

The Rock Prairie Dairy rapid Health Impact Assessment (HIA) is an objective assessment of the potential health impacts of the large dairy operation being developed in eastern Rock County. The HIA was initiated through a mini-grant offered by the Department of Health Services that was designed to introduce the process to local health departments and to build their HIA capacity. The opportunity to conduct this HIA on the dairy was seen as a great way to understand and learn about an emerging farming approach being integrated into the Rock County community that is shaping the agricultural landscape of the country. The ultimate goals of the HIA are: (1) to objectively highlight the potential issues and impact mitigation strategies of the dairy, (2) have a positive influence on the project development and its potential health impacts, (3) to help foster the relationship between the Rock Prairie Dairy, the community and local agencies.

A Health Impact Assessment (HIA) is a tool that can be used to incorporate health issues in the planning process of a project or policy. The World Health Organization defines HIA as:

“A combination of procedures, methods and tools by which a policy, programme or project may be judged as to its potential effects on the health of a population, and the distribution of those effects within the population.”

Rock Prairie Dairy
Rapid Health Impact Assessment

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Conducted by
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Citizens from the Towns of Bradford and Johnstown

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Executive Summary

The proposal to build the Rock Prairie Dairy (RPD) has generated concerns regarding the potential negative health implications that may result from the creation of such a large animal operation. Often times, public perception of Concentrated Animal Feeding Operations (CAFOs) is that they have negative impacts on the environment resulting in negative health outcomes for the residents surrounding the operations. A large body of research and case studies has supported this negative association. However, this generality cannot be projected across the CAFO spectrum as factors such as the type of animals, operational design, and on-going management practices play a significant role in the impact potential.

The Rock Prairie Dairy has also been a controversial issue for the surrounding community in which it will be built beyond the potential negative impacts linked to CAFOs. Segments of the public have expressed the concern that the current CAFO regulations are insufficient with respect to public health and do not provide local governments the necessary authority to address health impacts.

The purpose of this Health Impact Assessment (HIA) is to objectively assess the potential health impacts of the Rock Prairie Dairy. Early in the development of this HIA it became clear that making conclusive statements about health impacts would be challenging given the rapid nature of this project and deficiencies in existing data that correlate with the specifics of the proposal. The HIA itself was written prior to the construction of the facility so the quantification of actual environmental release was not possible. Since the dairy was still in the planning stage, a comparative analysis of the potential pollutants expected from this type of operation and the mitigation strategies built into the structural and operational plans was used as the evaluation tool. It should be noted that this HIA is non-regulatory and was completed with the assumption that the dairy will fulfill all legal requirements and be constructed as planned. The ultimate goal of this HIA is to highlight potential health impacts and to provide recommendations to the decision makers of the Rock Prairie Dairy that may minimize negative and maximize positive health impacts. Table 1 below summarizes the potential impacts analyzed as part of this HIA:

Table 1. Summary of potential health impacts

Health Outcome/ Determinant	Direction	Likelihood of Impact	Distribution of Impact	Literature Association
Hazardous Gas and Particulate Emissions	▼	Possible	Dairy workers and residents living closest to site and manure application will be impacted the most	***
Nuisance Odors	▼	Likely	Residents living closest to site and manure application will be impacted the most	***
Groundwater Quality	▼	Possible	Residents near site with poorly constructed or shallow wells	***
Surface water Quality	▼▲	Possible	Recreational users of waterways, fish, wildlife	***
Economic Impact	▼▲	Likely	Local economy, property owners, local businesses and farmers	**
Traffic	▼	Likely	Motorists near intersection of HWY 14 and Scharine Rd.	**
Noise	▼	Likely	Residents in close proximity to site	**
Visual	▼▲	Likely	Motorists on HWY 14 and Scharine Rd area residents	*
Insect Borne Disease	▼	Possible	Residents in close proximity to site	**

▼ = Negative impact

▲ = Positive impact

▼▲ = Both positive and negative impacts are possible

Literature Association – strength of studies associating health impact to large animal operations

- *** Many strong studies
- ** Few good studies
- * No clear studies, but consistent with public health principles

Introduction

The landscape of dairy industry in Wisconsin, America’s Dairyland, is undergoing dramatic changes as smaller “family farms” are being replaced by larger “mega dairies.” With this shift comes increasing public concern about the health impacts that have been attributed to Concentrated Animal Feeding Operations (CAFOs). As with any significant producer of waste in our built environment, CAFOs have the potential to negatively impact the surrounding environment resulting in negative health outcomes for the surrounding community. The degree of impact is dependent on a multitude of factors, which results in the need to assess CAFOs on an individual basis as opposed to a broad view. The goal of this Health Impact Assessment (HIA) is to provide an objective evaluation of the potential health impacts of the Rock Prairie Dairy, a dairy CAFO proposed for the Town of Bradford in Rock County, Wisconsin.

The Rock Prairie Dairy

The proposed Rock Prairie Dairy (RPD) will be built on 124 acres in the southeast ¼ of Section 2 in the Town of Bradford, Rock County, WI. At full capacity the dairy will house 5,200 milking and dry cows. An estimated 73,753,578 gallons of wastewater will be produced by the farm per year according to the wastewater permit application. Lactating dairy cows produce 37-fold more urine and feces than humans per day, excluding other agricultural and residential wastewater production. This is equivalent that would be produced by about 192,400 people. This mixture of manure and other wastewater will be stored in manure lagoons until it is land applied. The lagoons are sized to store 80,175,861 gallons of waste giving an approximate capacity of 397 days of storage capacity, which exceeds the 180 days of storage requirement. All liquid and solid manure and wastewater will be land applied on approximately 5,340 acres of surrounding farmland.

The original submitted RPD plans called for land disposal of manure through a combination of broadcasting, draglining and center pivot applications. As of the release of this HIA, the RPD voluntarily removed the center pivots from the facility plans to allow for the permitting process to move forward while the possible public health implications of this method are studied more closely.

Summary of the Proposed Rock Prairie Dairy Development

- 5,200 milking and dry cows (full capacity)
- Estimated Annual Waste
 - 64,585,275 gallons of liquid manure
 - 9756 tons of solid manure
 - 9,168,303 gallons of silage leachate & precipitation runoff from feed storage area
- Facility
 - 124 acres of development
 - 6 freestall barns
 - 4 waste storage lagoons
 - 2 milking parlors
 - Manure and sand storage area
 - Feed storage complex
 - Milking parlor
 - Storm retention pond
- 5340 acres to be used for manure disposal

The Community

The RPD will be situated approximately 8 miles east of the City of Janesville, which is the largest urban area in Rock County and approximately 12 miles northeast of the City of Beloit, which is the second largest urban area in Rock County. This area is known as the “Rock Prairie” and lies on a relatively flat outwash plain directly south of the southernmost extent of the Wisconsin Glaciation. The Rock Prairie area is known for its rich agricultural soils and agriculture has historically been the dominant land use. The predominant form of agriculture is a cash-grain

cropping system consisting of mainly of corn and soybeans. Dairying is not common in this area and has been declining in Rock County in recent decades. The introduction of the dairy represents a change in land use from one form of agriculture to another and will have a significant visual impact at this site.

Approximately 5,000 acres of farmland in the Town of Johnstown and the Town of Bradford have been contracted for disposal of manure. Due to their proximity to the dairy site and manure application site, residents of these towns are likely to experience the greatest impact from activities associated with the dairy. The towns of Bradford and Johnstown have similar demographic characteristics. In 2010, the population of the Town of Bradford was 1,121 and the population of the Town of Johnstown was 778. The dominant racial group for the Town of Bradford and Johnstown is white accounting for 98.7% and 99.6% of the population respectively.

HIA Process

A Health Impact Assessment (HIA) is a tool that can be used to incorporate health issues in the planning process of a project or policy. The World Health Organization defines HIA as:

“A combination of procedures, methods and tools by which a policy, programme or project may be judged as to its potential effects on the health of a population, and the distribution of those effects within the population.”

The five steps of a HIA:

1. **Screening** – Determines the need and value of a HIA
2. **Scoping** – Determines which health impacts to evaluate, the methods for analysis, and the workplan for completing the assessment.
3. **Assessment and Recommendations** – Provides: a profile of existing health conditions; evaluation of potential health impacts; strategies to manage identified adverse health impacts.
4. **Reporting** – Includes development of the HIA report and communication of findings and recommendations.
5. **Monitoring** – Tracks impacts on decision-making processes and the decision as well as impacts of the decision on health determinants.

(Human Impact Partners - <http://www.humanimpact.org>)

Step 1. Screening

In October of 2010, the Wisconsin Department of Health Services (DHS), Bureau of Environmental and Occupational Health (BEOH) announced the availability of mini-grant funding for local health departments to conduct a rapid Health Impact Assessment (HIA). The Rock County Health Department saw this as an opportunity to build HIA capacity. Several local projects and policies were analyzed to determine the potential added value that a HIA could

bring. This evaluation identified a proposed large dairy operation, the Rock Prairie Dairy (RPD), as the leading candidate.

The proposed RPD, with a maximum capacity of 5,200 dairy cows, would be the largest Concentrated Animal Feeding Operation (CAFO) in Rock County. The review of existing literature found it well documented that large CAFOs have the potential to significantly impact the health of the surrounding community. The negative perception became evident as the proposed dairy was increasingly becoming a controversial issue for citizens in the surrounding community.

The concerns also went beyond the potential negative health impacts associated with CAFOs. New or expanding CAFOs of this size are mainly regulated through the Wisconsin Livestock Siting Law, which was designed to balance local control, community oversight, environmental protection and the need for a predictable siting process. The siting law sets standards that are designed to minimize potential negative impacts, but does not allow local controlling governments from setting more restrictive standards or to address impacts not regulated in the law during the permitting process. These limitations lead to concerns that the regulatory processes were insufficient with respect to public health and did not provide local agencies with the necessary power to address potential health impacts.

For these reasons stated above, it was determined that a HIA would add value by identifying potential negative health impacts, especially in areas where the Livestock Siting Law standards fall short or are absent, and by providing mitigation strategies to the owner. It was also concluded that the HIA would provide a background that could serve as a base to address citizen inquiries and complaints that local agencies will likely encounter after the farm is in operation. Additionally, the HIA could also be drawn upon during the planning process for similar farms in the future since the national trend is towards larger operations and it is unlikely this will be the last CAFO proposed in Rock County. Given that the resources were available and the timelines were appropriate, it was decided that the Rock County Health Department would apply for the mini-grant to conduct a HIA on the proposed Rock Prairie Dairy.

In November 2010, the Rock County Health Department received notification that the mini-grant was awarded. After approval from the Rock County Board of Health, the acceptance was finalized.

