November 28, 2012

Office of Environmental Assessment (OEA)
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RE: Lower Yakima Valley Nitrate Study

To Whom It May Concern:

The Washington State Dairy Federation respectfully submits the following comments in response to the recent EPA report entitled: *Relation Between Nitrate in Water Wells and Potential Sources in the Lower Yakima Valley, Washington*.[1] Formed in 1892, the Washington State Dairy Federation is the oldest dairy association in the U.S., representing approx. 450 dairy producers located across Washington State.

Safe drinking water is a goal we all share, which is why the Washington dairy industry in general, and Yakima dairy farmers in particular, have been actively engaged in efforts to address complex non-point water quality concerns. A recent example of this is the involvement of several of our members in the Yakima Groundwater Management Area (GWMA) that was established over a year ago specifically to address nitrates in the lower Yakima Valley. Dairy farm families live and work in these communities and take their responsibilities very seriously to be protective of safe drinking water.

The dairy industry is alone among the major land uses in the Yakima area as the lone entity regularly monitored for compliance with best management practices for nutrient management. Dairy farmers are not water quality experts, so we rely heavily on credible organizations, agencies and institutions like American Society of Agricultural and Biological Engineers (ASABE); Washington State Department of Agriculture (WSDA); Natural Resources Conservation Service (NRCS); Conservation Districts (CDs); and Washington State University (WSU) to provide us with the most current scientifically-based information available and then to certify that our farms are adhering to these standards. Since the inception of the Dairy Nutrient Management program in 1998, dairy farmers have literally spent millions of dollars installing lagoons and other nutrient management technologies that have resulted in an exceptional compliance record. [2] If the protective measures identified, recommended and certified by these groups are not

[1] *Relation Between Nitrate in Water Wells and Potential Sources in the Lower Yakima Valley, Washington*. EPA. September, 2012. **(EPA 2012)**
[2] Dairy Nutrient Management Program - Report of Program Activities - January 1 - Dec 31, 2009

sufficiently protective of the environment, then the dairy industry wants to be the first to know.

Given the serious implications of the EPA report, we have consulted with numerous scientific and technical experts to assist in reviewing this report. What follows is not exhaustive, but a mere summary of some of the report's most striking deficiencies:

Non-representative and Biased Sampling

EPA did not conduct a randomized sampling design, choosing instead a biased design in which they concentrated only on areas of high NO3 concentrations. The report explicitly states this: *"This method of selection would be expected to bias the results compared with a study where the sampling locations were selected randomly."*[3] A truly objective endeavor would have included areas of low N03 concentration, comparing and contrasting them to the surrounding landscape and the areas of high NO3 concentrations.

Remarkably, only one potential source, dairies, included upgradient test wells. [4] It also appears, based on EPA's own rough flow gradient assumptions, that the one upgradient well from Haak's farm is not upgradient. Moreover, the well located upgradient of the dairy cluster shows coliform contamination indicating additional local sources. The absence of upgradient wells for two out of three potential sources makes reliable comparisons between potential sources impossible. The reasons why upgradient wells were sampled for only one out of three of the potential sources investigated are not described in the report, but appear symptomatic of a biased sampling regime.

The report relies on sample results from a single event conducted over the course of two weeks between February 22 and March 6, 2010 to conclude cause and effect. However, natural variability in groundwater quality over time arises from spatial or temporal fluctuations in groundwater recharge or discharge. Groundwater levels that change in response to temporal changes in recharge or discharge may affect groundwater flow rate and direction of movement, which may influence groundwater quality in the vicinity of a monitoring well as it may capture groundwater from different upgradient areas seasonally and limit the ability to identify seasonal trends in the monitoring results. Environmental guidance and standards of practice typically recommend multiple sampling events spaced over a water-year to capture temporal variability. Drawing conclusions perceived as representative of the system over time from a single sampling event violates even the most basic statistical principles. We are aware of tests and analysis subsequently conducted on some of the same wells you tested, and those tests do not confirm your results.

Soil samples were described as taken from the top one-inch of soil and composited. The choice of such a shallow soil sampling depth is very puzzling and the rationale behind this very unconventional approach is not explained. Such shallow sampling may be used when investigating potential surface water contamination, but not typically for ground

[3] Pp. 14 in EPA 2012
[4] Pp. 15 Table 1 in EPA 2012

water research. Deeper, composited soil samples below the roots zone would have provided better results. Also, detailed information on the timing these samples were taken relative to the most recent manure application, method of manure application, soil characteristics, weather conditions, growth stage of crops, etc. must all be factored in in order to determine the potential for nitrate infiltration.

A perfect illustration of sampling inadequacy is given on pg. 36 (Haak Dairy General Chemistry). In this section it indicates that five total well samples were collected for analysis, one from one upgradient well, and one from each of the four downgradient wells. Lack of multiple samples per well fails to account for variability within and among wells. Such minimal sampling does not allow for appropriate statistical analysis necessary to determine if significance has been met. This sampling regime does not even allow for standard statistical analysis and therefore the conclusions derived from it are invalid.

