarding the presence of “tracer” compounds in upgradient wells for the dairy facilities is presented, particularly when these compounds are either (1) present in greater concentrations or (2) not observed in wells downgradient of the facilities.

- Site-specific hydrology, geology, hydrogeology is not given any consideration in evaluating the location and types of sources. The facilities are bounded on the inferred hydrogeologic upgradient and downgradient boundaries by irrigation canals. These canals likely provide a significant source of groundwater recharge to the shallow aquifer and influence the local groundwater flow regime. Additionally, investigation of water quality in the canals has demonstrated that the canal water does contain nitrate at concentrations varying seasonally during irrigation and non-irrigation time periods.

- The Data Quality Objectives (DQOs) as presented in the report do not meet those stated in the Phase 3 QAPP.

- The calculations of lagoon leakage presented by EPA are not reproducible.

- Given the presence of upgradient nitrate sources and other potential nitrate sources adjacent to the facilities, the inference that all or a significant amount of the nitrate contribution to the shallow groundwater system is related to the dairy facilities is unsupportable based on the information contained in the Report.

Irrigated Croplands

- EPA did not make any effort to collect or analyze data that would provide information regarding conditions upgradient of the irrigated croplands included in the study.

- EPA did not collect samples below the root zone of the planted crops. Information related to nitrate concentrations in surficial soils cannot be extrapolated to deeper effects, based on application of a year-round cropping methodology.

- The collected data indicated further issues regarding the tracer use relationship, particularly when examining the presence of veterinary pharmaceuticals and hormones in soil samples when only synthetic fertilizer was used as the nitrate source for field fertilization.

Residential Septic Systems

- EPA did not make any effort to collect or analyze data that would provide information regarding conditions upgradient of the residential septic systems included in the study.

- Four wells (WW-19 through WW-22) were identified and sampled to evaluate if high nitrate concentration could be related to residential septic systems. All four sampled wells contained nitrate in excess of 10 milligrams per liter (mg/L), and two wells (WW-19 and WW-21) contained nitrate in excess of 35 mg/L. EPA collected wastewater influent samples from three Public Wastewater Treatment Plants (WWTPs). The WWTP influent samples were collected by EPA "to serve as surrogates for septic systems by providing a characterization and quantification of compounds that are found in rural septage." EPA further states that the "…WWTPs sampled serve rural communities and are sufficiently similar to residential septic systems for the purposes of this study." EPA's approach was intended to determine "…whether compounds detected in wells with high nitrate concentrations in areas with a high density of septic systems are similar to the compounds detected in WWTP influent or whether these wells are affected by other sources."

- ARCADIS assumes that EPA is equating "septage" with "effluent"; Typically, "septage" denotes the "liquid, solid and semisolid material that results from wastewater pretreatment in a septic tank, which must be pumped, hauled, treated and disposed of properly" while "effluent" refers to the "sewage, water, or other liquid, partially or completely treated or in its natural state, flowing out of a septic tank, subsurface wastewater infiltration system, aerobic treatment unit, or other treatment system of system component."

- A number of references are available for OWTS, their use, management, and performance; a summary is available in EPA's February 2002 *Onsite Wastewater Treatment Systems Manual* (EPA/625/R-00/008). Information provided in the manual states that there is a significant difference in character between sources (influent) of wastewater, particularly residential and non-residential sources. Additionally, these is a significant difference in character between residential wastewater influent and residential wastewater effluent, based on the design, condition, and loading of the system. Based on available literature, it is expected that functional residential septic tank system effluent produces nitrate concentrations up to 39 mg/L at the tank system location and that these concentrations extend through the soil column. The effects of a non-functioning residential septic system were not evaluated. EPA did not take into account this available and documented information regarding nitrate loading from residential septic systems when evaluation possible contribution from these sources.

- As with other potential sources, EPA made no effort to evaluate the type, construction, condition, location, or other characteristics of the residential septic systems evaluated during the study.

Conclusions

EPA has made a number of conclusions in the report that are unsubstantiated by the presented data. Regardless of the overall data quality or applicability as produced for the Report, these conclusions are not supported by the information obtained. ARCADIS makes the following general comments regarding the conclusions presented in the report; specific comments are included in Attachment A.

- Water well samples were not only collected from existing wells and well head and surrounding conditions were not fully evaluated, but also that water samples were collected from taps within the residence. There is a potential for significant changes in water quality between the groundwater bearing formation and the tap in a residential water system.

- Unknown groundwater flow and direction in the local vicinity of a well and potential source areas results in a confounding condition when attempting to ascribe sources of contamination and their associated contribution. This is a significant issue and has an impact on all conclusions that have been developed based on data interpretations and inferences included in this report.

- The stated objective of the study goes beyond the objective stated in the project QAPPs. If the full objective as stated in this report were also stated in the QAPP, it is likely that the data quality objectives and systematic planning processes would have resulted in a significantly different study and data collection design than what was actually performed.

- A significant shortcoming of the isotopic analysis is the inability to differentiate between human and non-human (animal) waste. This significantly impacts the ability to determine if sources are being adequately identified and evaluated or if other currently unrecognized or unstudied sources of contamination may be present that have a more significant impact on nitrate concentrations observed in wells. Additionally, the perchlorate data collected to augment the isotopic analysis does not appear to have been used to adjust or refine the isotopic analysis.

- While age dating may appear to differentiate between shallow and basaltic aquifer wells, the data are not presented in a manner that allows this conclusion to be fully evaluated. Further, geochemical information suggests that WW-06 identified in this report as an upgradient shallow aquifer well is actually more representative of the bedrock aquifer.

- The EPA relies on elevated concentrations of some major ions while others with significant concentrations in the inferred source area are not detected. This conclusion uses minimal evidence to identify dairies as a source of nitrate contamination while not fully elucidating how it was developed and explaining discrepancies in other major ion concentrations.

- The understanding and evidence used to determine groundwater conditions upgradient and within the Dairy Cluster are flawed. The well selected to represent upgradient groundwater conditions in the shallow aquifer, WW-06, actually appears to be more representative of a well completed and sourcing water from the bedrock aquifer based on geochemical analysis using data presented in this report. Further, the Dairy Cluster is bounded on the north by an irrigation canal that has been shown to have significant concentrations of nitrate. The relative contribution of potential nitrogen sources within the Dairy Cluster with respect to all other potential nitrogen sources in the vicinity of the Dairy Cluster that may be contributing nitrate to the shallow groundwater system was not evaluated or considered.

- Pharmaceutical and hormone data generated by the UNL laboratory did not meet DQOs for the study and were identified for screening use only. The presence of detected concentrations of pharmaceuticals and hormones in "upgradient" wells at or above concentrations observed in downgradient wells coupled with detections of hormones that were not detected in the same water samples by the EPA Kerr laboratory brings into question the validity of using this data to draw conclusions and assign contributions to potential sources.

- There is insufficient information to justify the isotopic data break points and interpretation used for attributing source types. In addition, perchlorate data collected to augment the isotopic data does not appear to have been taken into consideration. The issues associated with the break points and attempts to classify sources based on them is elucidated by the last sentence in this paragraph that states: "Isotopic data for the other residential drinking water wells downgradient of the Dairy Cluster indicate that the source of nitrate could be animal waste, fertilizer, or derived from the atmosphere, or some combination of these sources." This statement includes all possible sources of nitrated identified for the purposes of this study and also includes the possibility that there may be a combination of sources.

- EPA asserts that there is insufficient information from this study to support the conclusion that residential septic systems could be a source of nitrate in drinking water wells. The study contained an element designed specifically to evaluate possible contribution of nitrate from septic systems to drinking water wells. Nitrate concentrations in all four wells exceeded the nitrate MCL, and two of the wells contained nitrate in excess of 35 mg/L. Information exists reporting that residential septic systems are capable of producing effluent with nitrate concentrations in this range. Often, less evidence was used to assign nitrate contamination to other sources presented in this study.

- The EPA states within the report "The high nitrate levels in residential drinking water wells in the Lower Yakima Valley are likely coming from several sources. This study attempted to identify those sources. In some cases it was possible to identify likely or possible sources of the nitrate contamination." Allowing for the proposition that EPA has identified likely or possible sources of nitrate contamination in the area, EPA has made no determination on the type and amount of contribution from these sources, nor proven that one sources is the primary or exclusive source of nitrate detected in downgradient wells.

- The EPA states within the conclusions that "Evaluating actions to reduce nitrate concentrations in residential drinking water wells to safe levels is beyond the scope of this report. Although actions to reduce nitrate are needed, it may take many years to reduce the nitrate levels in residential drinking water wells to safe levels because of the extent of the nitrate contamination in the Lower Yakima Valley and the persistence of nitrate in the environment." ARCADIS agrees with this statement.

Closing

ARACDIS appreciates the opportunity to provide EPA comments for this critical document. Should you have questions regarding this submission, please contact Kevin Freeman at (509) 928-3369, extension 211.

Sincerely,

ARCADIS U.S., Inc.

Kevin M. Freeman, PG
Principal Hydrogeologist

Steven L. Hicks, PE
Principal Engineer

Copies:
Ms. Lori Terry Gregory – Foster Pepper PLLC
Mr. Patrick Ryan – Perkins Coie PLLC
Mr. Henry Bosma – Liberty Dairy LLC
Mr. Dan DeRuyter – George DeRuyter & Sons Dairy LLC
Mr. William Dolsen – Cow Palace Dairy LLC

Attachments:
Attachment A – Specific Comments to the Report
Attachment B – Stiff Diagrams for Attachment A, Comment 49

ARCADIS Specific Review Comments on *Relation Between Nitrate in Water Wells and Potential Sources in Lower Yakima Valley, Washington* Report, Prepared by U.S. Environmental Protection Agency Region 10, Dated September 2012 (EPA-910-R-12-003)

1. **Purpose of the Report. Section I, 1st Paragraph, 1st Sentence (Page 1)** states: "This report presents the results for sampling conducted from February through April 2010 by the U.S. Environmental Protection Agency (EPA) in the Lower Yakima Valley in central Washington State." The sampling conducted from February through April 2010 refers to sampling activities described and covered by the following Quality Assurance Project Plans (QAPPs):
    a. *Yakima Basin Nitrate Study Phase 2 – Initial Nitrate/Coliform Screening of Domestic Water Wells February 2010 Sampling Event*, prepared by EPA Region 10, January 27, 2010.
    b. *Yakima Basin Nitrate Study Phase 3 – Comprehensive Analytical Source Tracer Sampling April 2010 Sampling Event*, prepared by EPA Region 10, April 8, 2010.

