Save Family Farming

Washington State Dairy Federation | Idaho Dairymen's Association |

Oregon Dairy Farmers Association

EPA Yakima Nitrate Report

Summary of Concerns
(Including technical analysis by former NRCS Agronomist Richard Fasching)

January 2019

Background

On November 1, 2018 four dairy farmers and the Executive Director of Save Family Farming met with US EPA Region 10 Administrator Christopher Hladick and three EPA staff members. After hearing of the strong concerns of the farming community about the 2012-2013 Yakima Nitrate Report published by the EPA, the Administrator requested farm representatives meet with staff led by Edward Kowalski to discuss concerns about the Report and review recent monitoring results.

Save Family Farming with the support of the Washington State Dairy Federation is submitting this summary of concerns in order to expedite these important discussions. Our concerns are that EPA Region 10 is failing to recognize extremely serious flaws in both process and substance with the 2012-2013 Lower Yakima Nitrate Study and Report. This report was listed as "important and highly influential" yet it did and does not meet EPA standards for that designation. The report peer review process failed to follow numerous EPA and Federal peer review guidelines and policies. Even more troubling is the substantial content differences between the draft report that was reviewed in early 2012 and the published report that was released in the fall of 2012. The report failed to produce credible and reliable scientific results according to virtually every outside reviewer. The report should be recognized as flawed and withdrawn until, or unless, a properly conducted, independent peer review establishes its validity.

Washington State Dairy Federation retained Richard Fasching to conduct an analysis of the Report and the peer review. He served as Regional Agronomist for the US Department of Agriculture Natural Resource Conservation Service (USDA NRCS) in the Western US. His responsibilities included the technical development and implementation of the Nutrient Management Waste Utilization standards as well as technical training to states for Comprehensive Nutrient Management Planning. Mr. Fasching's in-depth analysis is provided to help inform EPA Region 10 leadership and staff of the serious faults with this study. His analysis includes this summary:

"In 2012 EPA concludes that their screening analysis showed that about 65 percent of the nitrogen generated in Yakima County comes from livestock predominantly as dairy cattle, about 30 percent from fertilizers applied to irrigated crops, about 3 percent from septic and wastewater systems, and the rest, less than two percent, from other relatively minor sources. They particularly investigated the Yakima Valley Dairy cluster and concluded that the dairy producers were causing groundwater contamination in wells miles away from their application and lagoon sites location...In their 2012 investigation of the Yakima Valley Dairy cluster EPA made numerous errors in data collection, therefore raising doubt and distrust in the conclusions."

Summary of Concerns

This Report and the scientific methodology employed to generate the results failed to meet EPA and federal peer review policies for important and influential information. The dairy farming community believes that if EPA, during the EPA sponsored peer review in early 2012, had allowed objective, independent peer reviewers the opportunity to actually examine the full report, including methodology, data collection and subsequent conclusions drawn by EPA staff this Report would never have been published. Those experts who did review the published Report during the public comment period in late 2012 were in full agreement regarding the errors. This includes experts from Texas A&M, Washington State University, the Yakama Nation, Washington Department of Agriculture and the USDA and many others. The scientific errors are so obvious and substantial that government leaders, public and private entities and ordinary citizens question if the report reveals not just incompetence but an intention to intentionally and fraudulently place blame on dairies for nitrate contamination.

Please refer to the Technical Analysis for details substantiating the summary of concerns. Topics addressed:

1) Peer review

2) Soil testing
3) Manure sampling
4) Lagoon storage
5) Manure application and irrigation water management
6) Legacy nitrate
7) Nitrate source identification
8) Updated data

1. Peer Review

The study and Report did not meet federal or EPA policies for peer review required for important and highly influential science and information. Such information is used for agency decisions that affect policies and enforcement action. EPA generated this information for enforcement purposes and used it as the basis for inducing dairy farmers into signing an extremely costly and punitive Administrative Order on Consent. The supporting document will detail the failings of the peer review used. In summary:

- The reviewers were provided limited data and information and asked to only respond to seven questions
- Only two reviewers provided uncritical comments and both those were EPA officials
- The USGS reviewer submitted comments consistent with other experts who reviewed it but who were not part of the EPA peer review process
- The expert from the USDA Agricultural Research Service (ARS) that was asked to review it, Dr. David Tarkalson, requested his name be removed after he saw the published Report; citing the failure of EPA to provide him with the complete report and therefore the information needed to review the study.

The public comment included numerous critiques from recognized experts from agricultural science, the NRCS and academia. All noted the Report failed in its goal to identify sources of nitrate in groundwater. The EPA produced a "Responsiveness Summary" that while acknowledging many of the science critiques as legitimate, nevertheless and despite this, EPA found no reason and took no action to alter their conclusions.

