

Response to Review: Summary of the Existing Science Regarding Public Health Effects from the Spreading of Dairy Manure, With an Emphasis on Effects in Eastern Washington and the Yakima Basin

This is a rebuttal and critique of a *literature review* that was submitted by Dr. Nichole Embertson of the Whatcom County Conservation District and the Washington Dairy Federation to the Yakima Regional Clean Air Agency in August of 2013. Her *literature review* was in response to a petition from fifty citizens to ban the land and aerial application of manure during inversions that trigger a burn ban. You will see that the *literature review* is a biased presentation with the intent to deceive the Yakima Regional Clean Air Agency and the people who live in the Yakima Valley.

Research Misconduct

“Some researchers are so at odds with the core principles of science that they are treated very harshly by the scientific community and by institutions that oversee research. Anyone who engages in these behaviors is putting his or her scientific career at risk and is threatening the overall reputation of science and the health and welfare of the intended beneficiaries of research.

Collectively these actions have come to be known as scientific misconduct. A statement developed by the U.S. Office of Science and Technology Policy, which has been adopted by most research funding agencies, defines misconduct as ‘fabrication, falsification or plagiarism in proposing, performing or reviewing research or in reporting research results.’ According to the statement, the three elements of misconduct are defined as follows:

- *Fabrication is ‘making up data or results’*
- *Falsification is ‘manipulating research materials, equipment, or processes, or changing or omitting data or results such that the research is not accurately represented in the research record.’*
- *Plagiarism is ‘the appropriation of another person’s ideas, processes, results, or words without giving appropriate credit.’*

In addition, the federal statement says that to be considered research misconduct actions must represent a ‘significant departure from accepted practices,’ must have been committed intentionally or knowingly, or recklessly’ and must be ‘proven by a preponderance of evidence.’ According to the statement, ‘research misconduct does not include differences of opinion.’”

(Statement from the National Academy of Sciences, 2009)

What is a Literature Review?

“Definition: A literature review is an assessment of a body of research that addresses a research question. Purpose: A literature review identifies what is already known about an area of study. It may also identify questions a body of research does not answer and make a case for why further study of research questions is important to a field.” (Harvard Graduate School of Education, n.d.)

Response to Review: *Summary of the Existing Science Regarding Public Health Effects from the Spreading of Dairy Manure, With an Emphasis on Effects in Eastern Washington and the Yakima Basin* paragraph by paragraph

Purpose & Scope

The author states, “It is postulated that the community members believe that there is a link between burn bans, manure application, and community health. The purpose of this review and professional assessment is to examine this postulation and assess its validity.” The community members believe that there is a relationship between feces and infectious disease. That is why we teach children to wash their hands after using the bathroom. The community members believe that there is a relationship between particles in the air and respiratory disease. The community members believe that the purpose of burn bans is to protect human health, especially during air inversions.

The author states, “The scope of this review focuses only on dairy and dairy manure. Additionally, this review only looks at the emissions from the application of dairy manure to crop land, not emissions from the dairy operations themselves (i.e. housing, manure storage, etc.)”. Much of the literature in this review describes animal waste in general and is not specific to the dairy industry. Some of the studies address waste from hog operations. Much of the literature in this review looks at all aspects of animal agriculture and dairy operations, not just manure application. It would be difficult to find sufficient relevant studies restricted to application of dairy manure to the land. The inclusion of health problems and complaints due to hog operations and other sources of air pollution is understandable and acceptable.

Summary Opinion

The author states, “Furthermore, the literature does not support the conclusion that dairy manure applied at agronomic rates to farm fields is a significant hazard to community health in the Yakima region. With the use of best management practices, any potential concerns with air pollutants from manure application can be actively mitigated to avoid potential transport to neighboring areas.”

Thirteen of the forty references in the *literature review* address community health. Twelve of these references document elevated health risks related to concentrated animal feeding operations and/or air pollution. Only one agrees with Dr. Embertson’s statement.

Donham et al (2007) state, with respect to poultry workers, “Significant dose-response relationships were observed between exposures and pulmonary function decrements over a work shift.”

Heedrick et al (2007) state, “This working group, which was part of the *Conference on Environmental Health Impacts of Concentrated Animal Feeding Operations: Anticipating Hazards—Searching for Solutions*, concluded that there is a great need to evaluate health effects from exposures to the toxic gases, vapors, and particles emitted into the general environment by CAFOs.”

Merchant et al (2003) contributed 25 pages to the *Iowa Concentrated Animal Feeding Operation Air Quality Study* in which they documented the significant health problems related to CAFOs. They cited four studies on community health, all of which showed adverse health effects from CAFOs:

Merchant et al (2004) state, “The high prevalence of asthma health outcomes among farm children living on farms that raise swine (44.1%, $p = 0.01$) and raise swine and add antibiotics to feed (55.8%, $p = 0.013$), despite lower rates of atopy and personal histories of allergy, suggests the need for awareness and prevention measures and more population-based studies to further assess environmental and genetic determinants of asthma among farm children.”

Mirabelli et al (2006) state, “Estimated exposure to airborne pollution from confined swine feeding operations is associated with adolescents’ wheezing symptoms.”

Ngo et al (2010) state, “We have observed seasonal variability in particle mass and composition along with small, significant changes in some markers of inflammation and cell viability. This type of field study, which characterizes ambient particulate-matter mixtures found in agricultural regions and determines health outcomes in animal inhalation models, helps provide new insights into how particulate matter affects agricultural workers and residents living in the San Joaquin Valley.”

O’Conner et al (2010) performed a literature review for the United Soybean Board and the National Pork Board looking for an association between animal feeding operations (AFOs) and health effects in neighbors. They found 4,908 pieces of research and rejected 4,899 before completing their analysis. Based on only nine studies they concluded, “There was inconsistent evidence of a weak association between self-reported disease in people with allergies or familial history of allergies. No consistent dose response relationship between exposure and disease was observable.”

Osornio-Vargas et al (2010) state, “Compelling evidence indicates that exposure to urban airborne particulate matter (PM) affects health. However, how PM components interact with PM-size to cause adverse health effects needs elucidation, especially when considering soil and anthropogenic sources. We studied PM from Mexicali, Mexico, where soil particles contribute importantly to air pollution, expecting to differentiate in vitro effects related to PM-size and composition. . . . We conclude that PM-size and PM-related soil or anthropogenic elements trigger specific biological-response patterns.”

Schiffman (1998) performed a literature review that found over a hundred studies showing adverse health effects related to odor.

Schiffman and Williams (2005) cited over a hundred studies showing adverse health effects related to air pollution from confined animal feeding operations and proposed that technological solutions will be needed to protect neighbors.

Schiffman et al (2000) state, "Complaints of health symptoms from ambient odors have become more frequent in communities with confined animal facilities, wastewater treatment plants, and biosolids recycling operations. The most frequently reported health complaints include eye, nose, and throat irritation, headache, nausea, diarrhea, hoarseness, sore throat, cough, chest tightness, nasal congestion, palpitations, shortness of breath, stress, drowsiness, and alterations in mood. Typically, these symptoms occur at the time of exposure and remit after a short period of time. However, for sensitive individuals such as asthmatic patients, exposure to odors may induce health symptoms that persist for longer periods of time as well as aggravate existing medical conditions."