    The objective of the Phase 2 study is stated in its QAPP (Section 1.2.2, 2nd Paragraph) as: "The objective of Phase 2 was to evaluate if, down gradient of potential nitrate contaminant sources, there are drinking water wells with nitrate levels over the MCL and/or total coliform." Further, in the Phase 2 QAPP, Section 1.2.2, 2nd Paragraph states that: "This (Phase 2) will help us better select potential nitrate sources and sampling sites for further source characterization in Phase 3, and will help management evaluate whether there is a basis for enforcement action."

    The objective of the Phase 3 study is stated in its QAPP (Section 1.3.2, 3rd Paragraph) as: "The objective of Phase 3 is to conduct research/sampling under a RARE grant to test techniques which may improve our abilities to link specific human practices to high nitrate levels in groundwater and private wells." Later in in the Phase 3 QAPP (Section 1.3.2, 5th Paragraph), the objective of Phase 3 is further identified as: "Phase 3 is attempting to demonstrate the potential to use low concentrations of trace organic compounds to link land use to observed nitrate contamination."

    Section I, 1st Paragraph, 2nd Sentence on Page 1 states: "The primary purpose of this study was to <u>investigate the contribution of various sources from nearby land uses</u> to high nitrate levels in groundwater and residential drinking water wells." (emphasis added).

    The statement of the primary purpose of this study does not align with the purpose and objectives for Phase 2 and Phase 3 stated in their respective QAPPs, which was to determine if nitrate levels in residential wells downgradient of potential sources exceed the MCL (Phase 2) and to evaluate the potential to use various sampling and analysis techniques to link specific human activities to elevated nitrate levels (Phase 3).

Per EPA guidance (such as, EPA QA/R-5, EPA QA/G-4, and EPA QA/G-5) systematic planning using the data quality objectives (DQOs) process is used to identify DQOs and develop sampling plans and identify analysis methods that ensure that the appropriate types, quantity, and quality of data required to answer the principal study questions are obtained. There are significant differences between the objectives used for planning the study and the state objective/purpose of the report.

While the types, quantity, and quality of data collected as identified in the Phase 2 and Phase 3 QAPPs may be appropriate to address their QAPP-stated objectives, there is no demonstration of this contained in this report other than the identification of elevated nitrate concentrations at some locations within the Yakima Valley. Throughout the report, there can be found no evaluation of the applicability to link sources with observed downgradient contamination using the "tracer" sampling results. Rather, there is an unstated assumption that the use of the "tracers" is applicable and no basis for their use is provided other than reference to studies performed by others at other locations that indicate that additional evaluation is required to more fully understand and defensibly use this type of data to link sources and downgradient conditions.

Given that no evaluation or evidence regarding the applicability of the "tracer" data to meet the Phase 3 objective is present within the report, the use of the data to support allocation of contribution from specific or even generalized sources is inappropriate and not supported. This is a significant shortcoming of this report that is discussed in more detail in later comments.

2. **Section II, 1st Paragraph, 2nd Sentence (Page2)** states: "To accomplish this, EPA sampled and analyzed sources of nitrate (dairies, irrigated croplands, and residential septic systems) and private residential drinking water wells for a variety of chemicals to evaluate whether chemicals, including nitrate could be used to link the nitrate contamination in groundwater and drinking water wells to the sources." This statement more closely aligns with the Phase 3 QAPP-stated objective, but the results of this effort are not fully communicated or elucidated in this report. Rather, in later sections of the report, an assumption is made that the above hypothesis is true and the data is then used for a purpose beyond its intended scope and usability.

3. **Section II, 1st Paragraph, 3rd Sentence (Page 2) -** This sentence states that the chemicals analyzed are expected to be associated with the sources, but no further evaluation of these chemicals and their presence is presented in this report. Rather, it is plainly assumed that these chemicals are a result of operations at dairy facilities and other land uses even when the chemicals are consistently detected in areas located “upgradient” of the potential sources.

4. **Section II, 3rd Paragraph, 4th Sentence (Page 2) -** The sources listed in this sentence are potential sources of nitrogen and none of the sampling or analysis performed as part of this study are capable of fully characterizing the potential relative contribution (main sources).

5. **Section II, 6th – 8th Paragraphs (Page 3)** – Data quality issues associated with laboratory data collected and analyzed as part of the study should be included in the limitations section. While EPA takes the time to point out other limitations, it fails to mention data quality limitations until much later in the report (Section VIII) and then only by reference to Appendix E. This gives the impression that data quality objectives for the study were met and only insignificant variations occurred. It is extremely important to note that many of the key data points used to develop and support inferences regarding sources of nitrogen presented in the report are based on data that was qualified for screening-level purposes only by EPA chemists and carries a caveat that users should be made aware of the screening level-status.

6. **Section II, 6th Paragraph (Page 2) –** It is appreciated that regional groundwater flow directions developed by USGS and other studies were used to support inferences on upgradient and downgradient locations on a smaller site-specific scale and that this is recognized as a significant limitation for conclusions and inferences presented in this report. However, the use of regional groundwater flow directions as the sole indicator of upgradient and downgradient locations is not acceptable for the interpretation and evaluation of environmental data on the scale presented in this report where there are several physical conditions which could greatly confound these inferences. Specifically, the presence of production wells, irrigation canals, irrigation systems, and other hydrologic features can have a significant impact on site-specific groundwater flow directions and potential infiltration patterns that must be accounted for before determining potential sources and fate and transport of chemicals in the environment. While this is recognized with one sentence later in the report (Section V, C, 5th Paragraph, Last Sentence) when discussing the overall study area setting, a similar treatment is not given to site-specific areas where inferences of potential source areas and contributions are performed later

in the report. This gives the reader the impression that the inferences of sources and potential contribution are more scientifically supported and defensible than the available data allows.

7. **Section III, 1st Paragraph, 2ndSentence (Page 3) -** The use of the 1.1 mg/L nitrate concentration as background for the Yakima Basin using the results of the study by Nolan and Hitt (2003) is not appropriate. While 1.1 mg/L is presented by Nolan and Hitt (2002) as a nation-wide relative background concentration, they also present relative background nitrate concentration values that are more applicable to various regions and land use types within the United States. The relative background nitrate concentration of 1.1 mg/L presented in Nolan and Hitt (2002) is based on evaluation of combined forest and rangeland data sets. Nolan and Hitt (2002) demonstrate that relative background nitrate concentrations for forest areas are significantly lower than for rangeland areas because the relative background concentration of nitrate is variable and depends, in part, on land use, hydrogeology, and climate which further identifies the importance of establishing local background conditions. Fortunately, Nolan and Hitt (2003) identified one subset within their study based on the Wisconsinan loess unit (Figure 7 from Nolan and Hitt 2003) which coincides with the Yakima Basin area. In fact, Nolan and Hitt (2003) identify that the 5 samples used to evaluate relative background nitrate concentrations for the Wisconsinan loess are from samples collected in southeastern Washington. In Nolan and Hitt (2003), the median nitrate concentration for the Wisconsinan loess was 1.7 mg/L and for rangeland as whole ranged from 1.4 to 2.7 mg/L. The 75th percentile relative background concentration of nitrate for the full data set (forest and rangeland) was 1.1 mg/L while the 75th percentile relative background concentration for rangeland presented in Nolan and Hitt (2002) is 2.3 mg/L. Therefore, the relative background concentration presented in this section should be revised to 2.3 mg/L.

8. **Section III, 1st Paragraph, 3rd Sentence (Page 3) -** The relative background concentration as defined by Nolan and Hitt (2003) "represents predominantly background concentration plus an extraneous component from low-level influence of human activities."

9. **Section VI, 1st Paragraph, 3rd and 4th Sentences (Page 9)** - The objective stated in Sentence 3 aligns with the Phase 3 QAPP-stated objective for the study, but no evaluation, analysis, or findings related to this objective are presented in the report other than an assumption that chemicals other than nitrate can be associated with specific sources and used to link sources and nitrate contamination. In the 4th sentence, it is implied that MST, isotopic analysis, and age dating will be used to evaluate the contribution of various sources. There is no explanation of

how this was performed or presentation of the results of the contribution evaluation in this report.

10. **Section VI, A, 2nd Paragraph, 2nd Sentence (Page 10)** – It is unclear what is meant by "estimates for different sources" and how these were used to compare with other source estimates. Is there an example that can be included?

11. **Section VI, A, 3rd Paragraph, 3rd Sentence (Page 10)** – "Livestock are prevalent throughout the Yakima Valley study area and accounted for about 65% of the nitrogen." This statement seems random and does not have supporting documentation to substantiate the claim. However, the next paragraph states that EPA is working with the USGS to further evaluate nitrogen fate and transport and a report will be issued in the winter of 2012. This additional report should be reviewed for content to ensure that the above statement aligns with data.

12. **Section VI, A, 2, 3rd Paragraph, 1st Sentence (Page 12)** – "EPA estimates that about 18.5 million pounds of nitrogen are applied to irrigated cropland each year in Yakima County." At the time of review, the nitrogen budget developed by EPA that produced this number was not available for review. This is a significant number that should be kept in mind when generating conclusions regarding contribution of nitrate to groundwater and the methodology to develop the number should be carefully considered.

13. **Section VI, 4, B, 2nd Paragraph (Page 13)-** Section 2.2.4.C of the Phase 2 QAPP states that well head information for the residential drinking water wells would be collected, but this information is not included in the report nor are references to well head conditions that may possibly contribute to elevated nitrate concentrations discussed.

14. **Section VI, 4, B, 7th Paragraph (Page 14) –** The focus of Phase 2 sampling stated earlier in this section focused on areas where elevated nitrate levels had been observed in the past and was not conducted using a random or other sampling design process. Therefore, it is rightly assumed that the percentage of water wells exhibiting nitrate concentrations above the MCL would be higher than if a basin-wide random or other systematic sampling program was employed to select sampling locations. However, the author later in the paragraph also seeks to attribute the increase in the percentage of sampling locations exceeding the MCL to other factors such as potential sources and increasing nitrate levels over time. These types of inferences are not data or scientifically based and the results are most likely the result of biasing resulting from the

sample program design that focuses on areas where elevated nitrate concentrations had been previously observed. Unless there was some sort of data analysis using data collected from previous studies at the same location to evaluate trends over time, there is no basis for inferring that nitrate concentrations are increasing over time in the basin based on the Phase 2 and 3 sampling results.