2. Soil testing protocol/technique

EPA's methodology for securing soil samples to determine nitrate loading in soil demonstrates the study was flawed from the outset. These flaws are found from the directions instructing the science team to follow an inappropriate process of collecting soil samples from fields where manure had recently been applied, then using a teaspoon to extract samples to a depth of one inch. Mr. Fasching's analysis provides details on numerous problems in the soil testing regime including:

- sample timing

- sample management
- sample handling
- number of samples or cores

His conclusion: *"The resultant analysis and conclusions derived from these improper sampling techniques are significantly erroneous."*

3. **Manure sampling**

As with proper soil sampling, manure sampling is an essential part of managing nutrients to protect water. Regarding manure sampling Mr. Fasching concluded: *"In addition to improper soil testing, EPA also erred in their attempts at collecting representative lagoon samples. Their improper collection methods resulted in erroneous results that grossly misrepresent the total amounts of nitrogen produced and consequently applied to fields."*

The technical analysis explains the proper procedure for collecting manure samples that accurately determine the amount of nutrients that will be applied. These include collecting samples in the field just before applying, not directly from the lagoon. Collecting samples from the lagoon or too far in advance of application will lead to erroneous results because such samples would not reflect the 70% to 80% loss of nitrogen to ammonia through handling and storage. The samples must also be taken immediately to a lab or frozen prior to delivery to ensure accurate results.

Mr. Fasching concludes: "*EPA did not follow either of those standard procedures and fraudulently reported the analysis results anyway.* "

4. **Lagoon storage**

EPA made numerous errors in predicting seepage rates from the lagoons they were investigating. Mr. Fasching points out four:

- improper use of lagoon construction guidelines (an abuse that the reviewer from the Yakama Nation said represented "borderline recklessness.")
- gross overestimation of lagoon storage volumes and therefore leakage
- storage design
- storage losses

Misusing a planning field guide, using aerial photography to determine storage volumes, failing to consider construction and condition of lagoons being studied and failing to include very significant losses of nutrients from storage and handling all led EPA to grossly overestimate leakage from lagoons.

It is well established that lagoons built to NRCS standards are protective of water. The errors made by

EPA in establishing leakage rates negate their conclusions about leakage and contributions to water quality concerns. However, these faulty conclusions were nevertheless used to coerce farmers into installing liners that will do little to nothing to protect water but are severely impacting the ability of these farms to continue operation. If EPA's existing and unjustified demands are promulgated more broadly, as the litigation industry is attempting to do using this false report, this one faulty finding alone will potentially put many family dairy farms in Washington state and across the western U.S. out of business.

5. **Manure application and irrigation water management**

It is well understood that protecting water and growing crops depends upon applying nutrients at agronomic rates. The numerous errors made by the EPA in this study contribute to a severe miscalculation of the contribution of nitrate to groundwater through field application. That miscalculation is based on:

- failure to recognize timing of nutrient uptake
- improper soil testing
- improper manure sampling
- inappropriate means of calculating lagoon volumes and therefore application rates
- failure to consider nitrogen losses from storage and handling

These errors are compounded so that the conclusions reached by EPA about over application bear little to no relation to reality. Fortunately, farmers have kept and are keeping excellent records and the technical analysis provides great detail of how these farms are and were applying at the appropriate rates to allow crop production while protecting water.

6. **Legacy nitrate**

The inability admitted in the report to determine the presence of legacy nitrate is one of the most significant failings. The technical analysis refers to a section in the report that plainly states that EPA was not able to determine when the nitrate entered the water. This is a crucial issue given the prevalence of legacy nitrate.

The dairy farms included in the study, like most larger dairies in the Valley, are relatively recent. But the Yakima Valley has been a highly productive farming area for many generations. Much of the current land used to grow forage crops for dairy cows was used to grow sugar beets, potatoes and other crops.

In the years following World War II when commercial fertilizer became available at very low-cost farmers were told that more was better. Over application was often accompanied by flood or rill irrigation systems which drove excess nutrients into groundwater. In some areas, Whatcom County for example, nitrate levels in farming areas are decreasing especially near dairy farms. A good indication that farmer stewardship, the use of nutrient management plans and appropriate regulations are helping repair the damage from the past.

If the EPA's conclusions are correct, how do they explain that most other farming areas in eastern Washington have nitrate in groundwater similar to or greater than Yakima? This includes Benton and Franklin counties where little to no dairies or other animal agriculture exists (a nitrate map showing this is also included in the technical analysis). A study from Canada shows that legacy nitrate requires 30 to 50 years to improve with improved protection including better farm practices.

7. Nitrate source identification

Despite the comment made by Mr. Winnicke in the November 1 meeting that all sources of potential nitrate contamination were thoroughly investigated, most reviewers of the Report noted that readily available information about other potential sources was simply ignored or discounted. We mentioned legacy nitrate above. Another well-established source, demonstrated in multiple areas in rural areas that include suburban development, is On-Site Sewage Systems. The EPA has provided detailed information on the contribution of these systems to water contamination. Failing systems combined with specific levels of concentration are known to be significant issues.

Mr. Fasching identifies in the technical analysis additional potential sources that were not adequately investigated.

8. Updated data

In the November 1 meeting, Mr. Kowalski stated that the current data coming from the dairies under the AOC demonstrate the Report was correct and, if anything, too conservative. He specifically referred to manure lagoon leakage data.