Schmalzreid and Fallon (2007) surveyed people living near two new 700 cow dairies. 87% felt that their property values were affected and 83% felt that these values had decreased. 47% feared that their drinking water would be affected and 69% felt that the quality of life was reduced. 92% had concerns about the smell of manure and 81% found the smell unpleasant. 70% felt that flies were a nuisance and 64% felt that the fly problem was bad. The authors argued that the neighbor's perceptions were not based on reality.

Williams et al studied bovine allergens and particulate matter in homes near Yakima County dairies. They state, "These findings demonstrate that dairy operations increase community exposures to agents with known human health effects. This study also provides evidence that airborne biological contaminants (i.e. cow allergen) associated with airborne particulate matter are statistically elevated at distances up to three miles (4.8 km) from dairy operations."

Overview of Yakima Dairy Manure Application Practices

Dr. Embertson states, "Following best practices, the majority of manure is applied to crops at agronomic rates using crop appropriate technologies." According to the Washington State Dept. of Agriculture 11% of the fields owned by dairy operations have soil nitrate levels greater than 45 parts per million, a sign of manure/fertilizer over application. In a county with 120,000 milk cows plus calves, replacement heifer's, and cattle for slaughter 11% is significant. This means that one out of ten dairies endangers public and environmental health by not following agronomic application guidelines.

Dr. Embertson details how and when manure is applied to the fields in Yakima County but she does not live here. Our observations differ. We know that manure is applied to bare fields during the months November, December, January and February. And these are the times when hospital admission rates for asthma are highest.

Can Dr. Embertson support the statement "A small percentage (<5%) of other crops and less desirable application technologies such as honey wagons (tanks) and Big Gun sprinklers are used for application, but the land acreage applying these technologies is small (<3%)."

It is our observation that this type of application is very common in the lower Yakima Valley. If she cannot provide supporting references, then she is fabricating data.

Dr. Embertson states, “All dairy operations must apply nutrients (i.e. manure) according to their Dairy Nutrient Management Plan which outlines agronomic guidance and application restrictions. Restrictions include when not to apply (i.e. wind > 10 mph, inversions, high temperatures, etc.) what local criteria (i.e. schools, neighbors, wells, etc.) and setbacks need to be taken into consideration when applying and best methods for reducing nutrient losses via volatilization.”

The *Dairy Nutrient Management Act* applies to water pollution, not air pollution. There is a small paragraph in the 2012 NRCS *Conservation Practice Standard for Nutrient Management* that addresses air pollution. It simply says "Do not apply poultry litter, manure, or organic by-products of similar dryness/density when there is a high probability that wind will blow the material offsite."

We find no restrictions for applying manure during inversions, high temperatures or winds > 10 mph in the WA State NMP requirements. Although these recommendations are found in recommendations from Purdue University and Michigan State University they are not part of the YRCAA *Air Quality Management Policy for Dairies and Best Management Practices*. The closest that this document comes to regulating manure application is a vague “Apply during cool weather and on still rather than windy days.” It is a fact that neighbors have complained to YRCAA when one of the authors of the YRCAA *Air Quality Management Policy and Best Management Practices for Dairies* sprayed manure into the air during 40 mph winds.

Dr. Embertson states, “In general, the technologies, timing, and application restriction guidance followed by the majority of dairy operations in Yakima meet the best management practice guidelines encouraged by University guidance and research for maximum reduction of emissions during application for ammonia, dust and odor (Smith et al, 2009; Webb et al, 2010; Rotz et al, 2011; Brandt et al, 2011).” None of the references cited examines best management practices in the Yakima Valley. They only define dairy best management practices and manure application in general. They do not state that dairy operations in the Yakima Valley follow BMP guidelines.

Smith et al (2009) used a simulation model to analyze various types of manure spreading with respect to ammonia losses. They found that putting lime on the soil to raise the pH increases NH₃ emissions. Delaying manure spreading till later in the day reduces NH₃ losses. Rainfall and incorporating manure into the soil immediately reduce NH₃ emissions. It is our observation that farmers in the Yakima Valley apply manure to the fields at all hours of the day and do not routinely incorporate manure into the soil after application. There is little rain in the Yakima Valley with annual precipitation of around 8 inches per year.

Webb et al (2010) reviewed the literature to determine the “impacts of manure application methods on emissions of ammonia, nitrous oxide and crop response.” They recommend open slot injection or trailing shoe application methods and note that incorporation into the soil is the most effective way to reduce ammonia emissions. We are unaware of any studies that detail how many operations in the Yakima Valley utilize these methods of application. Sufficient to say, we see frequent aerial applications of manure and flooding of fields with manure.

Rotz et al (2011) created and tested a dairy farm model to determine optimal feeds to meet fiber, energy and protein needs for six sub groups of dairy animals. We do not see how this relates to ammonia, dust and odor during manure application.

Brandt et al (2008) measured odor in the ambient air after different types of manure application to the land. They did not assess the “Big Gun” approach and did not assess human health or agronomic rates. They found differences in effect ranging from worst to best: surface broadcast > aeration infiltration > surface + chisel incorporation > direct ground injection = shallow disk injection > control (no application).

Burn Bans and Manure Application

Wood stoves may be the number one contributor to excess PM 2.5 in most areas of Washington State and in the Rocky Mountains. This does not mean that agricultural activities do not exacerbate the situation. Neither YRCAA nor the dairy industry has done the research needed to quantify the contribution of animal agriculture to PM 2.5 in the Lower Yakima Valley. The situation here is quite different from most parts of the state. The fact that smoke from wood stoves is the major contributor to PM 2.5 in Ellensburg, for example, does not mean that this is the major contributor in Sunnyside. The research by Ward and Lange (2009) is not from “a similar region”. The northern Rocky Mountains of Montana do not have high concentrations of dairy cows.

The statement, “. . . emissions from manure and nitrogen-based chemical fertilizers are considered a precursor to PM 2.5 when ammonia from applied nitrogen volatilizes and comes in contact with available nitrous and sulfuric acid gases that are released into the atmosphere from vehicles and combustion processes (NOx and SOx) to form fine particulates through chemical reaction.” is incorrect. Ammonia reacts with nitric acid, not nitrous acid to form particulate matter.

Dr. Embertson states, “Depending on atmospheric conditions and geographic location, this pathway contributes less than 10% of the total secondary PM 2.5 production in the atmosphere (Hristov, 2011). She omits Hristov’s ensuing comments, “In certain areas and in cool weather, farm animal contribution to atmospheric PM 2.5 concentration may be as much as 20%.” His graphics show that this scenario is especially true in the Pacific Northwest. (Please see pp. 3130 and 3133 of Hristov’s Technical Notes)

Dr. Embertson states, “. . . manure is not typically applied from November to February to the crops grown in dairy production in Yakima, WA.” This is simply untrue. Year round application is one of the main reasons that citizens requested a ban on manure spreading during inversions.