15. **Section VI, 4, B, 8th Paragraph (Page 14) -** If, as posited in the 7th paragraph of this section, that potential sources of nitrate are indeed sources, then why would other measures indicating the presence of sources actually show decreases from the previous study? As noted in the 7th paragraph, there was an anticipated increase in the percentage of wells with nitrate concentrations greater than 10 mg/L because Phase 2 focused on areas where historic information indicated elevated nitrate concentrations (increase from 12% to 20% in Phase 2). However, what is a plausible explanation for the significant decrease in wells exhibiting fecal coliform (20% in past studies to 2% in Phase 2)? Where are the 2% of wells that exhibited fecal coliform contamination located? Can this be shown on the nitrate concentration figure (Figure 10)?

16. **Section VI, 4, C, 1st Paragraph (Page 14) -** As noted earlier, the Phase 3 objective presented here is not consistent with the Phase 3 QAPP-stated objective to determine <u>if it is possible to link sources to downgradient nitrate using tracer compounds</u> not to “investigate the contribution of various sources.” These are clearly different objectives as one is attempting to infer contribution and the other is attempting to develop a suite of analysis methods that could potentially be useful to demonstrate the provenance of contaminants using tracer compounds to augment sampling of the contaminant itself.

17. **Section VI, 4, C, 3rd Paragraph and Table 1 -** The fact that no “upgradient” samples were collected for crop field or septic systems severely limits the ability of the authors to evaluate data for the three potential source areas identified in this report in an even-handed, although outside of scope and objective, manner. How can the objective of the study be evaluated without information regarding the presence or absence of proposed tracer constituents without this information? If this information isn’t necessary to address the principal study question(s) for the study, then why was “upgradient” information deemed necessary and collected for the potential dairy sources? As shown later in the report, inferences are freely made regarding contaminant conditions in wells downgradient of dairies that could potentially be made

regarding crop fields and septic systems if "upgradient" data were collected, analyzed, and available for evaluation.

18. **Section VI, 4, C, 1st Bullet and Footnote 18 (Page 16) –** What was the rationale for not including WW-22103 and WW-22085 in the Phase 3 study? Is it reasonable for EPA to assume that groundwater, nitrate, and "tracer" conditions observed in WW-06 are representative of conditions upgradient of the Dairy Cluster in the shallow alluvial aquifer?

19. **Section VI, 4, C, 3rd Bullet (Page 16) -** The use of WWTP influent as a representative surrogate for septic tank effluent is not appropriate. This assumes that all septic systems are equal when a number of different factors can have significant impacts on the effectiveness and effluent quality emanating from individual septic systems.

20. **Section VI, 4, C, 1 – Criteria for Selection of Dairies and Associated Sampling Locations, 3rd Bullet (Page 17) -** How was "Relatively consistent direction of groundwater flow from season to season." determined? This question also applies to Irrigated Cropland Areas and Septic System Areas (Page 18).

21. **Section VI, 4, C, 1 – Criteria for Selection of Dairies and Associated Sampling Locations, 1st Paragraph after bullets (Page 17) -** How were lagoon samples collected? Was there a standard protocol used that was repeatable at all locations and representative of conditions within the lagoon? Did lagoon sampling conform to the standard methods identified in Midwest Plan Service MWPS-18 reference?

22. **Section VI, 4, C, 1, Criteria for Selection of Dairies and Associated Sampling Locations, Last Paragraph, Last Sentence (Page 17) –** Collection and analysis of samples from a tap are indicative of exposure but cannot be considered to be indicative of underlying groundwater conditions. This is particularly true when site-specific groundwater flow directions and rates, near-well hydraulic conductivity, nearby hydrologic controls, physical and contaminant conditions in the immediate vicinity of the well head, and other factors that may impact water quality and quantity are unknown.

23. **Section VI, 4, C, 1, Criteria for Selection of Irrigated Cropland Areas and Associated Sampling Locations (Pages 17 and 18) -** What is the rationale for only considering the top inch of the soil column within the fields versus other sampling techniques? This is not clearly identified in either

the Phase 3 QAPP or in this report. Soil samples collected from the 0 to 1-inch interval are likely to be indicative of surface applications of fertilizers and soil amendments. However, the use of these values to infer potential sourcing of chemicals to groundwater is not appropriate. Several factors are present that can confound this inference including, but not limited to, root uptake and losses to the atmosphere.

24. **Section VII, A, 1 (Page 20) –** Discussion and the impact of nitrate and nitrogen compound analysis from EPA MEL for samples that did not meet preservation requirements should be mentioned in this section along with differences in the analytical method used, particularly when discussing agreement between nitrate analyses conducted by EPA MEL and other laboratories at the end of the section. In addition, when discussing comparability of data in this section, note should be made of the lack of duplicate and triplicate sample collection that was identified in the QAPP.

25. **Section VII, A, 1, Second Paragraph, 1st Sentence (Page 20) –** The description of how total nitrogen is calculated is incorrect. However, the correct concentrations are presented in the tables.

26. **Section VII, A, 2 – Major Ions (Page 21) -** In the 1st paragraph of this section, it is stated that the purpose of major ion sampling is to track the chemical evolution of migrating groundwater. The Phase 3 QAPP states that this will be performed using Piper diagrams and other methods. Was any of this type of evaluation attempted? If so, why is it not presented in this report?
In the 4th paragraph of this section, it states that contribution from sources will be determined based on the presence/concentration of major ions in potential source materials. However, the only source materials sampled for major ions were liquids from the dairy lagoons. Why were no major ion samples collected from septic effluent, field soils, manure piles, or other potential sources? Similar to the lack of upgradient groundwater samples for some potential source types, the lack of appropriate information from potential sources limits the ability to attribute contribution and identifies an area where data collection based on the QAPP-stated objectives does not align with the objectives of the study identified in this report.

27. **Section VII, A, 3 (Page 21) -** If organic carbon is a significant control/indicator, why wasn't it sampled either in lieu of or in addition to minor and trace inorganics? It is also not clear why crop fields and manure piles were exclude from analysis given that they may represent significant sources of organic carbon and as noted later in the report are inferred to be potential

sources. Because they are collocated with many of the other inferred sources, they should have been sampled and analysis and evaluation should take these inferred sources into consideration.

28. **Section VII, C, 2 (Page 23) –** The stated purpose of the trace organics sampling is to differentiate water wells affected by septic systems from water wells influenced by other potential sources. "The compounds analyzed include many that can be associated with human usage…" Why would trace organics that are not associated with human usage be included in the analyte list? Was the list of analytes developed using the systematic planning and DQO process to ensure that the appropriate data was collected and extraneous information was not collected? In addition, discussion should be added to this section similar to Section VII, A, 3, regarding the usability and quality of the trace organic data. In particular, it is important to note that as a result of laboratory processes and procedures that the data should only be considered for screening or information purposes and act as a starting point to evaluate potential future sampling. In addition, discussion of field blank contamination and potential impacts on other samples and data should be included.

29. **Section VII, C, 3 (Pages 24 – 26) –** Several of the references used in this section include significant caveats regarding the use of wastewater and veterinary pharmaceuticals as tracers. In particular, an understanding of the degradation of the compounds over time and their fate and transport properties must be understood as many have significantly short half-lives or have a strong affinity to sorb to the aquifer matrix to preclude their use for downgradient evaluation if they are present.

30. **Section VII, C, 4 (Pages 26-28)** – In this section, it is important to note the issues associated with UNL-generated data and its qualification for screening use only as a result of calibration issues and blank contamination. Further, significant differences between hormone data analyzed at the EPA ADA laboratory and UND Laboratory are present in the data when common constituents are compared.

31. **Section VII, E, Last Paragraph (Page 30) –** The conclusion that elevated SF6 observed in some samples is the result of "localized human-caused releases" is contrary to supporting information included in Appendix E and Table C-16. Appendix E, 6, 2nd Paragraph, Last Sentence (Page E-13) states: "Alternatively, volcanic rocks can contain more SF6 than the average atmospheric concentrations of SF6 and the volcanic terrain and mineralogy of the sediments in the local

aquifer may be the source of SF6." The footnote on table C-16 states "Aquifer materials in volcanic areas such as the basalts under the Yakima Valley are known to host naturally-occurring SF6. No anthropogenic source of SF6 is known in the area of the Dairy Cluster." These statements suggest that age dating data may overestimate the ages presented in the report. There is no mention about this potential issue within the report and ages estimated using the SF6 analysis is presented as complete. Additional evaluation or explanation of the potential issues associated with elevated SF6 concentrations associated with the geologic environment should be included in the report and inferences drawn using the age dating results should be qualified accordingly.

32. **Section VIII, Last Sentence (Page 30) –** This sentence is somewhat misleading as review of Appendix E indicates that significant issues were identified and limitations placed on the quality and usability of some of the data collected during the Phase 3 sampling. This statement does not clearly elucidate the gravity and potential impact that data quality and usability issues associated with portions of the Phase 3 data set have on inferences and conclusions drawn in this report. The data limitations and usability issues need to be clearly identified and presented up front rather than hidden in appendices and downloadable data quality reports. Some of the more significant data quality issues include:
    a. Change of relative percent difference (RPD) limits to fit laboratory standards. Were the changes in RPD evaluated to determine if data quality was impacted versus DQOs.
    b. Lack of duplicate samples for water well and lagoon samples. What impact did this have on the ability to validate and qualify the data generated for these samples?
    c. Trace Organics – Qualified as screening level data. Inferences and conclusions based on this data should be identified and caveated appropriately.
    d. UNL Data – A significant amount of the data generated using the UNL laboratory was identified as screening level data. Inferences and conclusions based on this data should be identified and caveated appropriately within the body of the report.

33. **Section IX, 1st Paragraph, 3rd Sentence (Page 30) –** "In addition, one well was sampled that was not related to a specific dairy or crop field (WW-18)…" Could this well then be determined to be representative of septic systems? What is the purpose of the well and sampling if it was not related to one of the potential sources identified in the study?