We have attempted to identify the data he is referring to. The analysis provided by Mr. Fasching demonstrates the erroneous nature of EPA's lagoon leakage conclusions. We are not aware of any soil tests or test wells directly below lagoons that can substantiate and justify Mr. Kowalski's conclusion. As we have seen in the testing beneath the Haak decommissioned lagoon, the ammonium and nitrate levels in seepage from the lagoon drops to background levels – due to biological processes - in two to three feet beneath the liner. This background level is maintained except for a small ammonium increase at 5-7 feet then back to background levels to 45 feet. This potentially suggests the presence legacy nitrogen, not lagoon leakage. These results are consistent with other studies, including a more recent evaluation beneath a decommissioned lagoon in Western Washington and studies conducted by the Department of Ecology in the 1990's. Further, page 80 of the March 2013 report states that the EPA was not able to determine the age of the water thereby confirming they cannot determine whether nitrate in the groundwater is legacy or from recent farm activities. This acknowledgement undermines conclusions about source of the nitrate, including those made by Mr. Kowalski in the November 1 meeting.

In short, there is nothing in the updated data that suggests the report is justified or correct.

Richard Fasching Technical Analysis

Introduction

Sound management practices are essential to maximize the agronomic and economic benefits of manure while reducing the risk of adverse environmental consequences. Livestock producers do not intentionally put water quality at risk. Virtually every regulatory and voluntary manure management approach calls for producers to develop a Comprehensive Nutrient Management Plan (CNMP). The plan documents how much manure is produced and how it will be managed. At the core of these plans is the concept that manure and commercial fertilizers will be applied at agronomic rates to crop land and hay land.

The agronomic rate is a nutrient application rate based upon a field-specific estimate of crop needs and an accounting of all N and P available to that crop prior to manure (and/or fertilizer) application. Implicit within the agronomic rate concept is an application rate that does not lead to unacceptable nutrient losses. The agronomic rate is not something that can be directly obtained from a textbook or tables. Rather, it must be evaluated for each farm and field. Knowledge of manure or effluent nutrient content and residual soil nutrients is critical to determining how much can be safely applied so that the agronomic rate is not exceeded.

While producers across the US were encouraged in the past to fertilize for maximum crop yields, now they also consider the environmental risk of nutrient losses in determining how much manure or fertilizer to apply. By knowing the relationship between manure nutrient content, residual soil nutrients, and crop needs, wise decisions are made such as where to spread manure, and how much needs to be spread.

In 2010, the USEPA conducted a study generated primarily due to concerns of ground water contamination and high levels of nitrates in water wells in the Lower Yakima Valley. The nitrate in these wells was consistent with nitrate levels in other similar farming areas throughout the nation and Southeast Washington. In an effort to determine the source of the nitrate in groundwater, dairy producers in proximity to the wells were identified by EPA as potential sources. To validate their claim, EPA collected a limited amount of data and performed various tests attempting to pinpoint the sources of nitrates. The final published report concludes that the dairy producer’s facilities and their associated crop and hay fields were the principal sources of high nitrates in the wells.

Concerns

1. Peer Review

In late 2011 EPA solicited peer reviewers for their report. The peer review process began in January 2012 with four selected individuals that were to provide an independent third-party review. However, the process ended with three of the selected individuals US EPA employees ("We would like to acknowledge the following individuals who provided an independent third party review of the report: Megan Young, PhD, U.S. Geological Survey; Stephen Kraemer, PhD, U.S. EPA Office of Research and Development; Roger Burke, PhD, U.S. EPA Office of Research and Development; and Lorraine Edmond, U.S. EPA Region 10" -ref. 2013 Final EPA report, Acknowledgements). It should be noted that Dr. David Tarkalson, USDA Agricultural Research Service, was one of the initial selected reviewers but asked to have his name removed from the report in December 2012 before final publication. He concluded that he was given a draft report that when compared to the fall 2012 published report was missing numerous pages of introductory statements as well as conclusions. Dr. Roger Burke replaced him on the review team.

It is almost certain that the significant information missing from the materials provided to Dr. Tarkalson was also missing in the information provided to other reviewers thereby limiting the value of their response. It is further understood that rather than seeking a full review of the study and report, the EPA limited the input by asking the reviewers to answer seven specific questions. We further note that Dr. Young's response included detailed concerns about groundwater flow directly and adjacent to non-dairy crop fields which undermine some of the critical assumptions and conclusions of the Report.

The peer review process utilized by EPA violates numerous versions of their own peer review policy, some enacted in 1994 and later updated in December 2004 and January 2006. The 2006 Peer Review and Peer Involvement policy specifically established policy requiring *"peer review of scientifically and technically based work products, including economic and social science products, that are intended to inform Agency decisions. Peer review, a form of peer involvement, is one process through which EPA staff augment their capabilities by inviting independent subject-matter experts to provide evaluation of the work product." - ref. Peer Review and Involvement, US EPA, Jan. 31, 2006*

The 2006 Peer Review policy further explains that, 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. The policy goes on to reiterate the importance of appropriate peer review: *"peer review is central to sound science and helps the Agency meet important criteria."* By EPA policy, peer review occurs when scientifically and technically based work products are evaluated by relevant experts who were not involved in creating the product. The policy also states that agency managers are accountable for ensuring that Agency policy and guidance are appropriately applied. *"For influential scientific assessments, external (External, in which the reviewers are independent experts from outside EPA) peer review is the expected procedure."* EPA policy requires that peer review be completed prior to public dissemination of any report.