Step 2. Scoping

There are a large number of health impacts associated with CAFOs, but the degree of impact for specific health concerns is not consistent for all operations. The type, size, design and geographical location all heavily influence the potential health impacts. In order to narrow the focus on the most significant potential health impacts for the Rock Prairie Dairy the following activities were completed:

1. Review of comments and concerns from public hearings conducted as part of the regulatory approval process.
2. Examination of local media coverage of the proposed project.
3. Analysis of the RPD proposed design and operational strategies.

4. Review of literature specific to health impacts of large animal operations.
5. Review of statutes and administrative codes related to large animal operations.
6. Interviews with stakeholders and agencies involved in the approval process.
7. Scoping brainstorming session involving Rock County Health Department staff and coordinators of HIA mini-grant from the WI Department of Health Services. (See Appendix B pathway diagrams and scoping worksheets developed as a result of this meeting)
8. Completion of a community survey that targeted residents living in close proximity to the proposed facility and manure disposal activities. (See Appendix B for survey results and details)

Table 2. Health Impacts Evaluated in the Assessment

Area Evaluated	Health Concern	Justification for Inclusion	
		Literature Association ¹	Community Concern ²
Air Quality	Respiratory Health	***	***
Odor	Mental Health	***	***
Groundwater	Unsafe drinking water	***	***
Surface Water	Unsafe recreational waters	***	**
Property Value & Economic Impact	Mental Health	**	**
Traffic	Vehicular related injuries	**	**
Noise	-Mental Health -Hearing Loss	**	*
Visual	Mental Health	*	**
Insects	-Disease Transmission -Mental Health	**	*

1 *Literature Association* – strength of studies associating health impact to large animal operations

- *** Many strong studies
- ** Few good studies
- * No clear studies, but consistent with public health principles

2 *Community Concern* – relative citizen concern expressed in surveys, public hearings and in media

- *** Mentioned frequently
- ** Mentioned moderately
- * Mentioned a few times

Although all of the areas listed in Table 1 were included in the assessment, the focus was weighted to the first four areas. A more in depth analysis was completed on air quality, odor, groundwater and surface water as these topics were noted as being of the greatest concern by citizens and were found to have the greatest association based on scientific studies.

The possible methods to analyze the chosen health impacts were limited to ones that were predictive in nature, since the HIA was scheduled to be completed prior to construction and operation of the proposed dairy farm. There were also no animal operations similar in size and design in the geographical area of the proposed site that could provide data. After considering these limitations, it was decided that the assessment would be conducted using a comparative analysis of the potential pollutants expected from this type of operation and the mitigation strategies built into the dairy's proposed structural and operational plans. The estimation of pollutants and effectiveness of the mitigation strategies were based on reviews of existing pertinent literature and the consultation of technical experts and individuals involved in aspects of animal operations. Participation was sought from key representatives from the Rock Prairie Dairy, Wisconsin Department of Natural Resources, Bradford Town Board, Department of Agriculture Trade and Consumer Protection, Rock County Land Conservation Department, Rock County Planning and Development Agency, University of Wisconsin Extension, Friends of the Rock Prairie advocacy group, and citizens residing in the surrounding area of the proposed dairy farm.

Step 3. Assessment

Air Quality

Concentrated animal feeding operations (CAFOs) have the potential to release a variety and large quantity of emissions including gases, particulate matter and odors. These emissions are mainly generated from the microbial decomposition of the substantial amount of feces and urine from the animals, with a smaller contribution due to wastewater from other processes. The Rock Prairie Dairy is estimated to produce approximately 64,585,275 gallons of liquid manure and 9,756 tons of solid manure a year, which will require extensive collection, storage and disposal systems. [1]

The list of potential gases generated and emitted from a CAFO operation, such as the Rock Prairie Dairy, is very extensive, with several of these compounds being considered hazardous to human health. Generally the main airborne chemicals of concern released from CAFOs are Ammonia (NH₃), Hydrogen Sulfide (H₂S), Methane (CH₄) and Volatile Organic Compounds (VOCs). Ammonia and Hydrogen Sulfide are the two toxic gases that have received the most attention in air quality studies and regulation on CAFOs.

Ammonia is a colorless gas that has a sharp pungent odor. It is a strong respiratory irritant and can cause chemical burns to the respiratory tract, eyes and skin. Reactions of airborne ammonia

with other compounds are also a significant contributor to particulate matter. Ammonia is essential to many biological mechanisms. Hydrogen Sulfide has a strong rotten egg odor and is an irritant gas that can cause inflammation of the eye membranes and respiratory tract. High concentrations may also cause nervous system complications. The release of these two gases can occur at a variety of operation stages of the RPD. Since both are the result of the breakdown of animal waste, release may occur during the generation, collection, storage and land application of the manure generated from the operation.

Particulate Matter (PM₁₀ & PM_{2.5}) is also a potential health concern associated with CAFOs. Particulate matter is composed of organic and inorganic material, which is inhaled and can cause damage to the respiratory system and heart. Endotoxins, products of gram-negative bacteria, are a component of PM that have been identified as a toxic agent largely responsible for adverse health effects of exposure to agricultural dusts. Particulate matter from the dairy would likely come from the housing barns, food storage areas, dry manure storage and liquid manure systems. Secondary PM may also be formed in the atmosphere from the reaction of released gases, particularly ammonia. Bioaerosols are another potential concern as manure contains many harmful pathogens such as bacteria, viruses and parasites or microbial by-products. Airborne pathogens may originate anywhere in the manure handling systems, but the biggest risk would come from the center pivot spraying.

Exposure Risk

There have been extensive occupational studies documenting unsafe emission exposure levels and the associated negative health impacts for CAFO workers. This relationship is expected since the farm workers are closest to the release points of hazardous gases. There has been limited research and thus little information to make conclusions regarding the exposure rates to the surrounding community beyond the property lines of CAFOs. The RPD can be expected to generate large amounts of hazardous gases and much will be released into the surrounding air, but the concentrations that residents in close proximity will be exposed to is difficult to predict. Environmental air monitoring studies have not identified air contaminants above permissible OSHA standards at property lines. Ammonia and Hydrogen Sulfide were found at less than 1 ppm. Levels of total dust and endotoxins were found to be undetectable at greater than 300 meters from the source [2]. Endotoxin exposure and the associated adverse health effects have been studied and documented for agricultural workers. There is evidence that endotoxins are a primary and secondary cause of asthma in a domestic setting, but there is a large gap in research that looks at how CAFO particulate emissions affect residents in the surrounding community [3]. The overall trends of bioaerosol studies on manure indicate microbial air concentrations decrease as distance from the source increases. Although the health risk associated with these bioaerosols is evident, trying to quantify the risk to neighboring properties is difficult due to the lack of research. More and improved studies are needed to help determine health risks to residents downwind from the sources, especially from the manure land application sites [4].

Existing Conditions

Specific air quality data for the proposed facility and manure land application sites with respect to the emissions of concern is not available. The Wisconsin Department of Natural Resources air monitoring program does collect and report air quality data to the public. The system uses the

Air Quality Index (AQI), which is based on ozone and PM_{2.5} data collected from several air monitoring sites throughout Wisconsin. The closest air monitoring station to the proposed RPD is the Beloit-Cunningham station located in Beloit, WI. This site has not measured PM_{2.5} since 2002, leaving ozone as the only available data. Regional PM_{2.5} levels are available based on monitoring sites in nearby counties, but quantifying the contribution the RPD productions will have on this level is unrealistic due to the large number of potential agricultural and industrial emission sites in the general region. There is also no significant data available for ammonia and Hydrogen Sulfide background levels for the potential RPD facility or manure activity sites. There are no industrial sites near the RPD facility or land application sites.

Predicting and measuring the hazardous emissions the RPD activities will generate is difficult without having a lot of uncertainty attached. Typically CAFO emission rates are intermittent and can vary greatly depending on weather conditions, daily activities, time of day and seasons. Existing dispersion modeling has been used in a limited capacity to estimate emissions downwind from CAFOs, but each method has been found to have significant deficiencies. According to a review on the existing methods of monitoring and modeling CAFO emissions, the use of modeling techniques have been complicated by the variety of pollutant sources, the emission rate variability and the inability to accurately account for the degradation and deposition of gas in transport downwind [5]. The study concluded that more research is needed to find a more accurate model for CAFO emissions. The Environmental Analysis conducted by the DNR estimated total annual emissions of pollutants the RPD is expected to generate including Ammonia, Hydrogen Sulfide and Particulate Matter (PM₁₀). However, due to the lack of accurate modeling techniques and existing research data, specific conclusions on how this will affect the health of the community members cannot be drawn with great confidence.

RPD Emission Potential

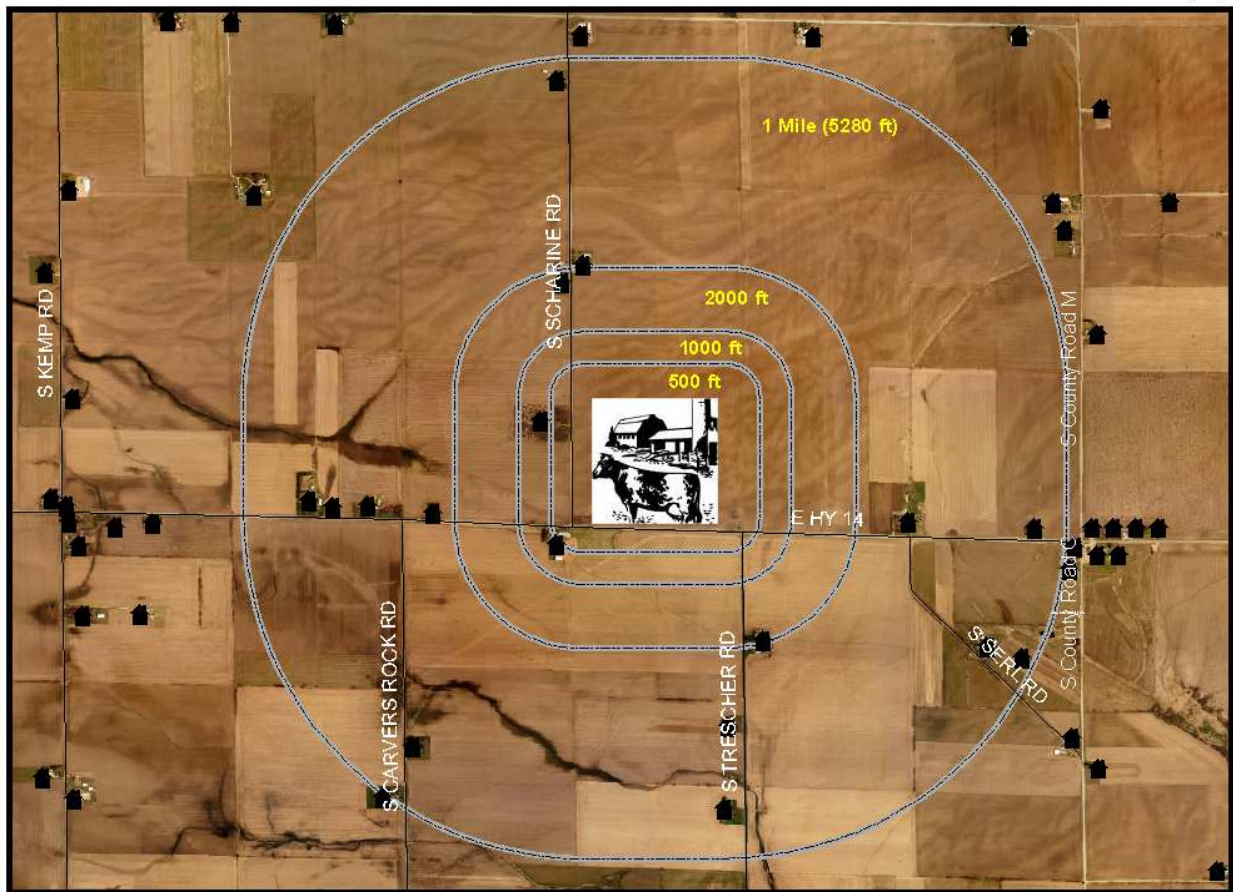
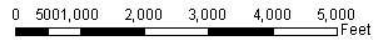
Despite the inability to paint a clear picture of public health implications it is reasonable, based on the sheer volume of emissions anticipated, to conclude there is a potential for a negative health impact on residents who may spend significant time near the RPD. This is especially true for high-risk groups, such as the elderly, young children and people with respiratory conditions like asthma. The potential negative impact along with the uncertainty of exposure rates leaves the hazardous emission mitigation strategies on the design and operation of the RPD critical when assessing potential emissions.