Dr. Embertson states, “Ammonia volatilization is significantly reduced during cold weather due to thermal reduction in biological and chemical processes in manure and the soil.” However, Hristov (2011, p. 3133) states, “In the cooler months, the formation of ammonium nitrate is favorable, and hence the presence of ammonia can significantly increase PM 2.5 concentrations.” His graphs show that around 19% of particulate matter in the northwest can be attributed to agricultural animals. May we suggest

that this may be even higher in the lower Yakima Valley where we have a winter nitrate problem and an overabundance of ammonia from concentrated animal feeding operations?

Emissions from Manure Application

Ammonia and PM 2.5

Dr. Embertson states, "Ammonia is produced from applied manure when conditions such as temperature, pH, and oxygenation allow hydrolysis of urea (in urine) and urease (in feces and soil) to form ammonia gas. For land applied manure, this reaction is catalyzed by the increased surface area and exposure of manure to aerobic conditions on the soil surface. Ammonia volatilization typically peaks within hours to days of application depending on manure type (solid versus liquid), application technology, and meteorological conditions (i.e. wind speed, temperature, precipitation, etc.) (Amon et al, 2006; Hristov et al, 2009; Leytem and Dungan, 2009)". The referenced study by Hristov et al does not address manure type, application technology or meteorological conditions. Their study was a laboratory testing of a new way to estimate ammonia losses using various chemical markers. Leytem and Dungan (2009) did not address land applied manure, manure type, application technologies or meteorological conditions. They measured ammonia concentrations during different seasons at open lots, compost yards and lagoons on a 10,000 cow dairy in southern Idaho.

It is important to note that Amon et al state in their abstract, "Ammonia emissions mainly occurred after field application."

Hristov (2009) states "Ammonia emitted from animal feeding operations is an air pollutant contributing to the formation of fine particulate matter (PM_{2.5}), considered a major environmental risk to human health."

Dust (PM 10)

Dr. Embertson states, "However, while biologically derived aerosols (bioaerosols), such as fecal and bacterial origin dust may be present in manure applied to fields, survivability of pathogens through the manure storage period, treatment, and application process is low (McGarvey et al, 2004; Ravva et al 2006; Grewal et al, 2006). It would help to define "low".

When they used aerobic plate counts McGarvey et al found bacterial counts of 2,100,000,000 CFU/g in manure, 1,900,000CFU/ml in separator pit water and 280,000 CFU/ml in lagoon water. When they used anaerobic plate counts they found bacterial counts of 6,900,000,000 CFU/g in manure, 5,500,000 CFU/ml in separator pit water and 670,000 CFU/ml in lagoon water.

Ravva et al (2006) only studied the ability of E coli O157:H7 to survive in dairy wastewater with or without aerators. They found low survival rates, possible due to competition from other organisms.

Grewal et al, (2006) studied *Escherichia coli* O157:H7, *Listeria monocytogenes*, *Salmonella* spp., and *Mycobacterium avium* subsp. *paratuberculosis* (*Mycobacterium paratuberculosis*) under different

manure treatments. In liquid manure and pack treatments, some of these microorganisms were detectable up to 28 days. *M. paratuberculosis* DNA was detectable through day 56 in all treatments and up to day 175 in liquid storage treatments.

Dr. Embertson did not address components of dust that have a greater impact on human health than bacteria. These include: the particles themselves, feed materials, endotoxins, fungi and viruses.

Manure Application and Health Effects

Dr. Embertson states, “In fact a comprehensive review of scientific studies conducted by O’Conner et al (2010) looked at the associations between animal feeding operations and measures of health of individuals living near animal feeding operations and found that there were very few applicable studies (0.2%) and no compelling evidence for a consistent, strong association between the clinical measures of disease and proximity to animal feeding operations.”

The truth is that O’Conner et al (2010) performed a literature review for the United Soybean Board and the National Pork Board looking for an association between animal feeding operations (AFOs) and health effects in neighbors. They found 4,908 pieces of research and rejected 4,899 before completing their analysis, using just nine pieces of research.

The petitioners referenced 106 pieces of research that describe adverse health effects from confined animal feeding operations. Dr. Embertson simply chose to ignore most of these studies when she considered manure application and health effects.

Dr. Embertson states, “Additionally a study surveying quality of life characteristics of residents living near and far from animal feeding operations concluded that emotional considerations, not physiological ones played a large part in perception of the impact of those facilities on health. (Schmalzreid and Fallon, 2007).”

Let us put this study in context. It was published in the Journal of Dairy Science and represents an attempt to understand concerns of neighbors. The study is based on a thirteen question survey that assessed public perceptions of property values, water quality, flies, odor and demographics. There were no questions regarding physiological symptoms experienced by neighbors or their emotional responses to a nearby CAFO. In addition, this study analyzed neighbors’ response to two 700 cow dairies. We can state with confidence that people in the Yakima Valley would not be complaining about one or two isolated 700 cow dairies. The number of dairy cows in the Lower Yakima Valley (120,000) is almost 100 times greater than the 1,400 cows in the survey by Schmalzreid and Fallon.

Dr. Embertson states, “Of the few relevant studies available, most are largely inconclusive and/or found no direct, replicable connection between farm exposure and health effects (Merchant et al, 2004; Heedrick et al, 2007; Muryama et al, 2010)”

In fact, Merchant et al (2004) studied four asthma outcomes in children who live in rural Iowa. The outcomes are doctor-diagnosed asthma, asthma/medication for wheeze, current wheeze and cough with exercise. They found a significant association between living on a hog CAFO and these four symptoms. The association was even stronger for hog CAFOs that fed antibiotics to the swine:

- Do not live on farm/do not raise swine – 33.6% have asthma symptoms
- Live on farm/do not raise swine – 26.2% have asthma symptoms
- Live on farm raising swine, 1–499 head – 42.9% have asthma symptoms
- Live on farm raising swine, 500+ head – 46% have asthma symptoms
- Live on farm raising swine and adding antibiotics to feed – 55.8% have asthma symptoms

The reference to Heedrick et al (2007) is difficult to address because this is another literature review that happens to come from Europe where CAFOs are more stringently regulated. There are abundant references to European studies that document adverse health effects related to animal feeding operations. They state, “This working group, which was part of the Conference on Environmental Health Impacts of Concentrated Animal Feeding Operations: Anticipating Hazards—Searching for Solutions, concluded that there is a great need to evaluate health effects from exposures to the toxic gases, vapors, and particles emitted into the general environment by CAFOs. Research should focus not only on nuisance and odors but also on potential health effects from microbial exposures, concentrating on susceptible subgroups, especially asthmatic children and the elderly, since these exposures have been shown to be related to respiratory health effects among workers in CAFOs.”

Muryama et al (2010) did not study farm exposure and health effects. Theirs was a laboratory analysis of air “immediately adjacent to the agricultural spreading of bovine slurry”. They found 16 bacterial genera in the air. “Only a few” were found to cause illness in humans and none were “previously described” as being passed by inhalation. For these reasons the authors concluded that none of the bacteria in the applied manure “pose a significant health and safety threat.”