In September 2012 US EPA simultaneously released their report and delivered a consent decree to four

Yakima Valley dairy producers (Haak, De Ruyter (2 farms), Cow Palace (Dolsen family) and Bosma) requiring immediate action. It wasn't until the Washington State Dairy Federation and Congressman Doc Hastings got involved that the EPA acquiesced to allow a short "public comment" period ending November 2012 (outside the official pre-publishing peer review process). The public comment period generated substantial feedback to EPA identifying numerous critical technical problems and mistakes with the report. EPA did acknowledge some errors in their report and prepared an errata sheet summarizing any corrections (or lack of). However, in most cases, even though many comments pertaining to lack of science-based integrity in the study were made by recognized experts during the post peer review, EPA ignored the stated concerns or dismissed the comments entirely. Only minor insignificant edits to the content of the report were made.

EPA's own policy was not followed in publishing this report. Because it was not followed, there are numerous technical errors and mis-diagnosis of data that grossly misrepresents the causes of groundwater and residential drinking water degradation. According to the published report this contamination is caused directly by the dairy producers of the Yakima Valley. Due to the lack of appropriate peer review, violating federal guidelines established by the Office of Management and Budget as well as EPA's own policy related to peer reviews, **the report is not based on science**.

2. Soil Testing Protocol/Technique

Soil testing serves as the foundation for crop nutrient and environmental responsible nutrient applications. Soil sampling has been an important part of agriculture since the 1800's. Land grant universities across the nation began conducting research already in the early 1900's that undergirds soil sampling and analysis programs in use today. Science based soil sampling techniques and analysis have been around since the 1940's developed by land grant universities in nearly every state in the US. The ultimate goal of soil sampling is to properly characterize the nutrient status of a field or zone accurately. Nutrient characterization and fertilizer recommendations are based upon proper soil and tissue tests and depend upon three factors: representative sampling, accurate analysis and proper interpretation of the analytical results. A soil sample must correctly represent an area of soil or a field. The resulting data obtained is only worthwhile if the tested soil sample accurately represents the sampled field. Sampling a zone or field at the depth of one inch does not follow any land grant university guidelines or recommendations for crop land nutrient sampling in the State of Washington or anywhere else in the US.

Below are explanations of proper soil testing which, if followed, would have produced significantly different results than what EPA reported. The sampling protocol which included targeting fields where manure had recently been applied, then using a teaspoon to extract a sample at a depth of one inch demonstrates either an exceptional level of scientific incompetence or a willful effort to deceive.

-Sample Timing

Timing of soil sampling is extremely important. The best time to sample is as close to planting time as possible for determining growing season nutrient availability. Sampling to diagnose poor crop growth or environmental issues should be taken while problem areas are delineated (when problems are occurring). Samples should never be taken shortly after application of organic or inorganic fertilizer applications as nutrient results will be dramatically inaccurate. For example, manure can dramatically increase nitrate results if applied to the soil surface.

-Management

Translation of soil test data into meaningful characterization involves the integration of all available pertinent information. Sampling should be completed by experienced agriculturalists who understand the principles of fertility and plant nutrition and who are familiar with the soils, crops, and management in the area being sampled. For example, it is extremely important to know the cropping and tillage history of the area being sampled to be able to diagnose potential nutrient availability. Additionally, areas within a field including headlands, turn rows, or areas that received recent applications of organic or inorganic fertilizers should be avoided as soil test results will not be representative of the entire field. The soil sampling procedures utilized by EPA to characterize crop land and hay land fields of the dairy farms did not meet standard operating procedures established in Washington. The resultant analysis and conclusions derived from these improper sampling techniques are significantly erroneous.

-Handling

Samples intended for nitrate-N analysis should be stored in ice chests/coolers during transport. Moist samples subjected to heat will result in N release through microbial mineralization, and the soil test N values will dramatically increase during transport and storage. Samples intended for nitrate-N analysis must be air-dried immediately after collections to prevent alterations of nitrate-N concentrations due to microbial activity. EPA did not follow these guidelines which resulted in analysis that were not representative of the area.

-Number of Samples or Cores

The accuracy of, and confidence in, a measured soil test level is positively related to the number of soil samples collected per field or zone. “Accuracy” measures how close the soil test value is to the actual field average, whereas “confidence” is how often the level of accuracy can be repeated. To have the greatest confidence and highest accuracy in a particular soil sample, a larger number of subsamples is required.

EPA should have collected at least 25 subsamples down to the crop rooting zone to ensure 90% confidence that their nitrate analysis was within +- 15% of the measured results. Because sampling was completed incorrectly and at an improper depth (the highest amounts of N are typically located in the top 0-6 inches of soil are found in reduced amounts as you sample deeper into the soil profile), the sample(s) collected represent fraudulent results that do not accurately represent the characterization of the area sampled of any field of the dairies.