Air pollutants may be released from the animal housing buildings, feed storage areas, manure storage areas and manure land application sites. Other activities, such as exhaust from machinery and trucking activities, will also contribute to smaller degree to the overall agricultural emissions of the RPD. Reduction of emissions is largely dependent on the mitigation strategies designed for CAFO operations.

The animal housing buildings, particularly the six freestall barns, have a large potential for emissions release due to the manure generated from the dairy cows. Ammonia is of the greatest concern due to rapid formation. Nitrogen in the animal urea will hydrolyze rapidly into ammonia soon after excretion. The microbial action will continue to produce ammonia under both aerobic and anaerobic conditions. It is also very water soluble accumulating in liquid manure and will volatilize quickly as it dries. Hydrogen Sulfide from the buildings is generally not a concern since it is formed under anaerobic conditions. The planned regular removal of

manure from the barns is expected at the RPD since it directly effects the milk production and should help reduce the emissions build-up and release. Workers inside the buildings are at the most risk due to exposure to elevated concentrations from the build-up of the gases. Several studies suggest an association of increased respiratory symptoms in animal confinement buildings [2,3]. Assessing the ventilation effectiveness of the ventilation system by measuring emissions, particularly ammonia and particulate matter, after operation begins is vital to protecting workers, as future air quality regulation requirements are unclear. The risk to surrounding residents is expected to be significantly less at and beyond the facility property line since ammonia concentrations will naturally decrease as distance from the source increases. There are a limited number of residences near the facility so the population exposure directly from the gases produced in the buildings is predicted to be low. There are two residences about 500 feet from the proposed facility site and five within 2000 feet. [Map 1]

Rock Prairie Dairy - Town of Bradford, Rock County, WI



Map 1. Proximity of residences to proposed dairy.

The manure storage system, which includes the dry manure storage area and the four lagoons, has a large hazardous emission potential. High concentrations of several toxic gases from the microbial activity can be quickly produced in these large manure collection areas. Hydrogen

Sulfide is of great concern as it has been implicated in a number of deaths associated with confined space manure storage designs. Hydrogen Sulfide can quickly reach life-threatening levels, especially during agitation activities such as pumping. At fatal levels it deadens the sense of smell and eliminates the natural “rotten egg” smell warning. The design of the four lagoons calls for impermeable covers and biofilters on the exhaust systems. The use of covers on manure storage lagoons is an established practice that has been shown to greatly reduce hazardous gas emissions. The agricultural beneficial management practices (BMPs) report from the WDNR indicates this method should reduce Ammonia and Hydrogen Sulfide by up to 90% [6]. The emission exposure risk to the community should be minimal due to the gaseous emission reduction and distance from the source. Workers involved in activities in or around confinement spaces where build-up of gases, especially Hydrogen Sulfide, still have significant exposure risks. Proper safety procedures should be required and strictly enforced. Proper safety training, warning signs, use of a self-contained breathing apparatus, life line systems, and hazardous gas testing before entering high-risk areas should be standard for workers. Proper installation and ongoing maintenance of the membrane and exhaust systems is crucial to the emission reduction as the manure facility design. The RPD operation and maintenance documents indicate the liners and exhaust systems will be subject to a frequent inspection schedule and call for timely repairs of identified failures.

Land application of the manure will likely have the most potential for releasing unhealthy emissions into the surrounding community. The spreading of solid manure and application of liquid manure via dragline hoses will be done the spring and fall. The planned injection or incorporation into the soil is expected to dramatically reduce the emission potential. These methods are expected to reduce ammonia release by up to 70% for injections and up to 60% for incorporation [6]. Similar reduction would be expected with other toxic emissions, such as Hydrogen Sulfide and other hazardous gases. The greater the amount of time the manure is exposed to the air the greater the emission potential, so limiting time between application and incorporation is critical with respect to emissions. There is an occupational risk associated with these applications due to the quantity of manure that will be handled. Workers applying the manure should have proper respiratory protection available if needed. As previously discussed, exposure risks of hazardous emissions to the surrounding residents is unclear. Testing procedures should be developed by the RPD or a regulating agency to determine rates of key emissions at the property lines of the fields undergoing the spreading.

Assuming the center pivot technology will be used as indicated in the original plans, the manure water from the storage lagoons will be applied on fields in June and July. Due to the aerosolization of the particles this manure application method carries a greater risk of toxic emission potential than the techniques previously described. The main concern of this method with regard to public health are bioaerosols that can drift and expose nearby residents. Bioaerosols may contain pathogens and the endotoxins produced by some pathogens. The actual risk of these bioaerosols is difficult to determine as dose response understanding is limited and dispersion prediction techniques are currently inadequate. The one consistent trend found in bioaerosol studies on waste application sites is that airborne microbial concentrations decrease with distance from the source [4]. As part of the Environmental Assessment of the RPD the Wisconsin Department of Health Services (DHS) conducted a review of the center pivot proposal with regard to public health [7]. The study found that the 500 ft minimum setback of the center pivots from residential homes would be adequate if the system is designed to provide a reduced microbial load, non-fine droplets and a spraying schedule that factors in weather and time of

day. The EA Addendum that was released after this study indicated that the WDNR and RPD management team agreed to address these recommendations before the final decisions regarding the center pivot design are made and that a study may be conducted to evaluate the effectiveness of the practices proposed. In March of 2011 the RPD voluntarily decided to remove the center pivots from the facility plans to allow for the permitting process to move forward. The WDNR is planning on conducting a study to determine how the center pivots may meet the intent of the DHS memo. Based on these developments there is a strong possibility the center pivots will be a part of the RPD operation. Future studies comparing changes in reported illness or respiratory issues with center pivot activities should be conducted to better understand the risk to the community.

Odor

Unpleasant odors that may be produced from the Rock Prairie Dairy are one of the biggest issues residents expressed in the citizen surveys and in public hearings. Some degree of odor from any animal operation, especially CAFOs, is unavoidable. There are several possible unpleasant odor sources on CAFOs, but the manure production, storage and disposal have the greatest potential to create negative impacts. There are several compounds that are associated with odor, but it is never the result of a distinct compound that is produced from CAFOs. The principal agents responsible for noxious odors are ammonia, hydrogen sulfide, and a variety of volatile amines, organic acids, and aldehydes etc. Some of these have very low odor thresholds and offensive smells. These chemicals also can act synergistically and produce an odor more offensive than expected from the sum of the individual compounds in the air.

Health Effects

The direct health effects of the odor that residents may be exposed to from large CAFOs are expected to be mainly psychological and not physically directly related. This is not surprising given that several studies have shown that the toxic compounds generally given off by CAFOs are found to be at significantly lower levels in the surrounding residences than human health impact thresholds [8]. However, physical symptoms can be annoyance-mediated, meaning they are a result of the primary psychological reaction. CAFO odors can still be quite strong beyond the property lines and lead to significant negative effects such as increased anger, anxiety, depression, and fatigue. The psychological effects can also lead to quantifiable physical problems such as high blood pressure and self-reported symptoms such as headaches or nausea [9].

Reactions to odors can vary greatly between individuals and can be influenced by a large number of variables. Frequency, intensity and duration are common factors that shape whether an odor is a problem for an individual. Other influences like age, sex, coping style or whether or not a person obtains a positive gain from the odor source also play a role. A neighboring landowner who has a business relationship with a CAFO is less likely to be bothered by odors if a monetary gain is made. Some individuals may even become acclimated to the agricultural odors. This is especially true among CAFO workers who are exposed to the odors on a regular basis. Conversely, for individuals exposed on an intermittent basis, as is expected by residents living near the RPD operations, acclimation may come slowly or not at all. For citizens this may

translate to a negative impact on their quality of life and result in behavior changes like spending less time outdoors or not opening windows. This complexity, along with the hundreds of potential odor causing compounds, makes it extremely difficult to monitor and set standard controls with regards to odor.

Existing Odor Standards and Regulations

Odor standards for the 160 acre site of the RPD site are subject to the Livestock Facility Siting Law (ATCP 51). The facility is required to meet the odor standard by achieving a 500 or greater Odor Score, which is determined by using predictive models to estimate odors generated from manure storage, structures and practices. The design of the Rock Prairie Dairy will need to achieve the desired minimum score before the siting permit is approved. It is likely that there are conflicting views on whether the scoring model is sufficient in addressing potential odors at the facility site.

Odor from the manure land application fields are not subject to the odor regulations of the Livestock Facility Siting Law and are not required to meet any specific odor standards. General code requirements, such as residential setbacks and application rates, indirectly address potential odor issues from the land application. Wisconsin administrative code NR 429, *Malodorous Emissions*, generally address odors, but it is not clear on how effective this would be in dealing with RPD odor issues. The issue is also complicated by Wisconsin's "Right-to-Farm Law" (s. 823.08), which provides legal protection to farmers by preventing normal consequences of agricultural activities, like odor, from being deemed a nuisance.