Pollutant Exposure Limits

Ammonia

Dr. Embertson documents exposure limits for ammonia of 300 parts per billion for chronic exposure based on the 2003 work of Merchant et al. In 2012 the Agency for Toxic Substances and Disease Registry established minimum risk levels of 1.7 parts per million (ppm) for acute exposure and 100 parts per billion (ppb) for chronic exposure. (ATSDR, 2012)

Dr. Embertson states, “Downwind measures of ammonia from applied manure rarely exceed concentrations in parts per billion (ppb) (Williams et al, 2011)”. The referenced study had nothing to do with wind direction or manure application. It did not even mention these parameters. Dr. Williams states, “This does not represent my work.” (Personal conversation, Sept. 2013)

Dust (PM10)

Dr. Embertson cites the research of McGarvey et al, 2004; Ravva et al, 2006; Grewal et al, 2006, Hutchison et al, 2008; and Dungan, 2010. All of these studies addressed bacteria in agricultural wastes and dust. None of them looked at the physiological impact of particulate matter per se.

The Environmental Protection Agency (EPA) states, "Major concerns for human health from exposure to PM-10 include: effects on breathing and respiratory systems, damage to lung tissue, cancer, and premature death. The elderly, children, and people with chronic lung disease, influenza, or asthma, are especially sensitive to the effects of particulate matter. Acidic PM-10 can also damage human-made materials and is a major cause of reduced visibility in many parts of the U.S. New scientific studies suggest that fine particles (smaller than 2.5 micrometers in diameter) may cause serious adverse health effects. As a result, EPA is considering setting a new standard for PM-2.5. In addition, EPA is reviewing whether revisions to the current PM-10 standards are warranted." A list of the extensive research that has been done in this area is available from the Environmental Protection Agency at <http://www.epa.gov/ncer/publications/workshop/11-30-2005/pmcentersabstract.pdf>

Conclusion

Dr. Embertson's conclusion is not supported by the data she provided in her literature review. There is substantial evidence to support the hypothesis that adding more contaminants to air that is already dangerous for vulnerable people increases health risks to the community. She simply chose to ignore it.

Dr. Embertson has omitted research on several relevant factors that impact this discussion. She has not discussed the work that the Washington State Department of Ecology is doing in the Yakima Valley regarding surprisingly high levels of nitrates in the winter air (Van Recken et al, 2013). She has ignored research performed by the University of Washington that found high levels of ammonia in homes near CAFOS in the Yakima Valley (Turcios et al, 2004). She has ignored the fact that Yakima County has a higher rate of pre-term births than Washington State as a whole and that pre-term delivery has been associated with elevated PM 2.5 in the ambient air (Washington State Dept. of Health, 2013b). She has ignored the recent finding of a high incidence of anencephaly in this region which has not yet been explained. She has ignored the higher rates of certain infectious diseases in the Yakima Valley (Washington State Dept. of Health, 2013c). She has omitted the fact that Yakima County has one of the highest rates for asthma hospitalization in Washington State (Washington State Department of Health, 2013a). She did not cite research linking inversions to impaired health in spite of the fact that a recent, well-known study in Utah shows a strong connection between prolonged inversions and hospitalization for asthma. (Beard et al, 2011). She ignored the 106 pieces of research provided by the petitioners to support their request. She did not address sulfur dioxide, hydrogen sulfide, endotoxins or volatile organic compounds.

Thank you for reading and considering this material

Jean Mendoza

References:

- Agency for toxic Substances and Drug Research (n.d.) Minimum Risk Levels for Hazardous Substances. Retrieved from http://www.atsdr.cdc.gov/mrls/pdfs/atsdr_mrls_july_2013.pdf
- Beard, J.D., Beck, C., Graham, R., Packham, S.C., Traphagan, M., Giles, R.T. & Morgan, J.G. (2011) Winter Temperature Inversions and Emergency Department Visits for Asthma in Salt lake County, Utah, 2003 – 2008. *Environmental Health Perspectives* 120 (10). pp. 1385 – 1890. Retrieved from <http://ehp.niehs.nih.gov/wp-content/uploads/2012/09/ehp.1104349.pdf>
- Environmental Protection Agency (n.d.) *Particulate Matter (PM 10)* Retrieved from <http://www.epa.gov/airtrends/aqtrnd95/pm10.html>
- Environmental Protection Agency (n.d.) *The PM Center Program 2005 – 2010 Overviews and Abstracts*. Retrieved from <http://www.epa.gov/ncer/publications/workshop/11-30-2005/pmcentersabstract.pdf>
- Harvard Graduate School of Education (n.d.) *The Literature Review: A Research Journey 3rd Edition*. Retrieved from <http://guides.library.harvard.edu/literaturereview>
- National Academy of Sciences (2009) *On Being A Scientist: A Guide to Responsible Conduct in Research*. The National Academies Press. Retrieved from http://www.nap.edu/catalog.php?record_id=12192
- Turcios, L.R., Armstrong, J.L., Yost, M.G. & Karr, C. (2004) Airborne Total Dust, PM 2.5, and NH3 and Residential Proximity to Confined Animal Feeding Operations (CAFOs) and Rural Roadways. University of Washington School of Public Health. Retrieved from <http://deohs.washington.edu/sites/default/files/research/posters/undergraduate/lilian-turcios.pdf>
- Van Recken, T. et al (2013) *The Yakima Wintertime Nitrate Study (YAWNS): Motivations and Preliminary Results*. Washington State University. Retrieved from http://lar.wsu.edu/nw-airquest/docs/20130207_meeting/20130207_YAWNS_VanReken.pdf
- Washington State Department of Health (2013a) The Burden of Asthma in Washington State: 2013 Update. Retrieved from <http://www.doh.wa.gov/Portals/1/Documents/Pubs/345-240-AsthmaBurdenRept13.pdf>
- Washington State Department of Health (2013b) Preterm Delivery for Singleton Births. Retrieved from http://www.doh.wa.gov/Portals/1/Documents/Pubs/160-015_MCHDataReportPrenatalDeliv.pdf
- Washington State Department of Health (2013c) Communicable Disease Surveillance Data. Retrieved from <http://www.doh.wa.gov/DataandStatisticalReports/DiseasesandChronicConditions/CommunicableDiseaseSurveillanceData/AnnualCDSurveillanceReports.aspx>

Timeline for Yakima Regional Clean Air Agency Policymaking Re Dairies

We present this timeline for YRCAA actions to help the reader better understand what has happened in Yakima County regarding dairy air quality over the past 50 years.

1967

The Yakima Regional Clean Air Authority, later the Yakima Regional Clean Air Agency, is formed per RCW 70.94.081

1997

YRCAA adopts a Beef Cattle Feedlot Air Policy

2002

YRCAA approves Confined Heifer Operations Dust Control Policy

2010

YRCAA discussion re AQMP for Dairies begins

Publication of *Emission Data from Two Dairy Freestall Barns in Washington*. Study performed in the LYV by WA State University for the National Air Emissions Monitoring Study.