34. **Table 7, Page 33 –** Lagoon leakage rates calculated and presented in the document could not be reproduced. Additional information regarding assumptions used is necessary to complete the calculations identified in Ham 2002.

35. **Section IX, A, 1, Haak Dairy Nitrate and Other Forms of Nitrogen, 2nd Paragraph (Page 36) –** The description of how total nitrogen is calculated is incorrect. However, the correct concentrations are presented in the table.

36. **Section IX, A, 1, Haak Dairy: Minor and Trace Inorganic Elements, 4th Sentence (Page 38) –** In this section, it is inferred that because barium and zinc were detected in dairy lagoons and in downgradient water wells that the source of barium and zinc in the water wells is the dairy lagoons. However, other metals that were detected in the dairy lagoons (chromium, copper, iron, and manganese) were not detected in the downgradient water wells. If the inference is that if a chemical is detected at a potential source and in a downgradient well, then the chemical comes from the potential source is true, then it would be anticipated that all chemicals detected in the source would be present at some concentration in downgradient wells unless there is a specific, scientifically-based reason why it would not be present.

37. **Section IX, A, 3 (Page 39-42) -** As noted in previous comments regarding data suitability and usability, the preface to this section should indicate that data presented and used to draw inferences are suitable only for screening purposes and do not represent data of a consistent quality that could be used to draw defensible conclusions.

38. **Section IX, A, 3, Haak Dairy Pesticides, 3rd Paragraph (Page 39) –** The assertion that the Haak Dairy is a likely source of atrazine in downgradient groundwater is not supported by the data. While the authors recognize the potential presence of atrazine in the upgradient monitoring well as an indicator of the presence of an upgradient source, attributing the potential presence of atrazine in the downgradient well is not supported by the analytical data and the upgradient detection of atrazine.

39. **Section IX, A, 3, Haak Dairy Trace Organics (Page 40) –** Phthalate was detected in an upgradient well. Phthalate is the second most common laboratory false positive (acetone is the most common). No discussion on the data quality of the trace organics data is provided.

40. **Section IX, A, 3, Haak Dairy Pharmaceuticals (Pages 40-41)** – As noted in previous comments regarding data suitability and usability, the preface to this section should indicate that the data presented and used to draw inferences are suitable only for screening purposes and do not represent data of a consistent quality that could be used to draw defensible conclusions.

41. **Section IX, A, 3, Haak Dairy Pharmaceuticals, 4th and 5th Paragraphs (Pages 40-41)** – The assertion that the Haak Dairy is a source of tetracycline and monensin are not supported by the available data given the quality issues associated with the data set and the estimated presence of monensin at concentrations at or above potentially downgradient concentrations.

42. **Section IX, A, 3, Haak Dairy Hormones (Pages 41-42)** – As noted in previous comments, the data from the UNL analysis is not of sufficient quality for uses other than screening. This is further supported by comparing common hormone results generated by the EPA Kerr laboratory that were qualified as usable. Testosterone results show elevated concentrations in upgradient wells, no detections in all but one dairy location, and concentrations less than upgradient concentrations in downgradient wells. These results are counter to the inferences presented in the report that the dairy is the source of testosterone.

43. **Section IX, A, 4 (Pages 42-43)** – The rationale for selection of isotopic interpretation break points presented in the report and Appendix D do not provide a sufficient level of detail or certainty regarding the use of isotopic data to make inferences regarding potential nitrate sources. This is clearly seen in inferences presented at the end of the section where the dominant sources for WW-03 are identified as all potential sources. In addition, the perchlorate data does not appear to have been used to adjust any of the isotopic data.

44. **Section IX, A, 6 (Pages 44-47)** – The inferences and conclusions presented in this section are confounded by several factors including unknown direction and flow characteristics of groundwater, data quality issues that limit the usability of the data to support conclusions, and inconsistencies in constituent concentrations in analytes (both usable and screening level data) that do not follow patterns similar to those used to base conclusions of potential source contribution.

45. **IX, B, Definition of Dairy Cluster (Pages 47-48) –** It is not clear how the D&A Dairy has been included with the Dairy Cluster other than by virtue of sharing ownership and property boundary with the DeRuyter Dairy. Further, from the inferred direction of groundwater flow

shown on Figure 14, D&A is not located upgradient of the downgradient monitoring wells identified for the Dairy Cluster. Based on preliminary review of Figure 10 (without precise locations of the dairy with respect Phase 2 water wells), it does not appear to be upgradient of any Phase 2 wells with nitrate concentrations greater than 10 mg/L. Please provide the rationale for including this facility with the Dairy Cluster.

46. **Table 18, Page 50 –** Lagoon leakage rates calculated and presented in the document could not be reproduced. Additional information regarding the assumptions used by EPA is necessary to complete the calculations identified in Ham 2002.

47. **IX, B, Surface Soils, 3rd Paragraph, Last Sentence (Page 51) –** "However, agronomic nitrogen application rates are not necessarily protective of drinking water." Agronomic nitrogen application rates are by definition the application rate required for plant growth to support yield projections and assume that N will be removed from the field by crop harvest.

48. **Section IX, B, Application Fields, Figures –** Figures do not match text description and need to be revised. Figures 12 and 13 are for the Haak Dairy, Figure 14 shows the Dairy Cluster boundary. Figures 11, 15, 16(a, b, and c) show Dairy Cluster sampling locations.

49. **Section IX, B, Application Fields, 1st Bullet (Page 53) –** WW-06 is not representative of groundwater in the shallow aquifer upgradient of the Diary Cluster and should not be used to provide a basis for changes to shallow aquifer groundwater quality changes as a result of potential sources between its location and downgradient wells. Major ion data presented in Table C6 of Appendix C were used to develop the attached Stiff plots for water wells sampled as part of the Dairy Cluster during the Phase 3 sampling event. These analyses show that the geochemistry of groundwater measured in WW-06 closely aligns with the geochemistry of groundwater from WW-07, WW-09, and WW-10. In Appendix A, the depths of WW-07, WW-09, and WW-10 are reported as 470, 482, and 345 feet below ground surface. These wells are likely completed and represent groundwater quality in the bedrock aquifer. Further, a hydrologic divide may be present between WW-06 and the northern boundary of the Dairy Cluster represented by the irrigation canal. No only may the irrigation canal represent a hydrologic divide, but it may also be a potential source of nitrogen to underlying groundwater. However, the nitrate concentration in the irrigation canal water is unknown. A number of other potential sources of nitrate are present between WW-06 and the northern boundary of the Dairy Cluster. In order to make inferences regarding the contribution of nitrate to underlying groundwater

resulting from potential sources within the Dairy Cluster, it is important that upgradient groundwater quality is understood.

50. **Section IX, B, Application Fields, 2nd Bullet (Page 53) –** Were efforts made to sample the supply well at the Liberty and Bosma dairies prior to the water treatment system similar to sampling conducted at residential wells? If not, why were standard protocol used at residential wells used at this location?

51. **Section IX, B, Application Fields, 3rd Bullet (Page 53) –** Sample SO-03 is labeled on Figure 15 as an application field sample but is labeled as a manure pile sample.

52. **Section IX, B, Application Fields, 6th Bullet (Page 53) –** While it is understood that downgradient wells represent "targets of opportunity" to estimate groundwater conditions downgradient of the Dairy Cluster, care should be taken and explanation provided regarding the setting of wells selected as "downgradient." For example, it should be noted that WW-15 is located within the outlined boundary of the Dairy Cluster and is not completely downgradient. WW-12 is located on the south side of the irrigation canal south of the Dairy Cluster boundary. The irrigation canal may represent a hydrologic and groundwater quality divide that needs to be considered in this evaluation. Care should also be taken to consider and account for potential sources of nitrogen between the Dairy Cluster boundary and WW-11, WW-12, WW-13, and WW-14 when discussing and evaluating groundwater conditions.

53. **Section IX, B, 1, Dairy Cluster: Nitrate and Other Forms of Nitrogen, 2nd Paragraph, 3rd Sentence (Page 54) –** As noted earlier, WW-06 is not representative of upgradient groundwater conditions in the shallow aquifer and the background concentration used in this report is not representative and does not align with information presented as a reference for this value (Nolan and Hitt, 2002).

54. **Section IX, B, 1, Dairy Cluster: Nitrate and Other Forms of Nitrogen, 2nd Paragraph, Last Sentence (Page 54) –** Nitrate concentrations greater than the MCL (10 mg/L) are present in 7 of the 8 wells identified in the report as downgradient and not in all wells (WW-10, not detected). As noted earlier, the usability and representativeness of WW-12 (located south of the irrigation canal) should be reconsidered and explained. The presence of a number of potential sources between the southern Dairy Cluster boundary and wells WW-11, WW-12, WW-13, and WW-14

should be considered and addressed in the report rather than simply assuming that the Dairy Cluster is the only potential source of nitrogen for these wells.

55. **Section IX, B, 1, Dairy Cluster: Major Ions (Page 54) and Dairy Cluster: Minor Ions and Trace Organics (Page 55) –** It should be noted that the highest total phosphorous (0.0664 mg/L) and zinc concentrations (0.471 mg/L) concentrations were observed in the Dairy Cluster well grouping was observed in the "upgradient" well WW-06 that is representative of groundwater conditions. Zinc concentrations for all other Dairy Cluster wells was less than 0.017 mg/L with the exception of downgradient wells WW-11 (0.0669 mg/L) and WW-15 (0.0538 mg/L). The order of magnitude decrease in zinc concentrations between "upgradient" and "downgradient" in the vicinity of the Dairy Cluster should be evaluated and explained.

56. **Section IX, B, 1, Dairy Cluster: Perchlorate (Page 56) –** This section states that perchlorate analysis was conducted to augment the isotopic data as an indicator of potential accumulation of atmospherically derived nitrate associated with caliche soils. However, there is no further discussion of the results in this section or in the isotopic analysis section (IX, B, 4). What do the perchlorate results tell us? The presence of perchlorate in downgradient wells ranging from 0.915 to 3.08 µg/L suggests that at least a portion of the nitrate observed in these wells may be associated with atmospherically derived nitrate. Were any attempts to quantify the atmospherically derived contribution or at least estimate the potential impact of atmospherically derived nitrate on nitrate concentrations in the study area conducted? There should be some discussion of this within the report beyond a simple data summary since the data was collected for an intended purpose to support the study.