RPD Odor Potential

The greatest potential for unpleasant odors created by RPD activities would come from the animal housing buildings, manure storage areas and manure land application sites. Large agricultural operations like the RPD will undoubtedly create significant unpleasant odors, but will generally only become an issue if the responsible compounds reach residents beyond the property lines. The relative flat terrain, open fields and lack of vegetative buffers enhance the potential distance the odors may travel.

The odor generated in animal housing buildings at the RPD may generate elevated levels of offensive odors on site mainly due to the manure generated from the dairy herd. Odors escaping the buildings through the natural ventilation should likely dissipate to non-nuisance levels before reaching nearby homes due to the sparsity of residential housing in that area. There is a stronger potential for odors to reach individuals traveling in vehicles down Highway 14 due to the facility location. The planned routine removal of manure accumulation at the facility is a key strategy that should greatly reduce odor drift potential. If odors originating from the animal housing is found to be a persistent problem in the future, additional mitigation methods such as diet manipulation, the use of biofilters on the buildings or vegetative buffers should be considered.

The manure storage systems present a greater challenge due to the volume of manure that will be held. The four manure storage lagoons are proposed to be oversized, covered with impermeable geomembrane covers and equipped with biofilters for exhaust air. These techniques, particularly the covers, will potentially reduce odor emissions by up to 90% provided

they are properly maintained. The dairy also has plans to add microbes, if approved, to the manure storage facilities to further reduce odors. The effectiveness of odor-reducing commercial additives is uncertain. The results of a Purdue University laboratory study on 35 additives indicated only four had significantly reduced odor [10]. More field research is needed to evaluate the value of these products. The design of the RPD manure storage provides odor control strategies which should, considering the lack of residential housing near the facilities, limit the frequent occurrence of noxious odors reaching nearby citizens. However, the desired mitigation results are critically dependent on the continuing use of BMPs and maintaining the lagoon covers and biofilters. Additional strategies to consider are the use of vegetative buffers that can absorb odors and can slow wind speeds and odor drift. Vegetation buffers may also reduce odor complaints by neighbors or drivers along Highway 14 as visual signals can effect an individual's odor perception.

The planned land application of the manure liquids and solids will provide the greatest potential of undesired odors reaching nearby residents of all the RPD activities due to the large amount of manure having surface contact with the air. The odor associated with this aspect of the dairy operation, especially the center pivots, has been a major negative impact concern of the surrounding community during the RPD approval process.

The land application of manure solids is expected to emit the fewest odors of the disposal techniques, as dry manure tends to emit fewest. The dragline application of liquid manure has an increased potential for offensive odors as a result of the increased moisture content and slight increase in surface air exposure during application. This method, considered low pressure and low height, is projected to have a low potential for odor and drift [11]. Both of these disposal methods are also planned to be implemented with injection or incorporation into the soil which can have a 20% to 90% reduction on odors [12]. These techniques drastically reduce odor potential with direct injection being more effective since incorporation leaves some manure on the surface and exposed to air. An important variable effecting odor release risk is time, which means all manure spreading conducted by spreading or draglines should be incorporated as quickly as possible when direct injection is not used. The effect odors from these techniques will have on the citizens living near the field application sites is difficult to determine. It may or may not increase the odors associated with the similar manure spreading that is being done on these agricultural fields. Additional strategies that should be considered are evaluating wind and weather conditions, applying in the morning to promote vertical dispersion and planting vegetative buffers.

The proposed application of manure water through the center pivot system generally has a greater potential for creating undesired odors for residents living near the fields. Manure systems that utilize spraying systems have a greater odor potential due to increased surface to air contact, higher release points that amplify drift possibility and the ability to deliver large amounts of manure in short periods of time. This is in contrast to the spreading and dragline methods previously discussed, which release low to the ground over longer periods of time. Comparing the methods, the center pivot application will likely equate to a greater intensity of odor, but will last for a shorter period of time due to the ability to rapidly apply the manure. The other two methods will generally create a less intense, but greater duration of odor and is more characteristic of the current manure application styles currently used on the agricultural fields in the areas of the proposed RPD (see Fig. 1).

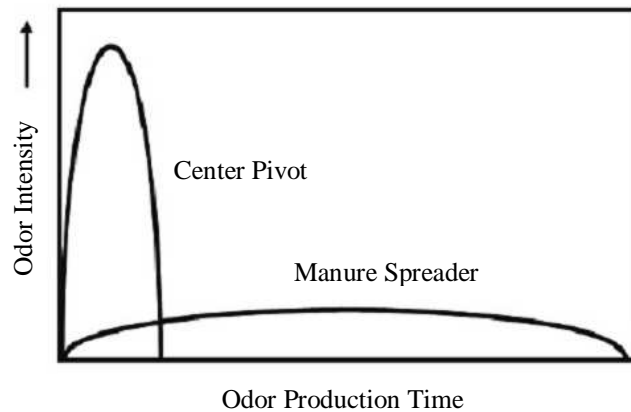


Fig. 1. Odor intensity vs Duration of odor exposure for two manure application systems.
(Application of Liquid Animal Manures p.3 [13])

The RPD center pivots odor production is largely dependent on design and application practices. The center pivot design does employ several features that will help minimize odor production. The RPD planned use of low-pressure nozzles set relatively close to the ground and use of oversized lagoon storage should help control odor. As suggested by a center pivot guidance document from the University of Nebraska-Lincoln, these designs should reduce odor production and drift [13]. The center pivot application practices for the RPD will play an equal, if not larger, role in the control of nuisance odor. The center pivot approvals are mainly based on optimum nutrient uptake by the crops and prevention of ground and surface water contamination. It is critical that the RPD consider weather conditions and timing of applications. Irrigation should take place in the late morning and early afternoon as odors disperse better when temperatures and winds are increasing. Applications should be limited when wind direction is pointed at residences near the field sites. Significant wind speed is also needed to dilute odorous air with fresh air so application during calm winds is not recommended. The RPD operation and maintenance documents do provide guidelines that echo these application recommendations. Additionally, the WDNR Environmental Assessment Addendum suggests the RPD management team is considering the recommendations contained in the DHS memo on center pivots [7], which does include incorporating weather and wind conditions in the schedule. It is recommended the RPD develop a detailed operation policy that addresses odors through application practices. Additional potential mitigation strategies include vegetative buffers around center pivot fields near residences, avoiding application on holidays, as neighbors are likely to have visitors and applying additional pretreatment process to the manure.

Despite the odor mitigation strategies the RPD has incorporated into its plans, agricultural odors from this operation are unavoidable and some will certainly be detected and deemed a nuisance by some citizens beyond the property lines of the facility and manure land application sites. The complexity and unpredictability of the odor emissions creates a situation in which communication and complaint management by the RPD is critical to the issue. The RPD Odor Management Plan does contain a protocol and a data collection form to use for complaints

received. Properly addressing complaints and using the data for future planning is necessary for RPD to establish a positive relationship with the surrounding community. Establishing a manure application notification system, such as a mass email or phone notification, may also minimize negative feedback from citizens. Being informed of potential odors related to the operation may reduce the surprise factor of odor perception and help nearby residents in planning outdoor activities.

Water Resources

The RPD plans to apply all manure it generates to surrounding farmland. Manure contains nutrients essential for plant growth, and thus is a valuable fertilizer. However, if applied improperly i.e. on frozen soil, during significant rain events, or in amounts exceeding the capability of the soil to hold on to nutrients, manure will runoff to surface water or leach into groundwater causing contamination. Other than nutrients, wastewater from CAFOs may contain pathogens, veterinary pharmaceuticals, heavy metals, naturally excreted hormones and antibiotics [14]. The exact concentration of nutrients and other potential manure constituents varies based on several factors such as the type of feed used and veterinary pharmaceuticals used in the operation.

The Wisconsin Department of Natural Resources regulates wastewater disposal from CAFOs through the Wisconsin Pollution Discharge Elimination System (WPDES). Nutrient management plans are required and have been developed for all fields receiving wastewater from RPD. The purpose of nutrient management plans is to limit the application of nutrients to the requirements of crops thereby minimizing the possibility of leaching and runoff.

Original plans called for the majority of liquid manure to be applied by 16 center pivot irrigators on fields in the Towns of Bradford, Darien and Johnstown with the remainder to be applied by dragline hose onto portions of fields not reached by center pivot irrigators. Solids would be broadcast onto the soil surface and later incorporated. As of the date of release of this assessment, plans for the use of center pivot irrigators have been taken out of the current WPDES permit application, but may still be added to future plans.

Groundwater

Drinking water in Rock County is almost entirely obtained from groundwater sources and thus protection of this resource should be a high priority [15]. Homes in the vicinity of the proposed dairy receive their water by means of private wells drawing from the limestone and in some cases the shallow sand and gravel aquifer. WDNR well reports from sections 1,2 and 3 of the Town of Bradford and sections 34 and 35 of the Town of Johnstown show a static water level range of 18 to 50 feet below ground surface and a depth to limestone bedrock of 18 to 110 feet below ground surface. The depths of these wells range from 62 to 214 feet below ground surface. Limestone bedrock in the area is overlain by sand and gravel. Limestone bedrock often contains fractures and fissures resulting in a relatively unobstructed pathway for water that percolates through the soil to reach groundwater. In general, the closer bedrock is to the surface, the greater chance of contamination.

Nitrates

Nitrates tend to be at greatest concentration in the upper levels of the aquifer making shallow wells more susceptible to contamination. Nitrate levels of 2.0 and greater are good indicators that landuse practices are likely affecting groundwater quality [16]. Rock County Health Department well testing data shows that wells within 2 miles of the proposed RPD are being impacted by nitrate contamination. Of the 21 test results available as of March 2011, 8 tests or 38%, were at or above the nitrate standard of 10.0 mg/L [17]. Nitrate levels for this group ranged from <1.0 mg/L to 23.0 mg/L. WDNR data is also available for two transient non-community wells 1 mi. east of the RPD. Both wells show a trend of increasing nitrate levels since the first recorded test in 1979 [18]. Figure 2 shows the trend of increasing nitrates in sample results for well # IZ090. Sample results for this well have been above the nitrate standard since the 1/22/1997 sample. Based on nitrate levels in area wells, it can be concluded that current agricultural practices are impacting drinking water quality. Some high nitrate levels in area wells may also be a result of poor management practices on land immediately surrounding the wells and possibly from failing septic systems.