3. Manure sampling

In addition to improper soil testing techniques, EPA erred in their attempts at collecting representative lagoon samples. Their lack of proper collection methods resulted in significant misrepresentations in the total volume, characteristics, and concentration of nitrates found in the manure storage systems. A representative manure sample is essential to provide an accurate reflection of nutrient content. Manure nutrient content is NOT uniform within storage structures so obtaining representative samples is *vital*. Proper mixing and sampling strategies are required to ensure that samples accurately simulate the type of manure that will be applied.

Sampling manure prior to application(s) does not give a completely accurate measure of nutrient content if the sampling is collected too long in advance of application due to handling and storage losses or when liquid storage structures are not adequately agitated. EPA's storage sample collection and estimated volumes and nitrate concentrations based on sampling did not account for storage losses (i.e., a liquid manure lagoon will lose 70-80% of its nitrogen as ammonia during handling and storage. MWPS-18, Livestock Waste Facilities Handbook).

There are really ONLY two ways to properly collect liquid manure samples, one from the storage facility itself and one in the field. THE BEST samples are collected in the field as liquid manure is applied by an irrigation system.

To sample directly from a storage facility, a sample must be collected with a sampling probe or tube. The tube should be longer than the depth of the facility. The tube should be slowly inserted into the entire depth of the lagoon. Each tube full of liquid should be placed into a bucket. Repeat this process at least 3 times in differing locations of each storage facility or lagoon to make a composite sample from each lagoon. Important - if the samples cannot be mailed or transported immediately to a lab within a few hours, they must be frozen to maintain accurate analysis results.

EPA did not follow either of these standard procedures yet reported and based conclusions on the erroneous analysis results anyway.

4. Lagoon storage

- Seepage Predictions

Using generalized recommendations contained in the USDA NRCS Animal Waste Management Field Handbook (AWMFH) to predict seepage loss contributions from individual farms is misleading and incorrect use of the guidelines. AWMFH is well supported by research and field experience throughout the US however, they are "planning" guidelines and are generalized recommendations that are adjusted to accommodate on site variables during installation phases of construction. AWMFH seepage rates cannot be used to predict leakage losses from multiple dairies distributed randomly in a watershed. The generalized seepage rates are strictly used for planning purposes to anticipate the potential for loss and the need for additional practices that provide adequate protection of localized water resources. EPA did not access important on farm sites or data that could have allowed for more accurate estimates of possible water degradation. The use of planning guidelines to estimate actual degradation is improper use of the AWMFH and the resultant estimates are incorrect.

- Storage volumes

The use of aerial photography to determine storage volumes grossly over estimates each operations manure storage capacity and therefore also over estimates seepage losses (if any). EPA did not measure the capacity of the lagoons on site. Every lagoon is built with specific side slopes and depth to hold appropriate amounts of effluent. In an attempt to calculate the total effluent holding capacity of the dairy lagoons in this study, EPA simply utilized aerial photography to measure the length and width of each lagoon and then assign a nominal depth. They did not consider side slopes nor differing depths. They also did not take into consideration the amount of free-board allowed in each lagoon (free board is designed into each lagoon for safety measures). This lack of detail grossly over-estimates the total amount of effluent stored in lagoons at any time.

Producers keep extremely detailed records of their lagoons. The total capacity of their lagoons varies tremendously. One producer’s lagoons total 25,000,000 gallons (two farms), another 62,500,000 gallons, and the third’s totals 39,000,000 gallons. Capacity as such is not the only detail that is needed. Records showing the actual amount of effluent applied to fields is critical when attempting to discern if agronomic rates were being applied and whether possibility of groundwater contamination is possible. Additionally, amounts of manure transferred off site is critical when assessing total quantity of nutrients. EPA did not collect any effluent field application data in their study nor did they collect offsite manure transfer data. Again, the dairy producers keep excellent detailed records showing one producer transferring 100,000 tons of wet manure off site annually to a private composting facility, and another recorded exporting 13,123,900 gallons off site (in 2012).

EPA in their report concluded the dairies were the direct source of nitrate contamination in the groundwater specifically due to the large quantities of effluent leaking lagoons that allowed effluent to seep many feet below the lagoons, and over application of effluent onto cropland. Their conclusions are based on extremely limited tests that were incorrectly collected resulting inaccurate analysis. In the case of nitrogen contained in the storage lagoons, EPA attempted to estimate the total amount of manure by measuring the surface area of the lagoons with no measured data pertaining to depth, side slopes, or free-board (or data on how full each lagoon is typically due to emptying and filling cycles). This lack of consideration grossly overestimates the quantity of effluent and thus the total amounts of nitrogen that might be contained in the storage facilities. Additionally, EPA failed to consider natural nutrient losses from storage, handling, and land application which are significant!

- Storage design

Storage facilities are designed following rigid engineering standards (NRCS standards or private industry) and local code usually requires monitoring for failure. EPA does not know if the storage structures were designed per code or if engineering guidelines were followed. Yet, there are many factors that could lead to a leaking storage facility. Yet, EPA targeted all operations upgradient of contaminated wells and unfairly focuses attention on well-managed operations. EPA collected only limited data from lagoons pertaining to seepage or leakage and cannot be used to surmise that all lagoons are leaking.

EPA did not determine whether the storage facilities were designed to handle the number of animals confined.