57. **Section IX, B, 2, Dairy Cluster: Microbiology, 1st Paragraph (Page 56) –** The well with a detected level of total coliform is the "upgradient" well. Was the condition of the well head, location of upgradient septic system, or other potential sources of coliform evaluated for this "upgradient" location? What are the potential sources of coliform that could be impacting this "upgradient" well but not having any impact on downgradient locations? Additional explanation regarding the coliform detection in the "upgradient" well is needed. The presence of coliform in "upgradient" well WW-06 is an additional line of evidence that WW-06 is not an appropriate surrogate for conditions shallow aquifer groundwater upgradient of the Dairy Cluster and upgradient to downgradient comparisons between WW-06 and other wells are not valid.

58. **Section IX, B, 3, Dairy Cluster: Pesticides, 4th Paragraph, 3rd Sentence (Page 57) –** None of the pesticides detected in the water wells were detected in application field or manure pile samples. If the dairy application fields or manure from the dairies were sources of these chemicals as stated in this sentence, it would only be logical that they would be detected in them. The supposition that the dairies are the source of these chemicals solely because the chemicals are used in corn production and the dairies have been known to grow corn is not supported by any of the data collected as part of this study. Further, the presence of one of these chemicals in the "upgradient" well further suggests that the source of the pesticides observed in groundwater during this study is not associated with the dairies and is more likely a result of a potential source located "upgradient" of the Dairy Cluster.

59. **Section IX, B, 3, Dairy Cluster: Trace Organics, 1st Paragraph after bullet list (Page 58) –** While DEHP was detected in 1 dairy lagoon sample (LG-10), it was also detected in the "upgradient" well (WW-06). **Last Paragraph (Page 58) –** It is unclear what the detections of trace organics in the dairy lagoons and not in the downgradient water wells tells us. Does this indicate (similar to other "tracer" chemicals analyzed for during this study) that trace organics are not an appropriate tracer (Objective of Phase 3 study) or that chemicals from the dairy lagoons are not migrating to the downgradient monitoring wells? Similarly, because pesticides detected in application fields were not detected in downgradient water wells, does this show that pesticides are not appropriate tracers (Objective of Phase 3 study) or those chemicals from the application fields are not migrating to downgradient water wells?

60. **Section IX, B, 3, Dairy Cluster Pharmaceuticals, 3rd Paragraph, 4th Sentence (Page 60) -** This sentence states that the dairies are the likely source of monensin detected in downgradient wells WW-10 and WW-14. Watanabe and others (2008) (cited as a source for this report) found that monensin was rarely detected downgradient of dairy facilities and that detections of monensin were limited to the actual footprint of the dairy facility as a result of the relatively short half-life of monensin (laboratory – 13.5 days, field – 3.3 to 3.8 days). Because of this monensin is not an effective indicator of downgradient impacts from potential sources. Given this, how are the downgradient detections of monensin in WW-10 and WW-14 reconciled? As noted earlier, WW-10 is representative of groundwater conditions and exhibited no detectable nitrate concentration. If the dairies are in fact the source of the monensin observed in WW-10, and if as inferred in this report the Diary Cluster represents a significant source of nitrate, wouldn't nitrate also be present as significant concentrations in this well? Further, review of data validation information presented in Appendix E suggests that there may be issues

associated with the pharmaceutical data analyzed at the UNL laboratory and that constituents to be analyzed were detected in blank samples. The quality and usability of this data and the basic understanding of hydrogeology of the site should be taken into consideration when making inferences regarding the presence and sources of chemical constituents measured in various wells within the Dairy Cluster vicinity.

61. **Section IX, B, 3, Dairy Cluster: Pharmaceuticals, 5th Paragraph (Page 60) –** A number of other pharmaceuticals were detected in dairy lagoons and manure piles that were not detected in any of the downgradient water wells. If, as the objective of the Phase 3 study suggested, pharmaceuticals are a representative tracer for this study and can be used to identify sources, then designation of a source would be based on the detection of chemicals in both the source and downgradient waters. A majority of the chemicals detected in the source were not detected in downgradient wells and therefore would suggest that the proposed sources are in fact not sources. There is little information or discussion of potential breakdown products, half-lives, or transport characteristics of the chemicals that are being used as the basis for determining contribution from various sources. This limits the ability and validity of assigning contributions from potential sources to conditions observed downgradient.

62. **Section IX, B, 3, Dairy Cluster: Hormones (Pages 60-62) –** There are significant differences between the EPA Kerr and UNL hormone analyses both in terms of analytes detected and not detected between the two as well as reported concentrations. This is illustrated by comparing the 5 common constituents that were analyzed by both laboratories. There does not appear to be a systematic difference between the two for three of the constituents. Detected concentrations, non-detects, and differences between concentrations are random and do not exhibit a pattern. Given issues associated with this data noted in the data validation reports for the UNL laboratory and narrative information provided in Appendix E, the use of UNL hormone data should be used with great caution and issues and caveats should be presented and discussed in this section. Basing assumptions and drawing inferences regarding the potential sources of these chemicals observed in downgradient wells should be tempered by the fact that issues are associated with the UNL analyses and that analytes were detected in the "upgradient" location at concentrations greater than those observed downgradient.

63. **Section IX, B, 4 (Pages 62-63) –** As noted earlier, there is no discussion of how the perchlorate concentrations observed in Dairy Cluster wells was applied to this analysis. The source of nitrate for WW-13 and WW-14 is identified as animal waste. While it is noted in the footnote to Table

23 that animal waste may be either human, non-human, or both, this should also be included in the text in the first sentence of the second paragraph. WW-13 and WW-14 are collocated near the downgradient boundary of the Dairy Cluster and may also be subject to influences from septic systems in this area.

64. **Section IX, B, 5 (Page 63)–** As noted in previous comments and in Appendix E, elevated SF6 concentrations may be present in this area as a result of the geologic environment. Discussion needs to be added to this section to explain this and how this may affect results and inferences drawn from the SF6 analysis. Were groundwater travel times estimated using USGS regional geology and hydrogeology information to determine if the travel time estimates presented in the report are representative?

65. **Section IX, B, 6, 1st Paragraph, Last Sentence (Page 64) –** It is not clear how age dating and well depth information correlate and what this indicates about hydrologic conditions in the vicinity of the Dairy Cluster. As noted in previous comments and using geochemical data collected from the wells, the wells selected to represent hydrogeologic conditions in the vicinity of the Dairy Cluster are a combination of bedrock aquifer and shallow aquifer wells. However, no distinction has been drawn between these two distinct groups when making inferences regarding nitrate sources using "tracer" analyte data.

66. **Section IX, B, 6, 3rd Paragraph (Page 64) –** This paragraph is correct in stating that nitrate concentrations observed in water wells selected to represent the Dairy Cluster area do increase along the inferred direction of regional groundwater flow direction. However, additional information should be included in this paragraph that relate the impacts of uncertainties and limitations associated with the data collected and current level of understanding of the hydrogeologic regime in the vicinity of the Dairy Cluster:
    a. WW-06, selected, identified, and represented as the upgradient location representative of groundwater conditions in the shallow aquifer upgradient of the Dairy Cluster is likely completed in the bedrock aquifer based on evaluation of major ion data collected during the Phase 3 sampling event.
    b. Potential sources of nitrogen are present between WW-06 and the Dairy Cluster boundary and above the Dairy Cluster as a whole. The presence of these potential sources and their impact on nitrate concentrations in shallow aquifer groundwater are not discussed or accounted for in the report.

c. The Dairy Cluster is bounded to the north and south by irrigation canals. Information presented in *Water Quality Conditions in Irrigation Waterways within the Roza and Sunnyside Valley Irrigation Districts, Lower Yakima Valley, Washington, 1997-2008* (Roza-Sunnyside Board of Joint Control, 2009) for the Granger Drainage (where the Dairy Cluster is located) showed median annual concentrations of nitrate + nitrite as N for the 1997 to 2008 time period in canals to range from 5 to 7 mg/L and 2 to 4 mg/L during the irrigation and non-irrigation time periods respectively. It is likely that a significant amount of leakage occurs from the irrigation canals that could have an impact on shallow aquifer groundwater conditions. The potential contribution from the irrigation canals both in terms of water quality and quantity should be taken into consideration and discussed in further detail in this report.

67. **Section IX, B, 6, 4th -7th Paragraphs (Page 64) –** Discussion of pesticides, trace organics, and pharmaceuticals presented in this summary section should be caveated based on limitations associated with the data, ability to define groundwater flow pathways, presence of target analytes in “upgradient” locations, and general data quality.

68. **Section IX, B, 6, 8th Paragraph (Page 68) –** As noted in previous comments, the hormone data used to support statements in this paragraph (hormone data generated by the UNL laboratory) is not consistent with hormone data generated by the EPA Kerr laboratory and significant issues associated with the data quality are noted in Appendix E and data validation reports. The use of this data to draw significant inferences regarding sources of contamination should either be removed or additional explanation regarding the limitations of the inferences should be included in this discussion.

69. **Section IX, B, 6, 9th Paragraph (Page 68) –** As noted in previous comments, the term animal waste should be explained to include both human and non-human waste. In addition, the impact of detected perchlorate concentrations on the isotope data and assumptions should be explained and included in this report.

70. **Section IX, B, 6, 10th Paragraph (Page 68) –** The broad, sweeping conclusion presented in this paragraph should also include discussion of additional sources of nitrogen that may be present. As presented in previous comments, there are potentially significant sources of nitrogen located upgradient of the Dairy Cluster boundary including other livestock facilities, agricultural fields, septic systems, and irrigation canals that exhibit high levels of nitrogen. While an increase from

"upgradient" to downgradient is noted, it is important to consider that WW-06 is likely screened in the bedrock aquifer and therefore is not representative of upgradient conditions in the shallow aquifer.

71. **Section IX, B, 6, 11th Paragraph (Page 68) –** See previous comments regarding monensin and other veterinary pharmaceuticals. In general, there is evidence that the data presented to support linkage between the dairies and downgradient detections of veterinary pharmaceuticals is suspect based on data quality information presented in Appendix E and data validation reports as well as chemical property and half-life information for veterinary pharmaceuticals presented in references used in the report (Watanabe and others 2008, and other report references for pharmaceuticals).