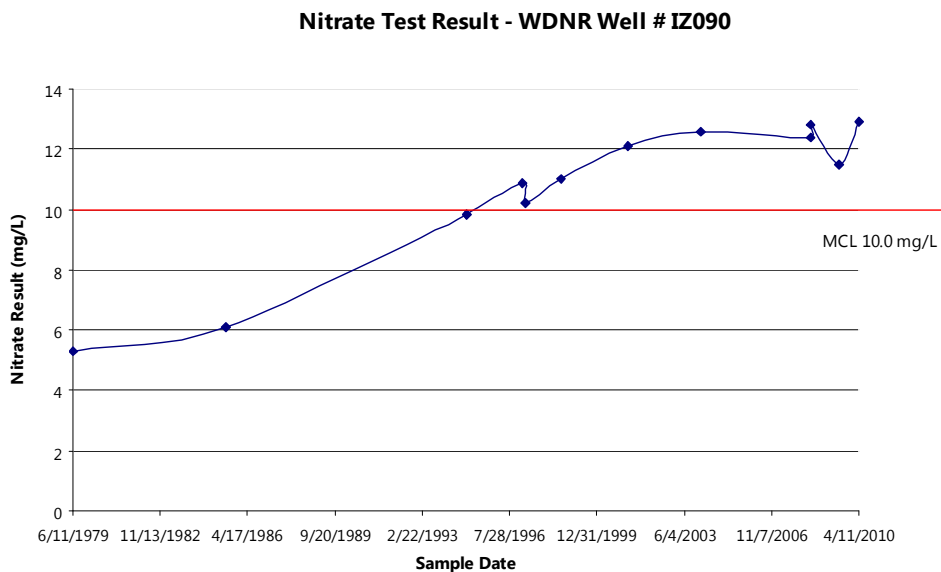


Fig. 2. Nitrate results from well #IZ090 from 6/11/79 - 4/12/2010.
Results obtained on 4/11/2011 via web:
[http://prodoasext.dnr.wi.gov/inter1/pws2\\$.startup](http://prodoasext.dnr.wi.gov/inter1/pws2$.startup)

Nitrate has been identified as the most common identifiable groundwater pollutant in Rock County and the State of Wisconsin as a whole [19]. Nitrate is of particular concern for infants and pregnant woman as it has been shown to cause a condition in infants known as methemoglobinemia (the nitrate standard is based on this condition), which is commonly referred to as “Blue Baby Syndrome”. Nitrate poisoning in infants reduces the oxygen-carrying capacity of the blood, which can cause the skin of an infant to appear bluish in color. The result of this oxygen starvation can be fatal.

Chemical and organic fertilizer (manure) are not the only sources of nitrate in the environment. Forests and fields planted with legumes can contribute but the contribution from these sources is usually low. Septic systems, if not properly sited and maintained can also be a significant contributor to groundwater nitrate levels.

Pathogens

Rock County Health Department data show that some wells in the area of the dairy have tested unsafe in recent years due to the presence of coliform bacteria. Coliform contamination of wells can come from a variety of natural and manmade sources and is in no way limited to manure spreading activities. The presence of coliform bacteria indicates impact from a pollutant source that has the potential to contain disease organisms.

Some pathogenic contaminants important to human health that can be present in bovine manure include E coli O1571:H7, Campylobacter, Salmonella and Cryptosporidia. The survival of these pathogens in manure depends on pH, dry matter content, temperature, the number and type of pathogens present and the presence of competing organisms. Once these pathogens are in the environment their exposure to sunlight, drying, freezing and thawing cycles, high temperature, high or low pH, exposure to oxygen and ammonia concentration will limit their survival [20]. Predicting whether pathogens from manure applied by the RPD will reach groundwater would be extremely difficult due to the many variables that affect their survival. Bacteriological testing of wells in the area is recommended prior to and after operations begin.

Potential for Groundwater Contamination

Due to the immense amount of manure that needs to be stored and subsequently transported, failures of a waste storage lagoon liner, leaks in the distribution system and accidental release during transport may present the greatest potential for groundwater contamination. The potential for unintentional releases to occur and whether groundwater contamination will result depends on proper construction and operation of storage and disposal systems and implementation of emergency spill response plans should a release occur. A monitoring well will be installed to detect leaks from manure storage lagoons and leak detection systems will be installed in the three HDPE lined lagoons. These systems, if functioning properly, should alert managers to leaks early to minimize contamination.

It is impossible to make a determination as to whether contamination will occur as a result of the operation of the RPD. However, elevated nitrate levels in area wells indicate that nutrients being applied at current rates are reaching groundwater. Nutrient management standards are designed to minimize the potential for nutrients to reach groundwater, but this does not guarantee that leaching will not occur. This highlights the need for regular testing of wells in the area. The Rock County Health Department is currently collaborating with the Wisconsin Department of Health Services to create a well monitoring program in the area near the RPD.

If center pivot irrigators are utilized, they could have some advantages for reducing the risk of groundwater contamination as long as recommended application rates are adhered to and setbacks from waterways are maintained [13]. Unlike conventional liquid manure application systems, RPD would be able to utilize the center pivot irrigators during the growing season

instead of only spring and fall when fields have not been planted. Applying manure directly to crops at strategic times during the growing season and in a precise manner may reduce the possibility of runoff and leaching since actively growing crops will be able to use the nutrients in the manure as it is applied.

Surface Water

The RPD will be located on the drainage divide of the Blackhawk Creek and Turtle Creek watersheds. The dairy will apply wastewater and/or solid manure to fields located in both Blackhawk Creek and Turtle Creek watersheds. The major waterbodies with potential for human contact within these watersheds are Blackhawk Creek (also known as Spring Brook within the City of Janesville), Spring Brook (Town of Bradford) and Turtle Creek. A map of area waterways and recreational areas can be found in the appendix [map 3].

Blackhawk Creek begins in the Town of Harmony near the western border with the Town of Johnstown and is fed by waterways within the range of proposed manure application activities by the RPD. This watershed is impacted by both agricultural and urban land use practices. Blackhawk Creek flows mostly through privately owned agricultural land and has little public access until entering the City of Janesville where it flows through a heavily used park and a public golf course before emptying into the Rock River. Potential human contact with water from Blackhawk Creek would come from children and pets that wade and play in the creek, golfers and from those using small watercraft. The WDNR lists Blackhawk Creek as an impaired waterbody due to sediment/total suspended solid pollution.

Water bodies within the Turtle Creek watershed are heavily utilized recreationally. Carver-Roehl County Park is approximately 3 miles southwest of the proposed site. Spring Brook, which begins approximately 1 mile south of the proposed site, flows through the length of the park before discharging into Turtle Creek. Sweet Allyn County Park, which is situated along the shores of Turtle Creek, is approximately 8.5 miles southwest of the proposed site. Approximately 312 acres of WDNR owned land is situated on Turtle Creek beginning about 2 miles south of the proposed site and extending 2.5 miles to the south. This area is known as the Turtle Creek Wildlife Area and is open to hunting, fishing, canoeing and several other recreational activities. Canoeing is a popular recreational activity on Turtle Creek. The DNR describes Turtle Creek as an important recreational asset [21]. Both Turtle Creek (in Rock County) and Spring Brook are designated as an Exceptional Resource Waters by the WDNR. Exceptional resource waters are those that “provide outstanding recreational opportunities, support valuable fisheries and wildlife habitat, have good water quality, and are not significantly impacted by human activities”. However, similar to the Blackhawk Creek watershed, the Turtle Creek watershed is impacted by agricultural practices. The WDNR notes that high fecal streptococcus bacteria counts that have been detected in Spring Brook are most likely due to stream bank pasturing of dairy cattle upstream [22].

Potential Surface Water Impacts

Potential impacts from the RPD to surface water affecting human health include runoff and sediment containing phosphorous which can lead to harmful algal blooms (blue-green algae) and pathogenic microorganisms which can cause acute and chronic human illness. Discharges of pollutants from the RPD to water bodies could occur from improper handling or equipment

malfunction on the farm site in fields or in-route to fields where manure is being applied. Inadvertent releases often occur as a result of accidents when transporting, equipment failure, human error or misapplication. A proper emergency response plan will minimize the risk of water contamination. Runoff and erosion from fields where manure is applied is another route by which contaminants can reach surface water. Injection of manure directly into soil or tilling manure into soil after application can reduce this risk.

In most Rock County waterbodies, phosphorous is the limiting nutrient affecting the growth of algae and other aquatic plants. When phosphorous levels become excessive, dense algae blooms can occur. Blue-green algae (cyanobacteria) blooms are often associated with excessive nitrification and can be harmful to human health due to the toxins produced by some species. Human exposure can occur by accidental ingestion, skin contact or breathing in aerosolized water droplets. Symptoms of blue-green algae exposure include stomach cramps, diarrhea, vomiting, headache, fever, muscle weakness and difficulty breathing. Blue-green algae blooms are most common during the summer months and after storm events that can wash large quantities of nutrients into waterbodies. No reports of blue-green algae exposure or sightings are available for surface waterbodies within the Blackhawk Creek or Turtle Creek watershed. Visually monitoring for blue-green algae is recommended for Blackhawk Creek, Turtle Creek and Spring Brook. According to the WDNR Environmental Assessment, the RPD's nutrient management plan is designed to stabilize and/or reduce soil phosphorous levels in fields receiving manure. Phosphorous levels in area waterbodies would not be expected to increase as a result of normal RPD activities so long as their nutrient management plan is adhered to.

The risk to surface water from pathogenic microorganisms due to normal operation of the RPD is difficult to determine. As noted above, this watershed is already being impacted by animal agriculture resulting in elevated bacteria levels in waterways. The Rock County Health Department plans to begin sampling for E. coli at Carver-Roehl Park and Turtle Creek at Sweet Allyn Park during 2011 as part of its surface water and beach sampling program.

Property Value and Economic Impact

The negative effects on property values from the presence of the RPD in an area previously void of CAFOs is a citizen concern that has been mentioned in public hearings, public comments to the WDNR Environmental Assessment and the citizen survey. Real or perceived negative environmental and nuisance impacts can affect the marketability of non-farm residential property. There are many factors that may influence property value impacts such as distance from the facility, type and size of the operation, the design and management of the CAFO. Whether or not a home or its occupants are tied to a farm or related activity in the area can also play a role since a connection to agricultural land use encourages more acceptance. The impact on strictly residential property is difficult to gauge, but a little more than half (59%) of the citizen survey respondents listed no farming related occupation while 73% had significant concerns (Level of Concern 4 or 5) of the RPD impacts.

A literature review of eight studies on the impacts animal feed operations on property values published by the University of Missouri Extension found a range of associations between the two [23]. The one trend found among the studies was that the negative effect of the operation

on residential values rapidly decreases as distance increases, with a negligible range from half a mile to over three miles. The range can likely be attributed to the influencing variables previously discussed. The RPD has a handful of residences within a half mile and less than 20 within a mile of the proposed facility [map 1]. Another finding of the literature review that relates to the RPD are that larger animal operations generally correlated to greater negative impacts on value and that building in an area without existing operations had more of an impact. On the other hand some studies found that new larger operations, such as the RPD, had less influence on properties, due to the design and operation, conservation and regulations that smaller or older farms are generally not subject to. The potential use of the center pivots may also be a significant factor in this issue if considerable odors levels are detected among the surrounding residential areas.