Hydrological Connectivity

Central to the report is the assumption that there is hydrological connectivity between up gradient wells, potential sources of contamination and downgradient wells. To determine this, the report relies on "regional" and "generalized"[5] groundwater flow data from the United States Geological Service (USGS), in lieu of *in situ* testing to actually confirm groundwater flow direction. This approach is insufficient given that preferential flow directions and velocities can vary greatly within and between established aquifers. In order to derive any reasonable conclusions, hydrological direction and connectivity between *specific* sampling locations absolutely must be confirmed.

Detailed Well Information

EPA's choice to use existing wells instead of monitoring wells represents yet another severe limitation. Furthermore, there is a dearth of information on the construction and depth of the wells up gradient from the dairies. The report states: *"lack of complete well information limits our ability to verify if the wells upgradient and downgradient of the sources draw water from the same water bearing zone."*[6] This concession alone is grounds to reject any conclusions that follow from it. A more rigorous study would have included some monitoring wells or at least excluded the two-thirds of wells for which there was no known information.

Lagoon Seepage

The report relies on seepage calculations derived from the lagoon liquid surface area, NRCS permeability rates and seepage rates estimated by Ham (2002). Liquid surface should not have been used in these calculations, as lagoons do not have vertical walls. Instead lagoon bottom areas should have been utilized. The report also fails to acknowledge or credit manure-sealing formation effects that have been well-documented in the scientific literature[7][8][9][10]. These oversights coupled with biased sampling

[5] Pp. 17 in EPA 2012
[6] Pp. 84 in EPA 2012
[7] Cihan, A., J. S. Tyner, and W.C. Wright. Seal formation beneath animal waste holding ponds. Trans ASAE 49:1539-1544.

procedures undoubtedly overestimate the potential for lagoon seepage. The only truly effective means of determining cause and effect would have been to sample underneath the lagoons in question rather than relying on dubious calculations.

Historical Land-use Information

Historical land use information was also absent from this report. The importance of this information cannot be overstated as evidence of groundwater contamination has been shown to persist long after the initial causal activity has ceased. The age dating of water was intended to provide valuable data to address this, however the report accurately states that it is only able to approximate the time of infiltration, not the time of contamination and is therefore unhelpful. While EPA admits the age dating has limited value, the report gives indication of possible ages ranging from recent (coliform contaminated wells) to possibly older than 45 years. Since the study design and results cannot differentiate historical from current effects, it is impossible to distinguish the effect of current and past land uses.

Pharmaceuticals

The detection of both human and veterinary pharmaceuticals is troubling and should be investigated further. The presence of the veterinary pharmaceutical monensin in groundwater is particularly surprising given that previously published work has indicated a relatively short soil half-life[11] [12]. Inclusion in the report of some discussion of possible reasons for these contradictory findings would be useful.

The assertion that dairies are the likely cause of samples testing positive for tetracycline is unfounded. While it is true that dairies use small amounts of tetracycline to therapeutically treat animals, another vastly more ubiquitous agricultural use goes unmentioned in the report. As of 2011, there were more than 70,000 combined acres of apple and pear orchards in Yakima and Benton counties[13]. A disease of great significance in both of these fruits is Fireblight (*Erwinia amylovora)* and tetracycline is frequently used to control it. The most recent *WSU Crop Protection Guide for Tree Fruits in Washington*[14] recommends the use of tetracycline to control Fireblight in both apples and pears at an application rate of 1lb/acre and goes on to state that multiple applications may be necessary for adequate control. Furthermore, it has been demonstrated that tetracycline is naturally produced by soil microorganisms[15]. The report does not describe how naturally occurring and anthropogenic sources of tetracycline were

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[8] Tyner, J.S. W.C., Wright, and J. Lee. 2006. Lagoon sealing and filter cakes. Trans. ASAE. 49:527-521.
[9] Tyner, J.S. and J. Lee. 2004. Influence of seal and liner hydraulic properties on the seepage rate form animal waste holding ponds and lagoons. Trans. ASAE 47:1739-1745.
[10] Sewell, J.I. 1978. Dairy Lagoon Effects on Groundwater Quality. Transactions of the ASABE 21(5): 948-952.
[11] Carlson, J.C. and S.A. Mabury. 2006. Dissipation kinetics and mobility of chlortetracycline, tylosin, and monensin in an agricultural soil in Northumberland County, Ontario, Canada. Environ. Toxicol. Chem. 25:1–10.
[12] Sassman, S.A. and L.S. Lee. 2007. Sorption and degradation in soils of veterinary ionophore antibiotics: Monensin and lasalocid. Environ. Toxicol. Chem. 26:1614–1621.
[13] Washington Tree Fruit Acreage Report, 2011. USDA-NASS. Accessed at: http://www.nass.usda.gov/Statistics_by_State/Washington/Publications/Fruit/FruitTreeInventory2011.pdf
[14] WSU Crop Protection Guide for Tree Fruits in Washington, 2012. EB0149
[15] Asagbra AE, Sanni AI, Oyewole OB (2005) Solid state fermentation production of tetracycline by Streptomyces strains using some agricultural wastes as substrate. World J. Microbiol Biotechnol 21:107–114

distinguished.