2011

John Hopkins study, *Airborne cow allergen, ammonia and particulate matter at homes vary with distance to industrial scale dairy operations: an exposure assessment*. The lead author presents the study to the YRCAA. There is no agency action.

February, YRCAA published public comments for the AQMP for dairies.

February, YRCAA Board of Directors approved the AQMP for dairies as a pilot research project.

2012

Presentation of Draft AQMP for Dairies at YRCAA Board Meeting

2013

May, Citizens present a petition to ban spreading and spraying of manure during burn bans and air inversions. The YRCAA Director recommends rejecting the petition and the YRCAA Board agrees.

June, the YRCAA Board of Directors approves an *Air Quality Management Policy and Best Management Practices for Dairy Operations (AQMP)*.

November, FOTC presents a critique of the Literature Review used to rebut a need for Ban on Spraying Manure during Inversions

2014

YRCAA adopts a *PM Advance Program Path Forward*

January, YRCAA forms an Agricultural Task Force and a Dairy Work Group

The Yakima Air Winter Nitrate Study is completed

November, Board Study Session to review *Report to the YRCAA Board of Directors of the July, 2013 to October 2014 Policy Implementation Period* – two board members hear the report.

Publication of Ecology's *2011 County Emissions Inventory*.

Additional air monitor placed in Sunnyside.

2015

YRCAA Board of Directors tables a proposed Five-Year Strategic Plan

University of Washington publishes studies on asthmatic children in the Yakima Valley.

FOTC asked the YRCAA to address Global Warming and Climate Change.

2016

FOTC asks the WA Dept of Health and the Yakima Health District for an “expert opinion on when and under what conditions it is safe to apply manures, especially aerosolized manures, to cropland when human and animal exposures and health risks are taken into consideration.” To date there has been correspondence but there have been no substantive answers.

FOTC responds to an article in two local newspapers that quotes the YRCAA Director and states that ammonia emissions from animal agriculture are insignificant.

FOTC analyzes ammonia emissions in Yakima County and shares the study with YRCAA. The YRCAA takes no action.

FOTC files a Civil Rights Complaint to the EPA re YRCAA

FOTC asks Ecology to investigate the YRCAA under RCW 70A.15.3100

FOTC complains about conflict of interest for a YRCAA Board Member

2017

Steve George from the Yakima Dairy Federation tells the YRCAA Board of Directors that he can speak for the dairy farmworkers.

YRCAA denies a second petition to ban manure spraying during burn bans and inversions.

2018

AQMP for Dairies rescinded

2019

FOTC repeats a request for Ecology to investigate YRCAA. The request is denied.

WA State helps a mushroom operation, with known odorous air emissions, to relocate from the west side of the state to the Sunnyside area.

The EPA Office of Civil Rights External Compliance comes to an agreement with the YRCAA regarding engagement of Spanish speaking residents.

2020

University of Washington publishes studies on asthmatic children in the Yakima Valley.

Laws Misinterpreted by YRCAA

RCW 70A.15.1070

Causing or permitting air pollution unlawful—Exception.

Except where specified in a variance permit, as provided in RCW 70A.15.2310, it shall be unlawful for any person to cause air pollution or permit it to be caused in violation of this chapter, or of any ordinance, resolution, rule or regulation validly promulgated hereunder.

RCW 70A.15.2000

Air pollution control authority—Board of directors—Composition—Term.

(6) Wherever a member of a board has a potential conflict of interest in an action before the board, the member shall declare to the board the nature of the potential conflict prior to participating in the action review. The board shall, if the potential conflict of interest, in the judgment of a majority of the board, may prevent the member from a fair and objective review of the case, remove the member from participation in the action.

RCW 70A.15.3150

Penalties.

(2) Any person who negligently releases into the ambient air any substance listed by the department of ecology as a hazardous air pollutant, other than in compliance with the terms of an applicable permit or emission limit, and who at the time negligently places another person in imminent danger of death or substantial bodily harm is guilty of a gross misdemeanor and shall, upon conviction, be punished by a fine of not more than ten thousand dollars, or by imprisonment for up to three hundred sixty-four days, or both.

(3) Any person who knowingly releases into the ambient air any substance listed by the department of ecology as a hazardous air pollutant, other than in compliance with the terms of an applicable permit or emission limit, and who knows at the time that he or she thereby places another person in imminent danger of death or substantial bodily harm, is guilty of a class C felony and shall, upon conviction, be punished by a fine of not less than fifty thousand dollars, or by imprisonment for not more than five years, or both.

(4) Any person who knowingly fails to disclose a potential conflict of interest under RCW 70A.15.2000 is guilty of a gross misdemeanor, and upon conviction thereof shall be punished by a fine of not more than five thousand dollars.

RCW 70A.15.4530

Odors or fugitive dust caused by agricultural activities consistent with good agricultural practices exempt from chapter.

Odors or fugitive dust caused by agricultural activity consistent with good agricultural practices on agricultural land are exempt from the requirements of this chapter **unless they have a substantial adverse effect on public health.** In determining whether agricultural activity is consistent with good agricultural practices, the department of ecology or board of any authority shall consult with a recognized third-party expert in the activity prior to issuing any notice of violation.

RCW 70A.15.6200

Legislative declaration—Intent.

The legislature recognizes that:

Acid deposition resulting from commercial, industrial or other emissions of sulphur dioxide and nitrogen oxides pose a threat to the delicate balance of the state's ecological systems, particularly in alpine lakes that are known to be highly sensitive to acidification;

Failure to act promptly and decisively to mitigate or eliminate this danger may soon result in untold and irreparable damage to the fish, forest, wildlife, agricultural, water, and recreational resources of this state;

There is a direct correlation between emissions of sulphur dioxides and nitrogen oxides and increases in acid deposition;

Acidification is cumulative; and

Once an environment is acidified, it is difficult, if not impossible, to restore the natural balance.

It is therefore the intent of the legislature to provide for early detection of acidification and the resulting environmental degradation through continued monitoring of acid deposition levels and trends, and major source changes, so that the legislature can take any necessary action to prevent environmental degradation resulting from acid deposition.

WAC 173-400-040

General standards for maximum emissions.

(4) **Fugitive emissions.** The owner or operator of any emissions unit engaging in materials handling, construction, demolition or other operation which is a source of fugitive emission:

If located in an attainment area and not impacting any nonattainment area, shall take reasonable precautions to prevent the release of air contaminants from the operation.

If the emissions unit has been identified as a significant contributor to the nonattainment status of a designated nonattainment area, the owner or operator shall be required to use reasonable and available control methods, which shall include any necessary changes in technology, process, or other control strategies to control emissions of the air contaminants for which nonattainment has been designated.

(5) **Odors.** Any person who shall cause or allow the generation of any odor from any source or activity which may unreasonably interfere with any other property owner's use and enjoyment of her or his property must use recognized good practice and procedures to reduce these odors to a reasonable minimum.

(6) **Emissions detrimental to persons or property.** No person shall cause or allow the emission of any air contaminant from any source if it is detrimental to the health, safety, or welfare of any person, or causes damage to property or business.