- Storage losses

Plant roots take up nitrogen in the form of nitrate (NO3) and *ammonium-N* (NH4). Major losses of N to the environment occur when ammonia gas (NH3) is lost to the air. Manure that contains large amounts of ammonium-N contain much PAN (plant available nitrogen) that is subject to volatilization to the atmosphere shortly after application. EPA failed to consider these storage losses in their attempts to quantify nutrient loads. Under the climatic conditions found in the Yakima Valley, ammonium (NH4) is readily transformed into ammonia (NH3) and is lost as a gas. Nitrogen lost as ammonia reduces plant available nitrogen that might be supplied by manure. The estimated fraction of manure ammonium-N *lost* after application from the dairy lagoons is high, approximately 45%.

PAN is released from manure organic N through microbial activity in soil in a process called mineralization. Organic N mineralizes most rapidly during the first months after application. The mineralization rate decreases over time. The dairy lagoons have approximately 1-5% dry matter (95-99% wet) classified as “thin slurry”. Accordingly, only 40% of the organic N mineralizes into PAN the first year, 15% the next year, 7% the next year, etc. EPA did not differentiate slow release mineralization but simply assumed all N leaches or is available to crops.

5. Manure Application and Irrigation Water Management

Animal manure has long been used as a source of nutrients for crop growth. Livestock manure or mixtures of manure and related organic by-products make excellent fertilizers and soil amendments. Manure provides benefits to the soil, as well as offsetting the amount of nutrients needed in the form of commercial fertilizers.

Manure contains necessary plant nutrients including nitrogen, phosphorus, potassium and a variety of micro-nutrients. Additionally, the high organic content of manure can readily improve soil quality by enhancing tilth, leading to better water and nutrient holding capacity.

- Nutrient Availability

Organic nutrients in manure are typically *not* available to a crop immediately upon application. **A producer can reasonably expect up to half of the nitrogen content to be available to a crop in the first season (range from 25-50%), the other half divided between residual value for the next year and volatilization (loss to the atmosphere)**. The application method also significantly affects the amount of nitrogen available to a crop. EPA did not consider N availability due to timing.

The method of manure application is determined by the type of manure collection system you are dealing with. Solids are typically broadcast from a box type spreader. Slurries, a mix of solid and liquid, are applied with a tanker or a big gun irrigator. Low solid liquids (like those from dairy lagoons) are normally applied using irrigation pivots or similar irrigation system. Applying manure liquids through a pivot or big gun system **will volatilize 50-70% of the analyzed nitrogen in the sample**. EPA did not accommodate for these losses in their calculations.

Application rates for any fertilizer must be based on accurate recent soil tests and the particular crop's nutrient needs. To do this, you simply take the crop nutrient needs, subtract what is present in the soil and, then calculate a rate based on manure nutrient content taking into consideration first year availability and all other losses. Timing of applications are particularly important. Nitrogen can easily be lost to the atmosphere through volatilization. Nowhere does EPA attempt to calculate appropriate agronomic rates.

- Miscalculation of agronomic rates

In 2012 EPA concludes that their screening analysis showed that about 65 percent of the nitrogen generated in Yakima County comes from livestock predominantly as dairy cattle, about 30 percent from fertilizers applied to irrigated crops, about 3 percent from septic and wastewater systems, and the rest, less than two percent, from other relatively minor sources. They particularly investigated the Yakima Valley dairy cluster and concluded that the dairy producers were causing groundwater contamination in wells miles away from their application and lagoon sites location. A well-designed nutrient management program includes multiple components to maintain fertility for crop growth and development. A well-designed soil sampling plan, including proper soil test interpretations along with manure sampling, manure nutrient analysis, equipment calibration, appropriate application rates and methods are all critical components. EPA, in their investigations of the Yakima Valley dairies in 2012, concluded that groundwater is being contaminated with nitrates due to improper application and too many nutrients (non-agronomic rates). However, EPA makes their conclusions from incorrectly collected soil sampling, waste sampling, and without adequate basic facts pertaining to cropping or irrigation systems to make such conclusions. To accurately determine what the needs of a crop are consideration *must* be given as to the proper rate, proper timing, the proper source, and the proper placement of nutrient applications including manure. Ignoring any of these while diagnosing an environmental issue or production problem will result in inaccurate conclusions. **In their 2012 investigation of the Yakima Valley dairy cluster EPA made numerous errors in data collection and fraudulently arrived at their conclusions**.

To make clear the serious errors made by the EPA, it is valuable to look at the nutrient application and uptake levels from the farms as revealed in their detailed records. Nutrient needs must be calculated to determine whether there is potential environmental harm occurring. There are two ways to address agronomic rate. One is to develop a nutrient budget based on land grant university crop nutrient recommendations and realistic yield goals. The other is to simply apply nutrients based on crop removal rates. A nutrient budget is typically developed for each individual field based on residual soil nutrient concentrations determined from soil tests, crop rotational needs, and realistic yield goals.