Septic Systems

The report may also discount the real or potential contribution of septic systems to groundwater contamination. Using WWTP as a surrogate is not valid for estimating what a localized residential activity and septic system performance. Only testing of the actual septic systems can provide this information. The WWTP could be yielding over or under analysis of certain compounds. The report states that as of 2009 there were 22,000 registered septic systems in Yakima County[16], however it fails to account for the likely total number of unregistered septic systems and the rigor with which current septic systems are inspected for proper functioning. This information is required in order to accurately assess the contribution of septic systems.

Agronomic/Mass balance Calculations

Losses of nitrogen from the agricultural system such as plant uptake, volatilization and denitrification were not adequately accounted for in the report leaving the false impression that the manure is merely produced on farms and for environmental transport. The report underemphasizes the fact that the majority nitrogen derived from manure and applied to crop fields is either denitrified, volatilized, mineralized and sequestered via crop uptake and converted into biomass. Similarly, the report acknowledges the likelihood of field-applied nitrogen infiltrating groundwater is largely dependent on irrigation practices, yet irrigation practices - current and historic - were not described.

Peer Review

EPA recognizes the importance of this study by designating and publishing it on the "influential or highly influential science" website.[17] For science with such a designation, EPA has policy guidance from both OFM[18] and EPA[19]; for peer review, study design and review, and public participation to ensure the credibility of science and of the agency:

"EPA strives to ensure that the scientific and technical bases of its decisions meet two important criteria: (1) they are based upon the best current knowledge from science, engineering, and other domains of technical expertise; and (2) they are credible. Peer review, a process based on the principles of obtaining the best technical and scientific expertise with appropriate independence, is central to sound science and helps the Agency meet these important criteria. (19)

Given the overall poor quality of the report, inadequate peer review is likely. Upon review of public peer review documents, it appears only one reviewer provided substantial comments and these comments do not appear to have been addressed in the final report[20]. In peer-reviewed academic journals, it is up to the discretion of the editor

[16] Pp. 12 in EPA 2012
[17] EPA Peer Review Agenda
[18] Issuance of OMB's "Final Information Quality Bulletin for Peer Review"
[19] Peer Review and Peer Involvement
[20] Relation between Nitrates in Water Wells and Potential Sources in the Lower Yakima Valley, WA

whether or not the reviewer's comments have been adequately addressed. For this report, who was charged with making this determination? EPA's response to reviewers, addressing their comments appears not to be available. Moreover, there is no indication at which phase of the study the reviewers solicited comments. Lastly, is appears that EPA failed to inform reviewers that this report was the basis of an impending EPA enforcement action against four dairy families. All of these factors likely convolved to allow for the premature and inappropriate publication of a scientifically unscrupulous report.

Miscellaneous

The number of animals and amount of waste generated calculations included in the report contains unnecessary information and therefore omission should be considered. For example, the report states that the Haak Dairy produces an amount of waste similar to a community of 115,000 to 278, 000 people.[21] (It is hardly interesting to learn that a 2,000lb animal produces significantly more waste by total volume than a human one-tenth the size.) It would have been far more informative and accurate to represent these numbers on a unit of N/unit basis for both humans and animals. This misleading comparison is repeated again later in the report as well and should also be considered for revision or omission.[22]

Conclusion

We had initially hoped this report would offer an opportunity to gather useful data on the reliability of various sampling and analytical methods to determine relative contributions of potential sources to groundwater nitrate infiltration. However, the data presented in this report are the product of deeply flawed assumptions, poor experimental design, biased sampling protocols, and inadequate peer review. In the absence of these basic scientific tenants, the report relies heavily on inferences, vague estimates and speculation, but has no valid data or statistical analysis to draw any conclusions about any of the sources as contributors. The overall lack of scientific rigor displayed throughout this report strongly suggests than no conclusions can be drawn about which sources are contributing to nitrate in wells.

In sum, the dairy industry stands by its commitment to explore practical, scientifically based solutions to the complex challenge of groundwater contamination. In this vain we respectfully request EPA carefully review and consider our comments and solicit comprehensive external peer reviews by scientists actively working and publishing in relevant fields outlined in the report to confirm or deny our analysis.

Thank you for the opportunity to comment and we look forward to answering any questions EPA may have.

[21] Pp. 32 in EPA 2012
[22] Pp. 48 in EPA 2012