72. **Section IX, B, 6, 12th Paragraph (Page 68) –** Similar to other comments, the evidence used to identify the dairies as the potential source of testosterone is not supported by the data and current level of knowledge. The presence of testosterone in downgradient wells at concentrations less than those observed in "upgradient" wells suggests that the source of testosterone is either upgradient or the Dairy Cluster or that testosterone concentrations are a more localized condition.

73. **Section IX, C, 1st Paragraph (Page 68) –** Unlike sampling conducted at the dairy facilities, no upgradient groundwater information was collected for irrigated cropland areas. This results in confounding the already difficult task of evaluating potential sources of nitrate and their contribution. Similar to observations about conclusions regarding the Dairy Cluster earlier in this report, additional information regarding upgradient conditions both in groundwater and land use activities are required to ascertain the potential impact of irrigated cropland on underlying groundwater conditions.

74. **Section IX, C, 1st Paragraph (Page 68) –** As noted earlier, sampling of the soils in the fertilizer application zone (0-1 inches) is not indicative of potential nitrogen levels after plant uptake in the root zone.

75. **Section IX, C, 2nd Paragraph (Page 69) –** As noted earlier, fertilizer application rates to production fields are typically determined based on soil sampling to determine the appropriate agronomic rate of fertilizer application rates required to achieve yields. Determination of agronomic fertilizer application rates are designed to reduce costs associated with fertilization

by matching plant uptake rates to achieve yields with application rates. Over-fertilization can have significant negative impacts on crop yields and quality.

76. **Section IX, C, 1 (Page 70) –** Similar to over-fertilization, overwatering crops results in significant negative impacts on crop yields and quality in addition to costs associated with water application.

77. **Section IX, C, 3, Irrigated Cropland: Pesticides (Page 70) –** Similar to discussion of the dairy facilities, without upgradient groundwater quality, gradient, and flow direction, it is difficult/impossible to infer that common detections of a compound between an irrigated crop field and a drinking water well are linked. For example, atrazine was found in upgradient wells at both the Haak Dairy and Dairy Cluster areas. An assumption would be that atrazine would likely be found in groundwater upgradient of the irrigated cropland, if it was analyzed.

78. **Section IX, C, 3, Irrigated Cropland Hormones (Page 72) –** As discussed in previous comments and shown in this section, analysis of hormones from the EPA Kerr laboratory met data quality objectives for the project identified in the QAPP and exhibited non-detect concentrations for the 5 hormones analyzed. UNL laboratory data was determined to be of use for screening purposes only as a result of issues with the data and exhibited detected concentrations for compounds that were found to be non-detect by the EPA Kerr laboratory (17-a-estradiol). Therefore, data from the UNL laboratory should be used with extreme caution when making inferences and caveats regarding the data should be included when inferences are drawn.

79. **Section IX, C, 6 (Page 74) –** The conclusions regarding irrigated cropland as a potential source of nitrate presented in the last 2 paragraphs of this section are not supported by data collected as part of this study and level of understanding of the hydrologic and hydrogeologic system in the vicinity of the irrigated cropland. The lack of upgradient information in the vicinity of the irrigated cropland evaluated as part of this study further confounds the ability to draw inferences regarding the potential for irrigated cropland to act as a source of nitrogen. This is further complicated by the detection of analytes in upgradient wells in the vicinity of dairies evaluated as part of this study.

80. **Section IX, D (Page 76) –** Review of figures provided with the report suggest that wells WW-18 and WW-30 should both be included and evaluated in this section as neither appear to be located in a potential area of influence from crop fields or dairies.

81. **Section IX, D, 2nd Paragraph, 1st Sentence (Page 76) –** As noted previously, WWTP influent does not provide a good surrogate for septic tank effluent. EPA's February 2002 *Onsite Wastewater Treatment Systems Manual* (EPA/625/R-00/008) states that there is a significant difference in character between sources (influent) of wastewater, particularly residential and non-residential sources. Additionally, these is a significant difference in character between residential wastewater influent and residential wastewater effluent, based on the design, condition, and loading of the system. For example, total nitrogen in typical residential wastewater influent ranges from 26 to 75 mg/L per day (OWTS Manual, p. 3-11). Total nitrogen in typical residential wastewater effluent ranges from 40 to 100 mg/L per day (OWTS Manual, p. 3-29). Residential septic tank effluent contained 0.01 to 0.16 mg/L of nitrate (NO3-N); however at two feet and four feet below ground surface, the measured nitrate in soil water ranged from 1.7 to 39.0 mg/L and 2.0 to 29.0 mg/L, respectively (OWTS Manual, p. 3-28). Based on available literature, it is expected that functional residential septic tank system effluent produces nitrate concentrations up to 39 mg/L at the tank system location and that these concentrations extend through the soil column. Additionally, most local state environmental agencies (Idaho Department of Environmental Quality, Oregon Department of Environmental Quality, and Washington State Department of Ecology/Washington State Department of Health) assume nitrate loads ranging from 30 to 60 mg/L per day from a functioning residential septic system. The effects of a non-functioning residential septic system were not evaluated. EPA did not take into account available and documented information regarding nitrate loading from residential septic systems when evaluation possible contribution from these sources.

82. **Section IX, D, 3, Septic Systems Organic Compounds (Pages 77-80) -** Similar to observations for dairies and cropland, the quality and limitations of the data generated should be discussed as the data are presented. The presence of unanticipated chemicals in residential wells needs to be evaluated in tandem with potential data quality issues. Similar to dairy and cropland results, hormone analyses conducted by the EPA Kerr laboratory (data qualified as usable) and UNL laboratory (screening level) do not correspond for common constituents.

83. **Section IX, D, 4, Last Paragraph, Last Sentence (Page 80) –** "The probable sources of nitrate for these water wells match the variety of land uses surrounding these highly scattered wells." Based on the information provided we assume that the author is confirming that the animal waste contribution to these wells is attributable to septic systems.

84. **Section IX, D, 6, First Paragraph, 3rd Sentence (Page 81) –** "Although microbial contamination is often observed in situations where septic systems contaminate residential wells, no microbial contamination was found in the downgradient wells." The intent of this statement is not clear. Is the author suggesting that the lack of microbial contamination is an indicator of a source other than septic systems? Is this also true for dairies where significantly greater microbial contamination would be expected? What does this say about the results of the high nitrate targeted Phase 2 study where only 2% of the wells exhibited microbial contamination down from 20% in previous studies. Does this indicate that a nitrate source other than dairies or septic systems is the main driver for elevated nitrate observed in the Yakima Basin?

85. **Section IX, E (Page 83) –** WW-18 exhibited the highest nitrate concentration of any water well in the entire study area (72.2 mg/L) (the units in Table 38 for nitrate are incorrect). Review of figures in the report indicates that WW-18 is not in an area that would be anticipated to be impacted by dairies or cropland. Does this suggest that septic systems may be a very significant issue in this area?

86. **Section X, 1st Paragraph, 2nd Sentence (Page 84) –** It should be noted that water well samples were not only collected from existing wells and well head and surrounding conditions were not fully evaluated, but also that water samples were collected from taps within the residence. There is a potential for significant changes in water quality between the groundwater bearing formation and the tap in a residential water system.

87. **Section X, 1st Paragraph, Last Sentence (Page 84) –** Unknown groundwater flow and direction in the local vicinity of a well and potential source areas results in a confounding condition when attempting to ascribe sources of contamination and their associated contribution. This is a significant issue and has an impact on all conclusions that have been developed based on data interpretations and inferences included in this report.

88. **Section XI, 1st Paragraph (Page 84) –** Similar to previous comments, the stated objective of the study in this paragraph goes beyond the objective stating in the project QAPPs. If the full objective as stated in this report were also stated in the QAPP, it is likely that the data quality objectives and systematic planning processes would have resulted in a significantly different study and data collection design than what was actually performed.

89. **Section XI, 2nd Paragraph (Page 84) –** A significant shortcoming of the isotopic analysis is the ability to differentiate between human and non-human waste. This significantly impacts the ability to determine if sources are being adequately identified and evaluated or if other currently unrecognized or unstudied sources of contamination may be present that have a more significant impact on nitrate concentrations observed in wells. Additionally, the perchlorate data collected to augment the isotopic analysis does not appear to have been used to adjust or refine the isotopic analysis.

90. **Section XI, 3rd Paragraph (Page 85) –** While age dating may appear to differentiate between shallow and basaltic aquifer wells, the data are not presented in a manner that allows this conclusion to be fully evaluated. Further, geochemical information suggests that WW-06 identified in this report as an upgradient shallow aquifer well is actually more representative of the bedrock aquifer.

91. **Section XI, Haak Dairy, 2nd Paragraph (Page 85) –** As noted in earlier comments concerning major ions downgradient of the Haak Dairy, the authors rely on elevated concentrations of some major ions while others with significant concentrations in the inferred source area are not detected. This conclusion uses minimal evidence to identify the Haak Dairy as a source of nitrate contamination while not fully elucidating how it was developed and explaining discrepancies in other major ion concentrations.

92. **Section XI, Haak Dairy, 3rd and 4th Paragraphs (Page 85) –** Pharmaceutical data collected to support the study did not meet data quality objectives for the study and were qualified for screening level and study development use only. In the vicinity of the Haak Dairy, tetracycline and monensin were detected in dairy facility samples and downgradient water wells. In addition, monensin was detected in the upgradient monitoring well. Despite the upgradient detection of monensin and the screening level designation of the data, the author infers that because tetracycline and monensin are present downgradient that the source is the Haak Dairy. This is counter to what the data show and reference material indicate (Watanabe and others, 2008).

93. **Section XI, Haak Dairy, 5th Paragraph (Page 85) –** As noted in earlier comments regarding the isotopic data, there is insufficient information to justify the break points used for attributing source types. This is further characterized by the last sentence in this paragraph that states: “Isotopic data for the other two residential drinking water wells downgradient of the Haak Dairy

indicate that the source of nitrate could be animal waste, fertilizer, derived from the atmosphere, or some combination of these sources." This statement includes all possible sources of nitrate identified for the purposes of this study.