Although the Yakima Valley dairy producers differ somewhat in their crop rotations and yields, they each generally follow a rotation of alfalfa, and double-cropped triticale/corn silage. Based on the number of acres of each crop produced and projected yields, the total amount of nutrients a crop will remove in any one year can easily be calculated. When we know the amounts of nutrients removed by a crop, we can then get a good idea, based on water application (effluent) requirements to grow a crop, if agronomic rates are being followed.

To demonstrate the degree to which EPA erred in their estimates of nutrient below are the calculations for the nutrient budgets based on the detailed records provided by the indicated farms. Available records go back to 2008, however this information is from 2012 and therefore useful in determining whether the farms in the dairy cluster were applying at agronomic rates at the time of the study.

Producer 1: (Bosma)

Crop	Crop Removal Rate		Yield		Acres		Total NO3 Removed
Alfalfa	50.39 lbs/ton	x	25 t/ac	x	372	=	468,627 Lbs
Triticale	20.53 lbs/ton	x	7 t/ac	x	1191	=	171,159 Lbs
Corn silage	7.75 lbs/ton	x	35 t/ac	x	1191	=	323,059 Lbs
				Total removed			**962,844 Lbs**

Producer 2: (Dolsen)

Crop	Crop Removal Rate		Yield		Acres		Total NO3 Removed
Alfalfa	50.39 lbs/ton	x	12 t/ac	x	228	=	137,867 Lbs
Triticale	20.53 lbs/ton	x	6 t/ac	x	305	=	37,570 Lbs
Corn silage	7.75 lbs/ton	x	35 t/ac	x	305	=	82,731 Lbs
				Total removed			**258,168 Lbs**

Producer 3: (DeRuyter)

Crop	Crop Removal Rate		Yield		Acres		Total NO3 Removed
Alfalfa	50.39 lbs/ton	x	12 t/ac	x	2300	=	1,390,764 Lbs
Triticale	20.53 lbs/ton	x	6 t/ac	x	6500	=	800,670 Lbs
Corn silage	7.75 lbs/ton	x	35 t/ac	x	6500	=	1,763,125 Lbs
				Total removed			**3,954,559 Lbs**

Grand Total for all 3 producers 5,175,571 Lbs of NO3 needed per year

Producer 1: (Bosma) Total N

Crop	Irr water applied	Lbs/1000 gal	Acres	Total NO3 Applied
Alfalfa	17,856,000 gal	5.46	372	97,494 Lbs
Triticale/ Corn silage	58,359,000 gal	5.46	1191	318,640 Lbs

(note-triticale and corn silage are double cropped)

Total NO3 Applied 416,134 Lbs

Producer 2: (Dolson)

Crop	Irr water applied	Total N Lbs/1000 gal	Acres	Total NO3 Applied
Alfalfa	11,637,000 gal	3.76	228	43,755 Lbs
Triticale/ Corn silage	38,000,000 gal	3.76	305	142,880 Lbs

(note-triticale and corn silage are double cropped)

Total NO3 Applied 186,635 Lbs

Producer 3: (DeRuyter)

Crop	Irr water applied	Lbs/1000 gal	Acres	Total NO3 Applied
Alfalfa	117,390,789 gal	4.77	2300	559,954 Lbs
Triticale/ Corn silage	809,836,066 gal	4.77	6500	3,862,918 Lbs

(note-triticale and corn silage are double cropped)

Total Applied 4,422,872 Lb

These producers apply nutrients to their crops mostly via effluent application from their dairy lagoons along with some supplemental commercial fertilizers, it is fairly easy to determine how much nutrient is being applied as recorded in their application records. The following does not include fresh water added.

If you compare the amount of nitrate each farm requires just to grow their crops with the amount of nutrients it is applying, you can see that two of the farms are removing more nitrate than they are applying (producer 1 & 2). The third producer under-supplies nutrients on his alfalfa but slightly over applies on his double cropped triticale/corn silage (applies approx. 594 Lbs/acre versus the required 394 Lbs/ac). It should be noted that these are *crop removal rates only*. Typically, land grant university nutrient *recommendations are higher* than crop removal rates. If producers only applied nutrients at the crop removal rate, the soil would eventually be depleted of nutrient reserves that help in building the soil, improves organic matter breaks down crop residues. The conclusion is clear: these farmers in 2012 were applying at or below agronomic rates demonstrating that EPA's conclusions about contamination from over application are erroneous.

EPA's report states that irrigated cropland is expected to be a likely source of nitrates in drinking water wells (ref. ES-9). However, the only pathways that nitrate contaminants can enter well water is through
a). leaching through the soil profile below the crop/forage rooting zone into ground water and subsequent movement underground to a well, or
b). through surface water flow off of a field and directly into a recharge area that feeds the well itself.

- Hydraulic Conductivity

The report attempts to characterize the soils on a majority of the fields receiving manures as "well drained" and that they have "saturated hydraulic conductivity" characteristics that are considered high (ref. EPA-910-R-12-003, surface soils, page 35 and Appendix B) citing the USDA NRCS soil survey and its associated reports. Saturated Hydraulic Conductivity, according to the USDA NRCS Soil Survey Manual (Ag Handbook 18) is described as "saturated flow occuring ONLY when soil water pressure is positive, that is, when the soil metric potential is zero (satiated wet condition)." This means that, if the soil remains saturated for a prolonged period (several months or longer), the percent of total pore space filled with water may approach 100 percent. Therefore, "saturated hydraulic conductivity" CANNOT be used to describe water movement under unsaturated conditions (ref. USDA Soil Survey Manual, Soil Survey Division Staff, Ag handbook 18, October 1993, page 103.