The effects on property values the proposed RPD will have are difficult to establish and a localized study is needed to get a better understanding of the issue. The ongoing operation and response to identified negative impacts of the RPD are the factors that will likely have the most influence. The mitigating strategies to reduce environmental, odor, noise and aesthetic impacts can heavily influence long-term property values.

Whether the RPD produces a positive economic impact on the community as a whole will depend greatly on whether local contractors are hired for construction and maintenance and whether materials are purchased locally. The RPD estimates that its operations will contribute nearly \$18 million annually to local goods and services and create 50 jobs.

The majority of the feed for the operation is proposed to come from surrounding farmland which will benefit local farmers. The landowners leasing their land for waste disposal stand to benefit from the dairy since they will be receiving fertilizer from the dairy in the form of manure and will be selling crops produced to the dairy for feed.

Traffic

The size of the RPD operation will create a significant increase in vehicular traffic in the facility area. According to the WDNR Environmental Analysis the RPD is estimated to have 9500 truckloads of feed, manure, supplies, etc., annually and additional vehicles from the 50 employee workforce working 24-hours a day. Traffic patterns will vary with the most being during daylight hours and peaks during crop and manure spreading related activities. The construction traffic from the building of the RPD facility will certainly be substantial, but should be short-term with the operation slated to begin at the end of 2011. The facility is designed so vehicles enter and exit on S Scharine Rd. The main road that will be used to and from the RPD will be E Highway 14, which is a heavily traveled road. A Wisconsin Department of Transportation corridor study describes the importance of this road [24]:

The US 14/WIS 11 corridor provides important regional connections throughout southern Wisconsin and also functions as a critical link between Janesville in Rock County and Darien in Walworth County. The corridor is heavily traveled by commuter, residential, commercial and recreational traffic.

Area growth, increasing traffic volumes and crash rates, and public interest have all contributed to the need to study potential corridor improvements to ensure continued years of service.

The main potential health concern related to the anticipated traffic would be increased vehicular accidents. This may stem from the rise in vehicle numbers, increased wear on the roads or disturbances in the existing traffic flow on a busy two-lane highway. The latter arises from the time and distance vehicles, especially large trucks, need to accelerate and decelerate to proper speeds when leaving and arriving at the facility. Dust generated from the traffic may also impair the visibility of drivers turning onto E Highway 14.

The RPD has received approval from the Department of Transportation to install turning lanes on E Highway 14, which should help address the speed changes needed upon arriving and leaving the site. Additional strategies may be beneficial on the two-lane highway as stopping distances for heavier trucks traveling at 55 mph is estimated to be between 200 and 300 feet. [25]. Placing signage on E Highway 14 warning travelers of frequent stopping by commercial trucks beyond the maximum predicted stopping distances may help reduce traffic accidents related to the RPD.

Other traffic strategies planned include “Courtesy to Neighbors” signs at the property exits and the maintaining of driveways to minimize dust potential. The influence of the signs will likely be dependent on the management reactions to visual offences and citizen complaints, although several trucks will not be direct employees of the RPD and subject to management rules. The effectiveness of driveway maintenance on dust control will be dependent on sufficient frequency of assessment and reaction to identified problems. The wear and tear on the roads the additional traffic will have is difficult to predict and will need to be addressed by the responsible level of government, which is either the state, county or township depending on the road. The Town of Bradford’s roads, which includes S Scharine Rd, may be subject to more long-term road hazard issues since the Town’s resources are limited compared to that available for county roads and state highways, such as E Highway 14. It is recommended that the RPD explore this issue with the Town of Bradford as well maintained town roads are beneficial to both the facility operations and the surrounding community.

Noise

Excess noise generated from the RPD is a concern some citizens expressed in the citizen survey, public hearings and comments to the WDNR Environmental Assessment. Citizens in the surrounding community exposed to undesirable levels of noise may experience a decline in mental health due to the stress that can accompany excessive noise. As expected in the construction of a facility of this magnitude excessive noise will be generated as the RPD is built. Noise from this phase will likely occur during daylight hours and in the short-term since construction is planned to end later in the year.

The facility itself, which will be in operation 24-hours a day, will be an additional consistent source of noise much different from the prior land use, which was an agricultural field used to grow crops. The animals, machinery and vehicular traffic will contribute to the noise exposure to employees onsite and residents offsite. RPD employees may be at risk for negative physical impacts to their hearing if noise exposure goes beyond safe levels. OSHA’s permissible noise

exposure is 90dB for 8 hours. The RPD should have proper hearing protection available for its workers. Whether or not levels will exceed OSHA standards is unknown and the RPD should have an audio measuring procedure to determine appropriate safety protocols. Facility noise can also reach nearby residents at levels under the damage threshold standard, but may be at nuisance levels. Traffic is not expected to add significantly to the total noise burden as E Highway 14 is heavily traveled. Animal and machine noise may have a minimal impact since there are only a handful of residences within a half-mile of the facility [map 1]. One exception may be one residential house that is approximately 500 feet from the facility at the S Scharine Rd intersection, which is the trucking entry and exit point. The residential effect is an unknown with many variables that will come to light as the operation begins. If complaints from nearby residents indicate the facility is an issue it is recommended that the RPD investigate and implement noise-reducing strategies, such as vegetative buffers.

Manure land spreading activities may also create noise nuisance levels that reach homes surrounding the sites. This is expected to be short-term since manure spreading is only conducted on a limited basis during the year. The planned spreading sites have been historically agricultural so noise from RPD manure activities are likely to be similar to past activities with respect to noise levels and timing as in years past.

Visual

The construction of the RPD on a field previously used for crops will certainly change the appearance of the area. This change will be especially prominent because of the relatively flat terrain of that region. This change may be seen as a negative, especially to citizens who move to rural areas for the aesthetic value. Although the placement of the facility on a major highway provides a logistical traffic advantage, it does create situation where a large number of citizens will drive near it on a daily basis. This consistent reminder may enhance negative feelings some individuals may have about the project. Implementing a sufficient vegetative buffer may help alleviate this by encouraging an out of sight, out of mind situation. The impact on the nearby residences that will be able to see the RPD from their property is unknown. The sparsity of homes within a mile radius of the facility, along with the fact that many of those are populated by individuals engaged in agricultural activities decreases the likelihood of significant negative visual impact. The visual of the impact of the manure spreading activities is expected to be minimal since similar actions have historically been done on those fields. Although center pivot irrigation is a common site and a routine agricultural practice in Rock County, the proposed manure spreading is new. These particular large permanent fixtures can be consistent reminder of the dairy farm and its activities, especially the associated manure spraying that has been a major concern expressed by the community. Visually assessing the center pivots after installation from the beyond the property lines and planting vegetative buffers may help reduce the negative visual influence they will have on nearby residents.

Insects

Insects at CAFOs like the RPD have a potential to become an issue onsite and beyond the property lines. Flies are generally the biggest issue on dairy farms. There are a variety of flies associated with animal operations with house and stable flies being the common ones found [26]. House flies breed in manure and stable flies lay eggs in decaying organic material. Flies can annoy workers, stress herds enough to effect milk production and transmit disease between animals. Flies can also travel long distances becoming a nuisance for nearby residents and possible be a vector for disease transmission. Houseflies for example can easily travel one to two miles [27]. Flies can multiply quickly given their rapid development and the manure generated by large dairy CAFOs provides ample breeding grounds. Mosquitoes are also a potential problem as they can be a nuisance and can spread a number of diseases if water is allowed to accumulate.

Insects, especially flies, are inevitable at the RPD. Frequent cleaning of facilities to promote sanitation and to prevent manure build-up is an essential in keeping fly populations down. Minimizing standing water is important in controlling mosquito populations. It is expected the RPD will attempt to accomplish these strategies since insect control is essential to the herd health and milk production. The covered manure storage lagoons should greatly help reduce insect potential. The impact the RPD will have on fly population at surrounding residences will not be known until operation begins. Identifying a problem will rely on observations of neighbors. Complaints regarding flies should be addressed appropriately. Fly monitoring onsite or near residences may be needed to better understand issues. If needed, additional measures such as chemical control should be considered.

Step 4. Reporting

This HIA will be released to all key stakeholders including the RPD owner, the Town of Bradford administration, Rock County Land Conservation Department, Rock County Planning and Community Development, the WI DNR and the WI DATCP. A press release will be sent to local media and a copy of the HIA will be made available on the Rock County Health Department's website. Rock County staff will also provide an overview of this project at the Wisconsin Public Health Association's annual conference in May, 2011.

The key findings of the assessment and recommendations based on these findings are reviewed below:

- 1. The size of the Rock Prairie Dairy (RPD) operation and the predicted amount of manure generated creates a potential for hazardous gas and particulate emissions.**
 - There are several potential hazardous emissions, including Ammonia, Hydrogen Sulfide, Particulate Matter, Methane & Volatile Organic Compounds.
 - Chronic exposure to farm environments, such as what would be experienced by workers, carries some risk of respiratory ailments.
 - Predicting the exposure levels for the surrounding community is difficult, making mitigation strategies critical to addressing emissions.
 - Some RPD design and operation strategies may significantly reduce emissions: lagoon covers, frequent animal housing cleaning, incorporation and injection of spread manure.