(8) **Concealment and masking.** No person shall cause or allow the installation or use of any means which conceals or masks an emission of an air contaminant which would otherwise violate any provisions of this chapter.

(9) **Fugitive dust.**

The owner or operator of a source or activity that generates fugitive dust must take reasonable precautions to prevent that fugitive dust from becoming airborne and must maintain and operate the source to minimize emissions.

The owner or operator of any existing source or activity that generates fugitive dust that has been identified as a significant contributor to a PM-10 or PM-2.5 nonattainment area is required to use reasonably available control technology to control emissions. Significance will be determined by the criteria found in WAC [173-400-113\(4\)](#).

WAC 173-400-075

Emission standards for sources emitting hazardous air pollutants.

National emission standards for hazardous air pollutants (NESHAPs). 40 C.F.R. Part 61 and Appendices (in effect on the date in WAC [173-400-025](#)) are adopted. The term "administrator" in 40 C.F.R. Part 61 includes the permitting authority.

The permitting authority may conduct source tests and require access to records, books, files, and other information specific to the control, recovery, or release of those pollutants regulated under 40 C.F.R. Parts 61, 62, 63 and 65, as applicable, in order to determine the status of compliance of sources of these contaminants and to carry out its enforcement responsibilities.

Source testing, monitoring, and analytical methods for sources of hazardous air pollutants must conform with the requirements of 40 C.F.R. Parts 51, 60, 61, 62, 63 and 65, as applicable.

WAC 173-400-220

Requirements for board members.

Public interest. A majority of the members of any ecology or authority board shall represent the public interest. A majority of the members of such boards, shall not derive any significant portion of their income from persons subject to enforcement orders pursuant to the state and federal clean air acts. An elected public official and the board shall be presumed to represent the public interest. In the event that a member derives a significant portion of his/her income from persons subject to enforcement orders, he/she shall delegate sole responsibility for administration of any part of the program which involves these persons to an assistant.

Disclosure. Each member of any ecology or authority board shall adequately disclose any potential conflict of interest in any matter prior to any action or consideration thereon, and the member shall remove themselves from participation as a board member in any action or voting on such matter.

Define significant income. For the purposes of this section, "significant portion of income" shall mean twenty percent of gross personal income for a calendar year. In the case of a retired person, "significant portion of income" shall mean fifty percent of income in the form of pension or retirement benefits from a single source other than Social Security. Income derived from employment with local or state government shall not be considered in the determination of "significant portion of income."

WAC 173-400-260

Conflict of interest.

All board members and officials acting or voting on decisions affecting air pollution sources, must comply with the Federal Clean Air Act, as it pertains to conflict of interest (Section 128).

YRCAA Regulation 1

https://www.yakimacleanair.org/site/files/file_manager/page/shared/YRCAA%20Regulation%201-%202020%20FINAL.pdf

1.07 General Provisions

B. FALSE OR MISLEADING INFORMATION. 1. False Statements. No person shall make any false material statement, representation or certification in any form, notice or report required under chapter 70A.15 RCW, or any ordinance, resolution, regulation, permit or order in force pursuant thereto.

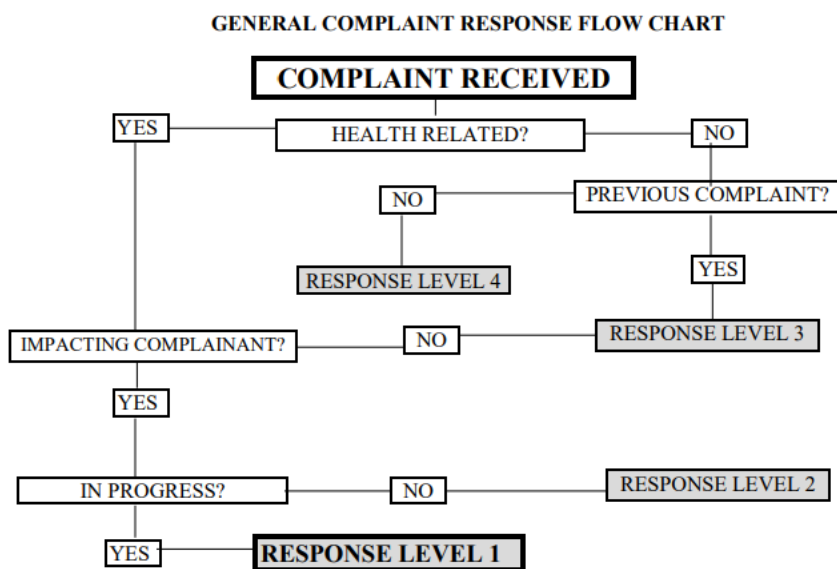
YRCAA Administrative Code B

5.6 Complaint Response The agency receives complaints about alleged air pollution violations routinely via voice mail, phone, e-mail, mail and in person. These complaint response guidelines are used to promote uniform complaint response and to help maximize complaint response efforts. The flow chart is used to channel generic types of complaints to pre-selected response levels. The general nature of the policy may cause some complaints to be assigned at an inappropriate response level. In these cases, professional judgment and initiative should be used to reassign the complaint to the appropriate level. Complaints involving other governmental agencies should be referred to the appropriate agency. Complaints involving imminent danger to life or health will be responded to immediately, regardless of the following guidance.

5.6.1 Receipt and Entry When staff receives a complaint, it will be immediately entered into a database and forwarded to the Complaint Manager. The Complaint Manager will determine if: a. It alleges an actual air pollution violation over which the agency has jurisdiction; b. The alleged violator is identified; c. The complainant is identified; d. The location of the alleged violation is

identified; and e. The date and time of the alleged violation is identified. 5.6.2 Invalid Complaints If the complainant did not or will not supply all the above information, the complaint will not be considered a valid complaint and no response action will be conducted, except to update the database with, “insufficient information to qualify as a valid complaint.”

5.6.3 Response Levels The complaint will be immediately forwarded to the Complaint Manager to determine the appropriate response level. The Complaint Manager will assign the complaint to appropriate staff for response. The following response levels will be used in conjunction with the complaint response flow chart. a. Level 1 Attempt same day site inspection. Request backup if not available for same day response. b. Level 2 Attempt inspection within 48 hours. Request backup if not available for 48 hour response. c. Level 3 Attempt site inspection within 7 days. Request backup if not available for 7 day response. d. Level 4 Site inspection not required. Correspond with the source to advise of the complaint, to inform of the applicable rules and to discuss the potential for enforcement action. A phone call or a fax may be helpful but, it should be followed up in writing.



1.6.4 Tracking The Administrative Assistant will track assignment, response and resolution of each complaint and update the database. a. Data Entry The complaint database will be updated as soon as possible after the response action is completed, no later than three working days. b. Review An updated copy of the complaint form will be forwarded to the Complaint Manager for review. The Complaint Manager will determine if the complaint was addressed adequately and either file the complaint or assign for further action. a. Enforcement Complaints resulting in Notices of Violation will be updated and copies maintained in the enforcement file. Any questions or problems will be referred to the Compliance Division Supervisor for resolution.