94. **Section XI, Dairy Cluster, 2nd Paragraph (Page 86) –** As noted in previous comments, the understanding and evidence used to determine groundwater conditions upgradient and within the Dairy Cluster are flawed. The well selected to represent upgradient groundwater conditions in the shallow aquifer, WW-06, actually appears to be more representative of a well completed and sourcing water from the bedrock aquifer based on geochemical analysis using data presented in this report. Further, the Dairy Cluster is bounded on the north by an irrigation canal that has been shown to have significant concentrations of nitrate. The relative contribution of potential nitrogen sources within the Dairy Cluster with respect to all other potential nitrogen sources in the vicinity of the Dairy Cluster that may be contributing nitrate to the shallow groundwater system was not evaluated or considered.

95. **Section XI, Dairy Cluster, 3rd - 5th Paragraphs (Page 86) –** As noted earlier, pharmaceutical and hormone data generated by the UNL laboratory did not meet DQOs for the study and were identified for screening use only. The presence of detected concentrations of pharmaceuticals and hormones in "upgradient" wells at or above concentrations observed in downgradient wells coupled with detections of hormones that were not detected in the same water samples by the EPA Kerr laboratory brings into question the validity of using this data to draw conclusions and assign contributions to potential sources.

96. **Section XI, Dairy Cluster, 6th Paragraph (Page 86) –** As noted in earlier comments regarding the isotopic data, there is insufficient information to justify the break points and interpretation used for attributing source types. In addition, perchlorate data collected to augment the isotopic data does not appear to have been taken into consideration. The issues associated with the break points and attempts to classify sources based on them is elucidated by the last sentence in this paragraph that states: "Isotopic data for the other residential drinking water wells downgradient of the Dairy Cluster indicate that the source of nitrate could be animal waste, fertilizer, or derived from the atmosphere, or some combination of these sources." This statement includes all possible sources of nitrated identified for the purposes of this study and also includes the possibility that there may be a combination of sources.

97. **Review of Data Validation Memoranda Provided on the FTP Site for the Project –** The EPA posted data validation memos describing the data validation process performed on the analytical results. Based on the posted information, the data validation followed the procedures described in the QAPP. The purpose of the data validation was to verify that the laboratories produced defensible results. Data which did not meet the criteria were qualified as either estimated or rejected. The data validation acceptance criteria were consistent with EPA data validation guidance. A data validation report was written for each type of analysis on each chain-of-custody. Two levels of data validation evaluation were performed, referred to as Stage 2 and Stage 4. The Stage 2 summaries verify holding times, sample preservations, and internal spike recoveries.

The summary memos provided minimal information on the actual data validation. The reports stated which data were validated and noted if noncompliance with either the QAPP or laboratory methodologies were observed. The typical details provided in most data validation reports were not included. Also, EPA protocol dictates that internal quality control samples be analyzed for every 20 field samples. EPA analytical protocols include analyzing the method blanks and continuing calibration standard on the same day as the field samples. No information was provided to verify that these criteria were met.

In addition, the EPA performed their own data validation, even when the samples were collected by EPA personnel and analyzed at the EPA laboratory. EPA guidance clearly states that an independent party should perform the data validation. The purpose for using an independent third party reviewer is to avoid potential conflict of interest. The combination of the EPA performing their validation and the minimal information provided in their validation reports ultimately produces ambiguity in the data defensibility. The EPA does not include sufficient information in their data validation report to strongly support the data defensibility.
Soil and water samples were analyzed for pharmaceuticals, herbicides, hormones, organic waste indicators such as caffeine, hormones, and inorganic compounds such as nitrates.

A summary of the data validation ambiguities is provided below:

Pharmaceuticals – 63 samples were collected from lagoons, soil, and waste water and were analyzed for veterinary pharmaceuticals at the University of Nebraska, Lincoln – Water Science Laboratory. The defensibility of the data precision and accuracy is reduced based on the following statements included in the data validation report:

"Due to the complexity of the liquid matrices (water, lagoon, and WWTP) and chromatographic interferences, internal standard used for calculating the concentrations of target compounds were affected resulting in a potentially high biased associated data. Data users are warned to use the reported values with caution as the concentrations of the compounds in the samples may be lower than reported."

In addition, the veterinary pharmaceuticals report states, "Approximately 9% of the total data points were qualified as unusable and an additional 18% were qualified estimated concentrations with a high bias due to out of control internal standards and/or calibration. Five lincomycin and three monensin results in the water samples were detected above the reporting limits but were flagged non-detects due to contamination in the associated field blank, WW-29." The overall data quality for the veterinary pharmaceuticals results is reduced because of analytical performance issues with the internal standards spiked in the field samples and interferences produced on the individual chromatograms. Based on the information in the data validation reports prepared by the EPA, the entire pharmaceutical data set is suspect and, in the EPA's own words, should be used with "caution" because the reported values "may be" too high.

Herbicides – Sixteen soil and 30 water samples were analyzed for herbicides. The water samples were reportedly evaluated using the EPA's level 4 data validation method.

Water Samples – The laboratory noted that "experimental method" was used for the water samples and no holding time would be applied. The actual holding time used for the samples was not presented in the data validation report. Several quality control issues were identified which caused the detected and nondetected results for the following analytes to be qualitfied:

- *2,3,6*-trichlorophenol
- 2-4-D, clopyralid
- dacthal-DCPA
- dicamba
- picloram
- 4-nitrophenol
- chloramben
- fenhexamid

Based on the identified quality issues with the laboratory control samples and the matrix spike samples, the result for these analytes should not be used.

Soil Samples – The soil samples were analyzed for an equivalent EPA method 8151. The data validation report states that since no holding times were identified in the QAPP for frozen samples, no holding times apply. The holding times listed in the EPA analytical method guidance document do not differentiate between frozen and non-frozen sample preservation. Based on the EPA guidance, holding time is 40 days. The samples were analyzed eight months after collection.

Several quality control issues were identified which causes the detected and nondetected results for the following analytes to be qualified:

- Dinoseb
- Acifluoren
- 2,3,6-trichloropheno
- 2-4-D, 4-nitrophenol
- chloramben.

Based on the identified quality issues with the laboratory control samples and the matrix spike samples, the result for these analytes should not be used.

Hormones – The September 2011 data validation report discussed 16 soil samples and 48 water samples. Limited information was presented in the report. No information was provided on whether individual sets of data quality control samples for each 20 field samples criterion was compliant. No information was provided discussing whether the QC samples were analyzed the same day as the field samples, surrogate recoveries compliance, matrix spike recoveries compliance, calibration or holding time compliance.

The September 2011 report has the following statement concerning the overall data quality. “Due to the calibration results, the detected results and/or reporting limits for androstanedienedion, a-methyltestoserone, androsterone, progesterone, caffeine, estrone, a-zearalanol, a-zearalenol, b-zearalonol for samples associated with the calibration run on 01/18/2011 were qualified estimated J/UJ."

The report also states that approximately 15 percent of the total data points were flagged estimated due to calibrations. The report also states that additional qualifications were applied due to blank contamination. However, the report does not state which samples are qualified or whether soil or water samples are affected. The data validation report states that data quality issues were identified, but does not provide sufficient information to understand the full ramifications of the quality issues.

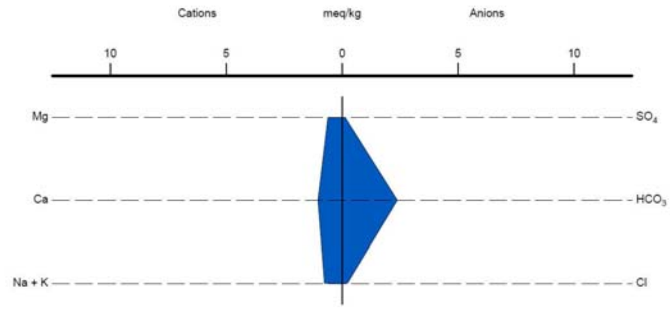
Nitrates – A January 2011 data validation report discusses the data quality for 108 water samples collected in two phases. The report states that the samples were evaluated using EPA stage 4 criteria. However, the details of the review are not included in the report. The report qualified the results for six samples based on quality control noncompliance.

- A March 2011 report discusses the data quality for 30 water samples. Limited information is provided. Missing information includes if sufficient data quality samples were analyzed and whether they were analyzed on the same days as the field samples.
- A September 2011 report discusses the data quality for 43 water samples. Limited information is provided. The report states that data were not qualified. Missing information includes if sufficient data quality samples were analyzed and whether they were analyzed on the same days as the field samples.
- A November 2011 report discusses the data quality for 10 soil samples. Limited information is provided. The report states that data were not qualified. Missing information includes if sufficient data quality samples were analyzed and whether they were analyzed on the same days as the field samples.

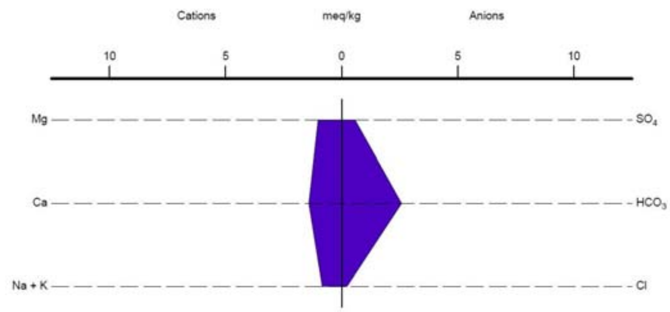
Data Quality Summary – As discussed above, the EPA does not include sufficient information in their data validation report to strongly support data defensibility. The EPA performed their own validation despite EPA guidance stating that an independent reviewer should be used. In addition, the data validation report for pharmaceuticals stated that due to data quality issues, caution should be used in reviewing the results. The minimal information provided in the validation reports and the potential conflict of interest reduces the data defensibility.