- Future research and monitoring is needed to obtain a clearer understanding of impact.
2. **The drifting of unpleasant odors from manure related activities is a major concern of the surrounding community.**
 - Impacts are generally psychological, but physical symptoms can be annoyance-mediated.
 - The planned manure handling system and the lagoon covers may drastically reduce odors on-site.
 - Although the center pivot system is designed to minimize odor drift, this technique of manure application still has significant potential for off-site odor issues and needs further assessment.
 - Predicting odor drift and individual response is complex and difficult, making post-production analysis and complaint response critical.
 3. **Accidental spills, leaks from pipes and storage lagoons and over application or misapplication of manure could lead to contamination of ground and surface water resources.**
 - Monitoring wells are proposed near storage lagoons and in fields to help detect groundwater contamination. An inspection and maintenance plan for the lagoons has also been developed. Leak detection systems are proposed for three HDPE lined storage lagoons.
 - Water contamination issues exist with more traditional smaller farms as well as CAFOs although the volume of manure produced by CAFOs increases the potential that accidental releases will create detrimental human health impacts.
 - Several wells in the area have tested above the nitrate standard indicating that past agricultural practices have affected these wells.
 - Nutrient Management Plans have been created for all fields that, if followed, will decrease the potential for over application, although it will not guarantee nutrients applied in accordance with the plan will not reach ground or surface water. Center pivot irrigators, if used, could reduce the potential for groundwater contamination by delivering nutrients to plants while they are actively growing.
 - A variety of pathogens are common in bovine manure and these pathogens could potentially contaminate ground and surface water in the event of accidental release or inadvertent over application. Pathogen survival after application depends on a variety of factors and it is difficult to predict when and if contamination will occur.
 4. **The annual addition of an estimated 9,500 dairy-associated trucks onto a two-lane heavily traveled state highway may impact traffic volume, safety and increase road maintenance needs.**
 - Dedicated turn lanes are planned. Additional strategies may be needed.
 5. **The size of the animal operation creates conditions that favor the breeding of flies and mosquitoes that have the potential to transmit diseases to humans.**
 - If planned strategies are not effective, monitoring may be needed to help determine alternate control options.
 6. **The construction and operation of a 5,200 animal dairy will impact aesthetics of the area and contribute to the noise burden.**
 7. **RPD could potentially have positive and negative economic impacts.**

- RPD is likely to have a net positive economic impact on the area with the addition of 50 jobs and the purchase of local goods and services.
 - Marketability of homes in close proximity to the farm may be affected due to real or perceived negative impacts of the dairy.
 - Landowners contracted for waste disposal will benefit economically from an inexpensive fertilizer and the ability to sell crops to the dairy.
- 8. Monitoring is essential in order to ensure operational procedures and mitigation strategies are effective and the public's and CAFO staff's health is protected.**

Recommendations

1. Implement a private well monitoring program for concerned citizens living near the facility or manure application sites.
2. Develop a notification system to alert the surrounding community of manure spreading activities (e.g. email list, mass phone call, website, signage). This information will be helpful to citizens planning outdoor activities.
3. Increase surface water monitoring program for potentially impacted waterways.
4. Develop a public friendly complaint tracking and collection system. Coordinate with local agencies that may receive complaints.
5. Enhance communication and foster good relationships with the surrounding community (e.g. open house, tours, field trips for area schools).
6. Develop an emission monitoring system onsite and offsite after operations begin.
7. Provide health checks and a wellness program for workers.
8. Install signage on Highway 14 warning traffic of frequent stops by trucks.
9. Institute appropriate insect control.
10. Install vegetative buffers to help decrease aesthetic, noise, odor and emission impacts around the facility and manure application fields.

Step 5. Monitoring

The monitoring step describes how the process and findings of the HIA affects the implementation of the project and outcomes. It is the final step in the HIA process. At this point in the project it is impossible to fully report on the impact of our findings and recommendations since the project is still in the beginning stages. After the report is released to stakeholders, the authors of this HIA will continue to monitor the acceptance and impact of the report. This will be accomplished by engaging the Rock Prairie Dairy and the regulatory agencies involved in the physical development of the farm to determine if changes in the facility design or operational plans are reflective of the recommendations of this document.

In addition to the influence of the HIA on the Rock Prairie Dairy development, attempts will be made, and in some cases have already begun, to monitor the environmental health indicators that may be affected. The Town of Bradford has expressed interest in our findings and recommendations. The Rock County Health Department has already committed to increase

surface water sampling in Spring Brook and Turtle Creek in the Town of Bradford and is in the process of designing a groundwater-monitoring program for the area.

Conclusion

This rapid Health Impact Assessment is meant to be an objective assessment on potential health impacts of the development and operation of the Rock Prairie Dairy. This report does not reflect all aspects of the impacts discussed nor does it provide an exclusive list of all potential health impacts a large dairy farm may have. The purpose of the project is to provide constructive information that will serve as a way to inform the public on the associated issues with the dairy farm development and a tool to provide recommendations to the decision-makers that may minimize the negative and maximize the positive impacts of the project.

The Rock Prairie Dairy is a break from the smaller “family farms” that many people in Rock County are familiar with. Considering sheer size and anticipated manure production of the proposed Rock Prairie Dairy, there is little doubt of the significant potential for negative impacts on the environment and public health. A positive that comes with an animal operation of this magnitude is that it does trigger a number of legal oversights designed to protect aspects of the environment and the surrounding community that smaller farms are generally not subject to. This regulatory process influences the design of the dairy to incorporate a number of mitigation strategies that should theoretically reduce that risk.

The Rock Prairie Dairy’s original plans called for the use of center pivot technology to dispose of manure water, which is a new practice to this area and relatively new to Wisconsin. As of the release of this document it is still uncertain whether this method will be utilized in the operation. If used, the impacts of this disposal method could have both positive and negative impacts compared to traditional land application of manure. The precision nutrient application may minimize risks to ground water, but may also increase the risk of hazardous emissions and odor. What balance of negative and positive impacts the center pivots will have is unclear and more time and research is needed to shed light in this area.

The fact that the operation is still in the planning stage along with the uncertainty of predicting impacts from CAFOs means post-production analysis is critical to understanding the impacts of the Rock Prairie Dairy. Ongoing measuring of quantifiable environmental and health indicators is strongly recommended. Just as important, is the need for the Rock Prairie Dairy to ensure that mitigation strategies are followed, maintained and adjusted when warranted.

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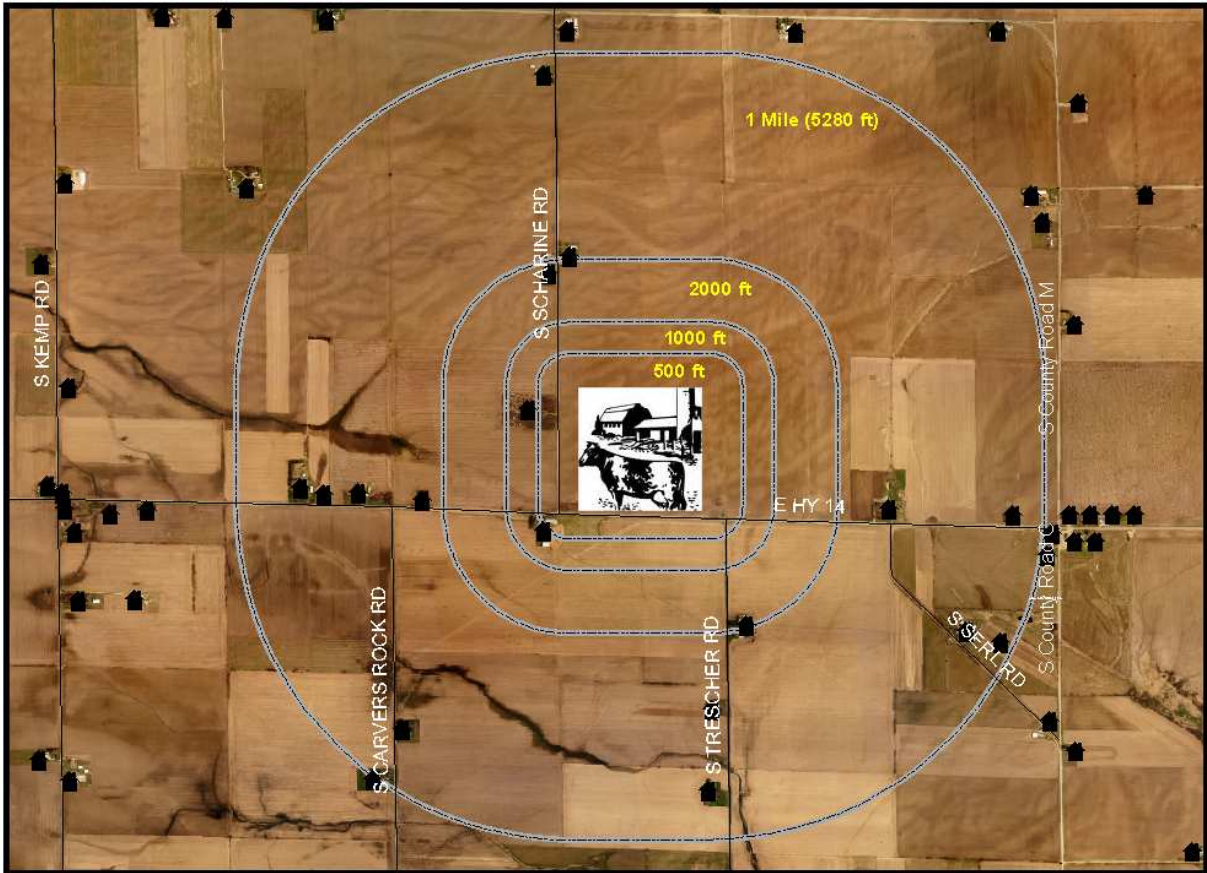
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Appendix A: Maps

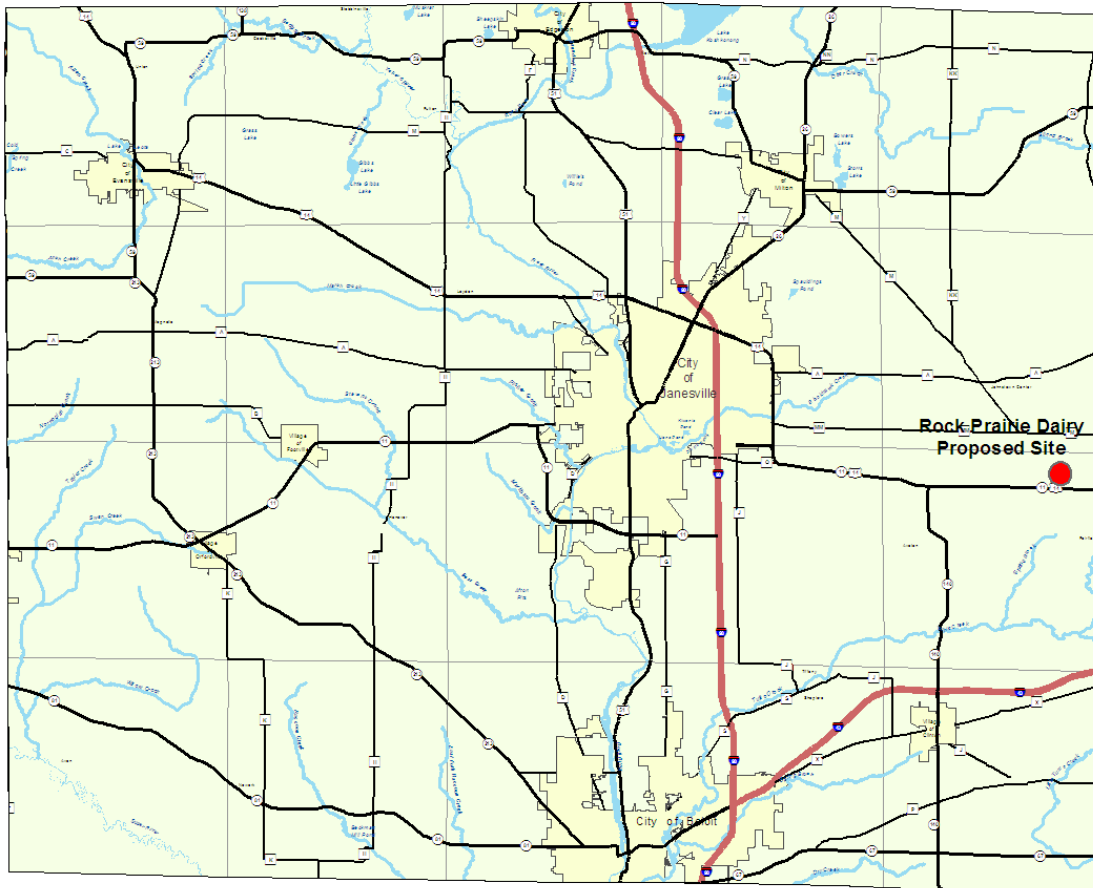
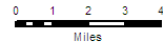
Rock Prairie Dairy - Town of Bradford, Rock County, WI