5.7.4 Off-Premises Observation

- a. Observations of areas surrounding the facility before entering may reveal a variety of signs of operational practices and pollutant emissions which can aid in the pre-entry evaluation. These include, but are not limited to:
 - i. Obvious vegetation damage near the facility;
 - ii. Odors downwind of the facility;
 - iii. Deposits on vehicles parked near the facility;
 - iv. Other signs of fugitive dust downwind of the facility;
 - v. Fugitive emissions near facility boundaries;
 - vi. Mud or dirt tracked onto public roads or streets; and
 - vii. Proximity of potential receptors.
- b. If odors are present, the weather conditions (including wind speed and direction) should be noted in the compliance evaluation report. Once inside the facility, olfactory fatigue may reduce the compliance evaluator's ability to detect these odors.
- c. In addition to observing the facility surroundings prior to entry, the compliance evaluator should also perform visible emission observations. Although some emission points may not be visible from a location outside the facility property lines, those that are should be read and recorded prior to entry.

5.8 Evidence is the data used by the Agency to support or establish the truth of an allegation. It can be any information or proof which clarifies or helps establish the truth. During the course of an inspection, compliance staff may make observations, conduct interviews, obtain statements, obtain or copy documents, take photographs and collect samples. All of these may become evidence. There are five different types of evidence:

- a. Testimonial Observations made from personal knowledge, derived from a person's sense of smell, touch, sight, taste or hearing;
- b. Direct The object, item or thing itself (e. g., physical material samples);
- c. Documentary A document having significance due to its content (e. g., reports, logs, notifications, manuals);
- d. Demonstrative Something other than the above which is prepared or selected to support, illustrate or otherwise make some fact clearer or easier to understand (e. g., photographs, diagrams, maps, summaries, video tapes); and
- e. Judicially Noticed Matters about which there could be no dispute and become evidence by virtue of their being officially noticed by an administrative or court judge (e. g., YRCAA regulations, scientifically accepted facts, geographic locations, matters of common knowledge).

5.8.1 Evidence Collection An inspection is the process whereby evidence is legally collected and documented. The Agency's case is dependent on the evidence gathered during an inspection. It is

imperative that sufficient evidence be gathered to support a finding and that all pertinent circumstances supporting a compliance determination be clearly documented in the body of an inspection report. Responsibilities in the collection of evidence include:

- a. Substantiating facts with items of evidence, including samples, photographs, copies of documents, statements from witnesses and personal observations;
- b. Collecting evidence in a manner that can be substantiated in legal proceedings;
- c. Documenting the collection of supporting evidence in a clear and detailed manner; and
- d. Maintaining the chain of custody and integrity of physical samples. The following sections are divided into the first four of five types of evidence discussed previously (judicially noticed evidence is only substantiated by courts of law). In each section the most common forms of evidence collection are addressed along with procedures for collection, preservation and documentation.

5.8.2 Testimonial

a. Employee Observations made by an employee during an inspection are the most common form of testimonial evidence. They are indirectly supported by the qualifications of the person making the observations. In some cases, Agency personnel may be considered expert witnesses based on individual education and experience. Quite often, the observations of the employee are the only evidence supporting an alleged violation, so it is imperative that all applicable observations be documented in the inspection report.

b. Statements On occasion it may be necessary to obtain a formal statement from a person or persons who may have first hand knowledge of relevant facts. A statement of fact is signed and dated by the person who can testify to those facts in court. The principal objective of obtaining a statement is to record in writing, clearly and concisely, relevant factual information so that it can be used as documentary support. The following are recommended procedures to follow when considering whether to take a statement:

i. Determine the need for a statement. Will it provide useful information? Is the person making the statement qualified to do so by personal knowledge?

ii. Determine the facts and record those which are relevant and which the person can verify under oath. Make sure all information is factual and first hand. Avoid taking statements that cannot be corroborated.

iii. The person preparing a statement should:

- 1. Use a simple narrative style;
- 2. Avoiding stilted language;
- 3. Narrate the facts in the words of the person making the statement;

4. Use the first person singular; and 5. Present the facts in chronological order including all relevant dates and times, unless the situation calls for other arrangements.

iv. YRCAA staff should:

1. Document why the person is qualified to make the statement;
2. Have the person sign and date the statement; and
3. Always provide a copy of the statement to the signer.

5.8.3 Direct The collection of material samples is often necessary to establish a "substance specific" violation (e. g. asbestos). The Agency's successful processing of enforcement actions is dependent on samples carefully collected, preserved and presented. The integrity of evidence must be established on all material objects collected, and records must support the integrity of the evidence. This section outlines the recommended procedures for collecting and handling samples.

a. Consent Samples may always be taken from public property but consent is required to collect samples from private property. As long as the employee is allowed to sample it is considered voluntary and consensual. Absence of an expressed denial constitutes consent. Expressed consent is not necessary.

b. Split Samples A portion of the recovered sample should be offered to a facility responsible person so they can conduct an independent analysis. Whenever a split sample is taken, Agency personnel should try to select homogeneous materials so the samples will be as similar as possible.

c. Equipment All sample containers must be clean prior to recovering a sample to eliminate cross contamination of the specimen. To ensure the accuracy of collection instruments or devices used to obtain a sample, the equipment must be properly calibrated before and after the sampling. Documentation of the calibration should be included in the inspection report.

d. Identification All evidence must be clearly identified and labeled or tagged to show:

- i. The date and time collected;
- ii. The name of the person collecting the evidence;
- iii. The name and address of the premises involved;
- iv. The specific location where the evidence was collected. Photo documentation, where possible, will strengthen the integrity of the evidence; and
- v. Identify the sample with a distinct numbering system.

e. Chain of Custody For the laboratory analysis of a sample to be admissible as evidence, a logical and documented connection must be shown between the samples taken and the analytical

results reported. This connection is shown by using the chain of custody procedures which document sample integrity from the time the sample was taken to the time it is analyzed. Agency personnel taking the samples are responsible for assuring that the chain of custody procedures are observed. Every person handling Agency samples or any other materials collected as evidence must follow the chain of custody requirements. Whenever possible, employees who collect the samples should deliver the samples to the laboratory and request the analysis themselves thus, limiting the number of persons handling the sample. To establish and maintain an effective chain of custody on evidence, the sample collector should follow four general rules:

- i. Evidence should be handled by as few persons as possible;
- ii. Evidence handling procedures must ensure the evidence is not contaminated or altered;
- iii. The names of all persons handling evidence, and the date and time of such handling, must be recorded to show continuous custody and control from collection to presentation. There should be no gaps in the accountability; and
- iv. Physical evidence must be secured in a locked area with limited accessibility to keep the evidence from being tampered with or lost.

f. Chain of Custody Form Records must support the integrity of the evidence. Every person handling the evidence must be identified to show continuity of custody. Persons completing the Chain of Custody must handle it as a legal document. When the sample is transferred from one person or agency to another, both the sample and the form become links in the chain of custody of evidence. The lower portion of the form is a record of transfer and receipt of the sample, and thus is a written account of all persons responsible for routing, processing and storing of the sample. The following entries on the form must be completed:

- i. Relinquished by - The person giving up the sample must sign the form.
- ii. Received by - The person receiving the sample must sign the form.
- iii. Firm/Agency - Name of the laboratory performing the analysis.
- iv. Date - Date the sample is submitted to the laboratory.
- v. Time - Time the sample is delivered to the laboratory.
- vi. Analysis - Type of analysis requested.