Stiff Plots for Attachment A, Comment 49

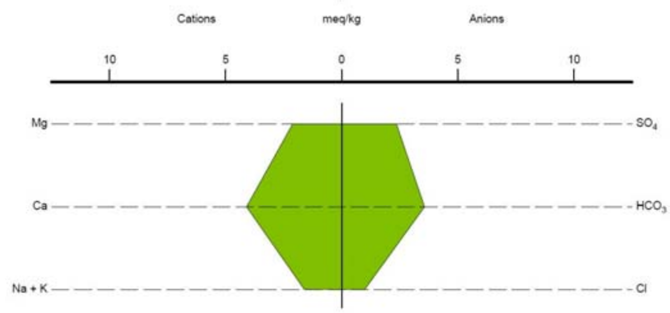
Stiff Diagram: WW-06



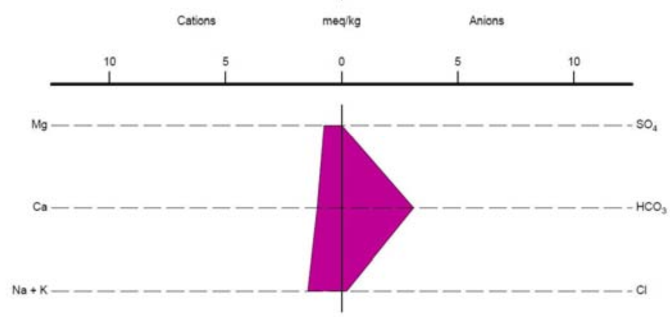
Stiff Diagram: WW-07



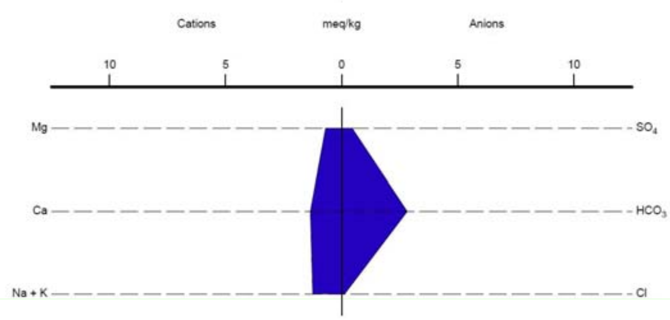
Stiff Diagram: WW-08



Stiff Diagram: WW-09

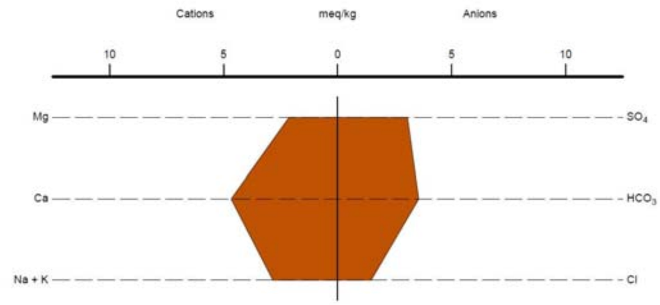


Stiff Diagram: WW-10

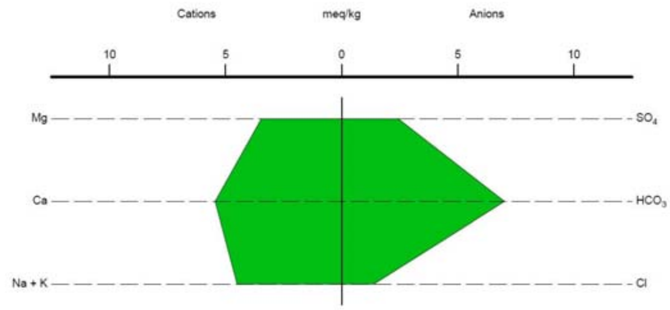


Stiff Plots for Attachment A, Comment 49

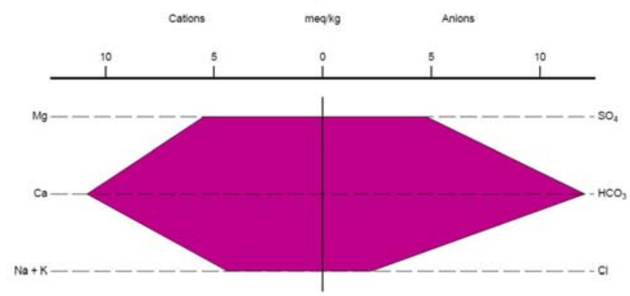
Stiff Diagram: WW-11



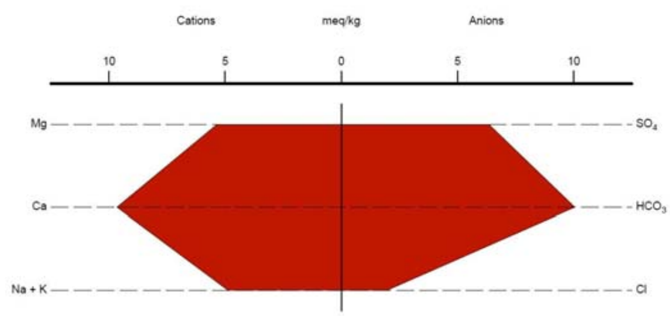
Stiff Diagram: WW-12



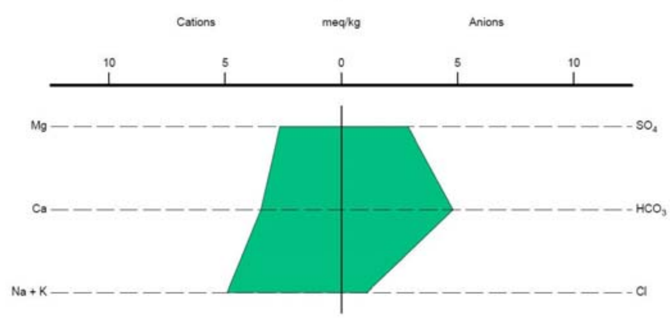
Stiff Diagram: WW-13



Stiff Diagram: WW-14

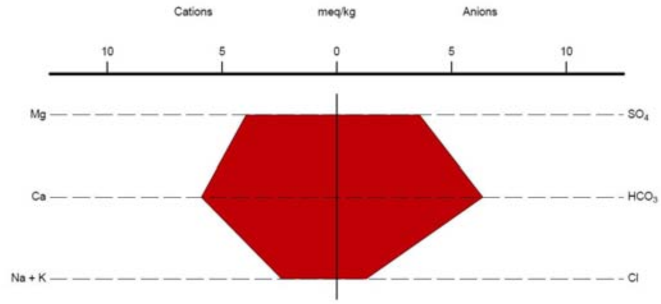


Stiff Diagram: WW-15

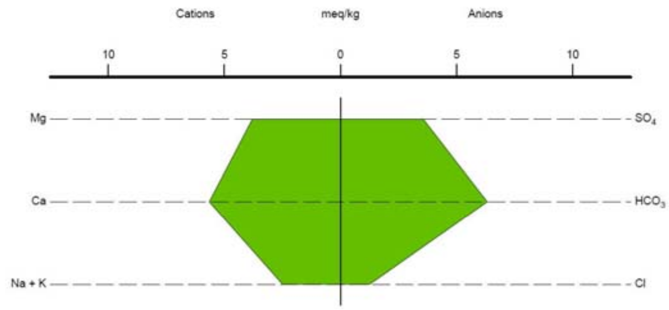


Stiff Plots for Attachment A, Comment 49

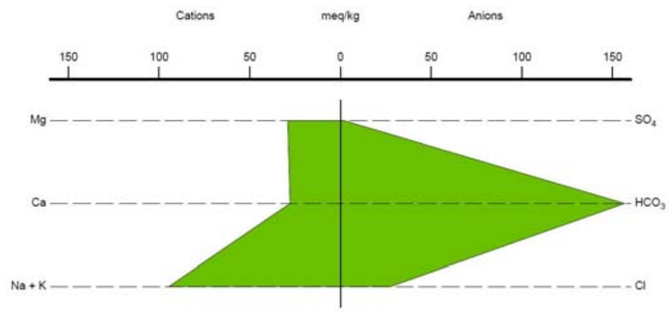
Stiff Diagram: WW-16



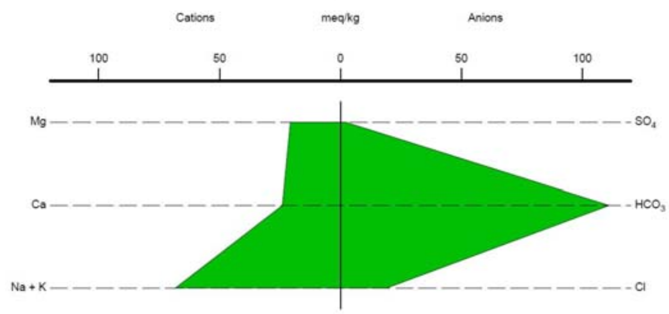
Stiff Diagram: WW-17



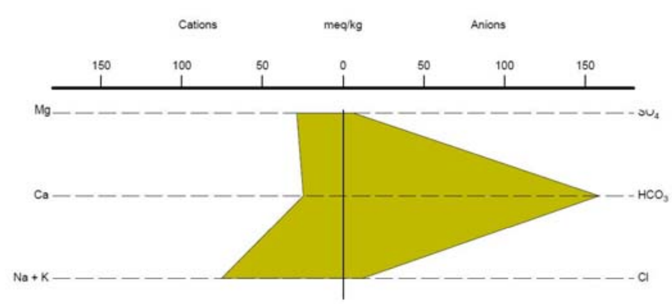
Stiff Diagram: LG-04-06-AVG



Stiff Diagram: LG-07-09-AVG

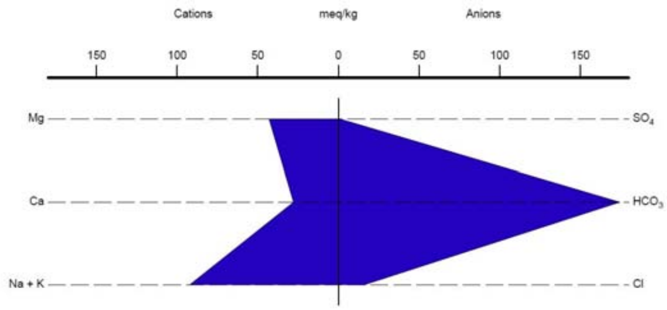


Stiff Diagram: LG-10-12-AVG



Stiff Plots for Attachment A, Comment 49

Stiff Diagram: LG-13-15-AVG



Stiff Diagram: SP-01-04-AVG