- Drainage Class

Drainage class, according to the USDA Soil Survey Manual, refers to the frequency and duration of wet periods under conditions similar to those under which the soil is developed (natural conditions). Under anthropogenic conditions, the drainage class cannot be used to characterize or depict potential leaching. EPA misinterprets the definition of "well drained" tying nitrate leaching to the natural drainage classification of the soil. There is no documentation of any kind that would lead to the conclusion that, based on the natural drainage classification of the soil, leaching or subsurface water contamination occurred in the lower Yakima Valley.

- Irrigation water management

EPA did not collect irrigation water management details (i.e. irrigation water application, irrigation applied manure effluent, irrigation timing, etc.) in the field or from producers. Because there is no data pertaining to irrigation management, EPA cannot substantiate that the simple (mis) classification of hydraulic conductivity precludes leaching pertaining to land treatment where manures and fertilizers are applied.

6. Legacy Nitrate Levels in the Soil and/Groundwater.

EPA erred in not sufficiently investigating the possibility of legacy nitrate levels in the soil or the groundwater. Because of this significant failing, EPA cannot conclude that the nitrate degradation throughout the watershed has been caused by the Yakima dairy producers without much more refined and detailed information, data collection, and proper analysis. EPA admits the water age data element of the study did not yield reliable results necessary to establish the presence of legacy nitrate in Yakima groundwater. On page 80 of the March 2013 report it states: "The age dating results were not useful to determine when the nitrate contamination was introduced into the well." Given the presence of legacy nitrate throughout the nation and state, this comment should be seen as sufficient to undermine confidence in the report.

Legacy nitrates are a well-established issue throughout the country where historic agricultural activities have occurred. Nitrate in groundwater above the EPA MCL is in 24% of wells in farming areas of high vulnerability. The map and chart from USGS makes clear this concern is not unique to the Yakima Valley. Note the significant portions of southeast Washington state with soil conditions considered vulnerable. The map below that shows nitrate in groundwater in areas throughout southeast Washington where traditional farming activities have occurred but where there are few if any dairy farms.

Prior to the establishment of the dairy farms in the Yakima Valley, much of the cropland was used to produce row crops including sugar beets and potatoes. Additionally, irrigation systems often included flood irrigation, furrow irrigation, or somewhat antiquated hand lines (sprinkler irrigation) and rolling lines, which typically applied too much water due to their inefficiencies. Nutrient management was not as technically advanced then as it is now. Because of the relatively cheap costs of commercial fertilizers, the typical producer was taught to apply adequate amounts of N-P-K to ensure high yields to make an economic return. Often, due to the lower efficiency of older irrigation systems, irrigation water was over applied which drove water soluble nitrate through the root zone prior to being utilized by the crops. To counter this, additional nitrogen would be applied, and the cycle would continue. Because of the antiquated irrigation systems and nutrient management ideals, there is a strong possibility that “legacy nitrate levels” can be found below the root zone in much of the Yakima Valley.

(NOTE: for web publication the maps and charts used as part of this presentation are located in an accompanying document.)

There are very few dairy farms or animal agriculture operations in Franklin County.

7. Investigation of Other Potential Sources of Nitrate

Additional items needing investigation to accurately determine sources that were not considered:

- was a nutrient management plan followed including proper irrigation water management, proper waste application/timing?
- are animals fenced out of streams/watercourses?
- are nutrients being applied too close to unbuffered streams?
- potential contributions from non-dairy animals including migrating winter waterfowl?
- do irrigation delivery ditches leak (water and nutrients)?
- are there abandoned wells improperly sealed?
- what contributions come from improperly built and maintained On-site Sewage Systems?

- how much legacy nitrate exists from previous crop farming and earlier dairy practices?
- what do naturally occurring nitrates contribute?
- what do crops add, such as alfalfa during plow down?
- how much is contributed by non-dairy nutrient applications?

As an example of the last item about non-dairy nutrient applications: EPA found detectable levels of the antibiotic tetracycline/oxytetracycline. There are about 40,000 acres of tree fruit crops that have tetracycline applied at up to 2 pounds per acre annually to prevent fire blight. Tetracycline has been legal for this purpose for perhaps 40 years. Some or all of the wells upgradient showed tetracycline which EPA gives a brief reference to this in the report. However, it appears this is a strong indicator of upgradient sources that are NOT dairy. Tetracycline use on dairies is limited mostly to calves and at a very small rate. This EPA data – discounted in the report – is one example of non-dairy sources identified without serious consideration.

8. Updated Data

As mentioned above, we have not seen in any of the current data from the farms under the AOC that would suggest the conclusions in the report are accurate or too conservative as Mr. Kowalski reported. The admitted failure of EPA to determine the age of the water and thereby the time when the nitrate entered the groundwater undermines the conclusions that current farm operations are responsible.