To establish and maintain an effective chain of custody on evidence, the sample collector should follow four general rules:

- i. Evidence should be handled by as few persons as possible;
- ii. Evidence handling procedures must ensure the evidence is not contaminated or altered;

iii. The names of all persons handling evidence, and the date and time of such handling, must be recorded to show continuous custody and control from collection to presentation. There should be no gaps in the accountability; and

iv. Physical evidence must be secured in a locked area with limited accessibility to keep the evidence from being tampered with or lost.

f. Chain of Custody Form Records must support the integrity of the evidence. Every person handling the evidence must be identified to show continuity of custody. Persons completing the Chain of Custody must handle it as a legal document. When the sample is transferred from one person or agency to another, both the sample and the form become links in the chain of custody of evidence. The lower portion of the form is a record of transfer and receipt of the sample, and thus is a written account of all persons responsible for routing, processing and storing of the sample. The following entries on the form must be completed:

i. Relinquished by - The person giving up the sample must sign the form.

ii. Received by - The person receiving the sample must sign the form.

iii. Firm/Agency - Name of the laboratory performing the analysis.

iv. Date - Date the sample is submitted to the laboratory.

v. Time - Time the sample is delivered to the laboratory.

vi. Analysis - Type of analysis requested.

5.8.4 Documentary Documentation is a general term referring to all print and mechanical media produced, copied or taken by Agency personnel to provide evidence of facility operating conditions. Types of documentation include inspection reports, checklists, drawings, flow sheets, maps, lab analyses of samples, chain of custody records, statements, copies of records, printed materials and photographs. Any documentation gathered or produced in the course of the inspection process may eventually become part of an enforcement proceeding. To this end, it is the employee's responsibility to produce documentation that is legible, concise, objective, accurate and complete. All documents taken or prepared by Agency personnel should be noted and related to specific inspection activities. (For example, photographs taken at a sampling site should be listed, described and related to the specific sample number.)

a. Photographs Clear photographs of relevant subjects provide an objective record of conditions at the time of inspection and therefore are valuable support to other evidence. To be admissible as evidence generally an employee must be able to testify that any given photograph "fairly and accurately represents" what he/she saw at the site on that date. When a situation arises that dictates the use of photographs, the employee should obtain consent to take photographs from the facility representative. As long as the employee is allowed to photograph it is considered voluntary and consensual. Absence of an expressed denial constitutes consent;

expressed consent is not necessary. The employee must be tactful in handling any concerns or objections about the use of a camera. If the facility representative denies the employee permission to take photographs, the employee should request the facility to provide a photographer. Photographs may always be taken from areas of public access (e.g., outside the fence, from the road, from the parking lot, etc.) as long as no equipment is used that might extend over or onto private property. Photographs are only as good as the documentation accompanying the photographs, because the employee must be able to convince a Hearings Board, a judge or a jury that the photographs fairly and accurately represent what the employee saw at a given facility on a given date. To build the documentation necessary for this purpose, the employee should enter notes about each photograph in the inspection report in its proper place in the chronology of the inspection, and in a separate photo record log. When taking a photograph, the employee should visualize how the photographs will look to the general public or in a courtroom. Evidence may be strengthened by photographs when the picture tells its story with a minimum of explanation. There are several guidelines that should be considered:

i. Direction It is helpful to photograph a subject from a point that will indicate direction and location of the subject;

ii. Center of Interest There should be only one major subject or center of interest in a scene. When taking photographs, the employee should eliminate or subordinate all secondary elements and focus on the main element. Be sure the subject actually fills the view finder;

iii. Simple Background The background should be kept simple, so as not to distract attention from the main subject;

iv. Scale If the subject is unknown or unfamiliar to viewers, the employee should include some familiar object to indicate comparative size (e.g., a person, a car, a pen);

v. Location or Context It is sometimes useful to photograph a subject from a point where the location of the subject will be clear in relation to other features;

vi. Motion If action or movement is implied by the photograph, more space should be allocated in the direction of the action than away from it;

vii. Tones Make sure the background is tonally distinct from the subject. Imagine how tones will look when reduced to gray; and

viii. Safety In areas where there is a danger of explosion, flash photographs should not be taken. If there is a danger of electrical shock, photographs should be taken from a distance known to be safe. A photo log should be maintained for all photographs taken during an inspection, and the entries made at the time the photographs are taken. These entries are to be numerically identified so that after the photos are downloaded to a file, they can be serially numbered corresponding to the logbook description. The log entries should include the name of the photographer, a description of film used (i.e., its ID number and ASA number), date,

location, a brief description of the subject being photographed and the registration number of the source or complaint number. If printed, prints should be numbered and identified corresponding to the photo log. Employees should not write on the front of the print.

b. Records Agency personnel are authorized to obtain copies of any facility records necessary to complete the inspection report. When employees are called to testify in court, they must be able to positively identify each particular document and state its source and the reason for its collection. The employee should initial, date, number and record the facility's name on each record, and reference these items in the field notes. Originals should be returned to the proper personnel or to their correct location.

c. Printed Material Brochures, literature, labels and other printed matter may provide important information regarding a facility's condition and operations. These materials may be collected as documentation, if, in the employee's judgment, they are relevant. All printed matter should be identified with the date, employee's initials and related sample numbers. Reference to these materials should be made in the field notes.

5.8.5 Demonstrative Schematic drawings, flow sheets, maps, charts and other graphic records can be useful as supporting documentation. They can provide graphic clarification of location relative to the overall facility, relative height and size of objects and other information which, in combination with samples, photographs and other documentation, can produce an accurate, complete evidence package. Drawings can provide graphic clarification of a site location relative to an overall facility and the parameters of an emission or contamination. A drawing can be entered directly into the inspection report itself; this integrates it clearly with other notes in chronological order. Drawings should be free of unnecessary details. Basic measurements and compass points should be included as necessary to provide a scale for interpretation. Some types of drawings are:

- a. General sketch of the facility;
- b. Sketch showing where photos and/or samples were taken;
- c. Sketch showing where potential violations are observed; and
- d. Sketch showing the layout of a particular part of a facility, which was the major focus of the inspection. Although, not as accurate or credible as a photograph, drawings and diagrams are good backup methods when photography cannot suffice. Sometimes a photograph would contain so much detail that the crucial features are not clear or would require too much explanation. In such cases a good, simple schematic drawing or diagram can be useful. The drawing should contain notations of the approximate dimensions of the subject. The level of accuracy of the drawing should also be noted (e.g., "estimated" or "measured with steel tape"). All such visual notes should be referenced to show where the subject was observed in the facility. All drawings should be labeled "not to scale".