0 500 1,000 2,000 3,000 4,000 5,000 Feet

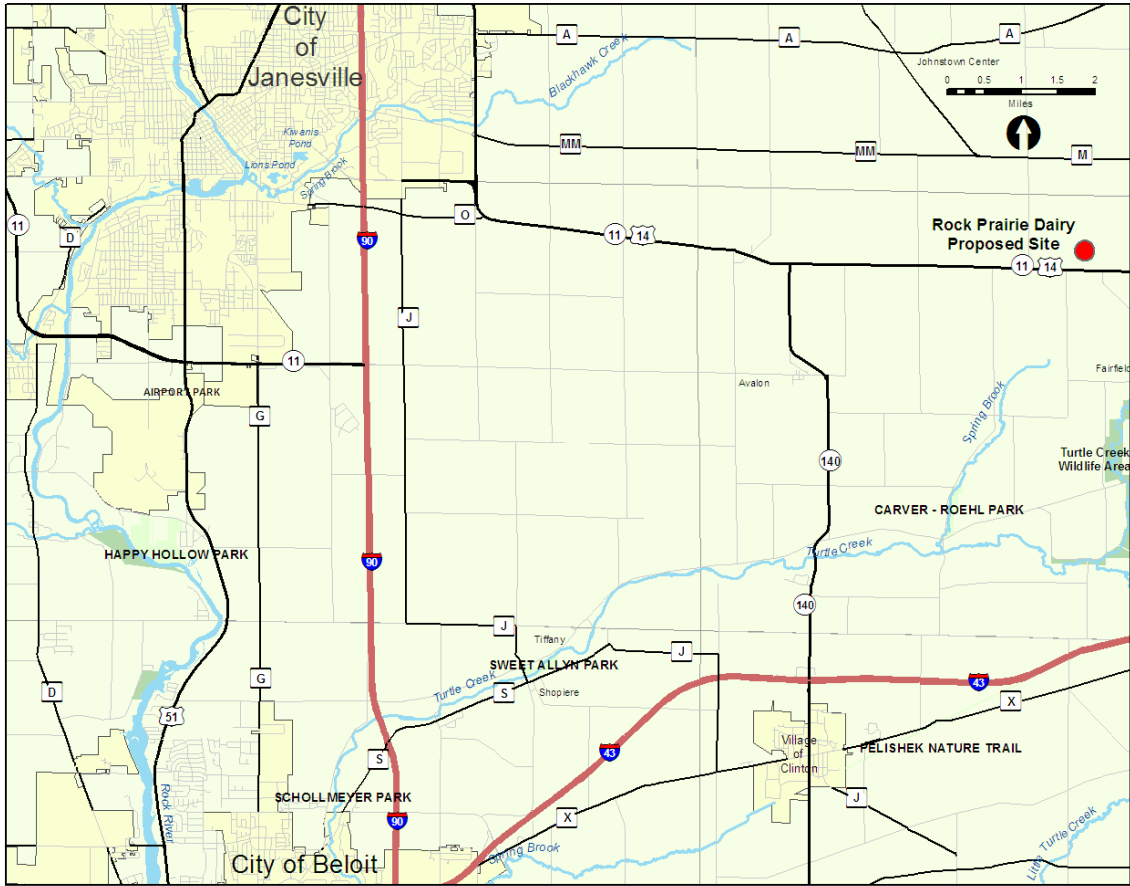


Map 1. Proximity of residences to proposed dairy.

Rock County, WI - Proposed 5,200 Cow Dairy



Map 2. Rock County, WI showing the location of the proposed dairy.



Map 3. Proposed Dairy Site With Named Waterways and Recreational Areas

Appendix B: Scoping Documents

Citizen Survey

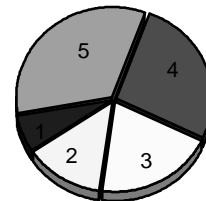
CAFOs have a complex and sometimes controversial relationship with the communities in which they are built. The large-scale farms are designed and built by private entities yet their influence can reach beyond property lines into the surrounding community. CAFOs are private decisions that become public issues. Although residents living near the Rock Prairie Dairy have little influence over the approval process, they are stakeholders whose perspective is important in assessing the potential health impacts of the operation. A citizen survey was developed and sent to the 118 residences identified as being within one mile of the RPD site and original planned center pivot manure application fields. Stamped return envelopes were provided as well as an internet based survey alternative. A total of 44 surveys were received. The following is a summary of the survey responses:

Question #1

On a scale of 1-5, with 1 being the least and 5 being the most, how concerned are you about the impact Rock Prairie Dairy will have on your health?

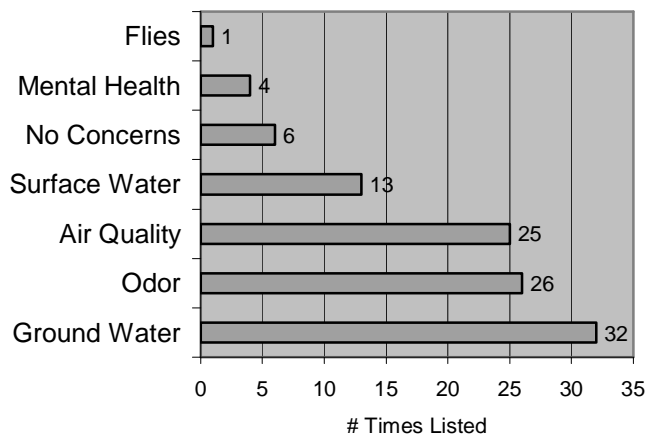
Average response: 3.91

Level of Concern



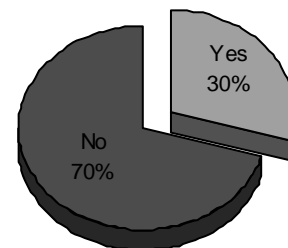
Question #2

What specific health issues are you concerned about with the building of a large dairy farm in your community?



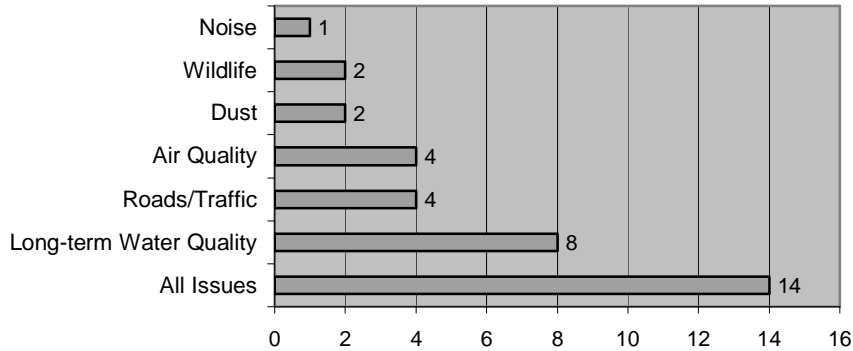
Question #3

Do you feel there is adequate information available to the public on the RPD's operational activities and strategies to reduce potential negative health affects?



Question #4

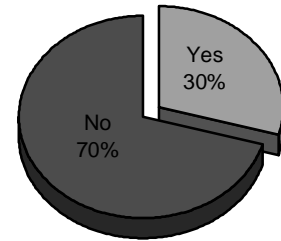
Are there any specific health issues you feel haven't been properly addressed enough or at all by the planning and regulation process at this point?



Question #5

Have you been informed of a citizen complaint procedure for health issues that may arise (e.x. odors or dust) and if so, how effective do you feel it will be? Do you have any suggestions for making it more effective?

No suggestions were given. Four who responded yes indicated the existing procedure was not effective



Question #6

Do you have any other comments or concerns?

Comment/Concern	#
Livestock Siting Law inadequate to protect citizens	6
Concerned RPD will lower property values	5
Concerned residential wells may dry up	3
Valuable farm land being lost at the facility site	3
Unsure of overall long-term negative effects	2
RPD will have no significant negative impacts	2
Operation will negatively impact area aesthetics	2
No baseline data available for studying effects on area wells	1
Historical flooding on facility property may cause manure runoff	1
Possible increase in cancer due to facility pollution	1

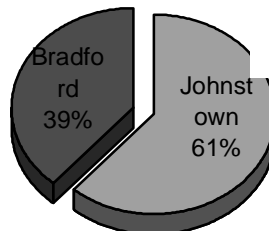
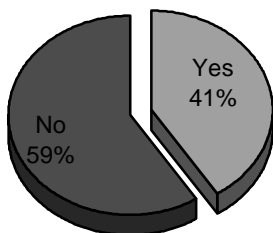
Question #7 Survey Respondent Information

Average Age – 57

Occupation Farming Related

Township

Average Years Lived in Area – 28



HIA Scoping Worksheet

Project:	Rock Prairie Dairy					
Health Determinant:	Surface Water Quality					
Geographic Scope:	Turtle and Blackhawk Creek watersheds					
Existing Conditions Research Questions	Impact Research Questions	Indicators	Data Sources	Methods	Priority	Notes
Proximate Effects						
What is the existing water quality of area waterways?	How will this project affect surface water quality?	E. coli, phosphorous, streamflow, Blue Green algae presence	EIS, DNR, USGS, citizen monitoring groups, parks dept., UWEX, Land Conservation	Review of literature, data	HIGH	
Health Outcomes						
How does existing surface water quality affect health?	What surface water quality changes would be anticipated that would impact the health of those in the geographic scope?	Disease reporting, level of use of waterways	Parks dept, planning, land conservation, Disease data	Lit, data review	HIGH	
Vulnerable populations						
How do demographics of populations using waterways within the geographic scope near the proposed farm compare to characteristics of people living elsewhere?	Will the proposed farm adversely impact the surface water quality for people with social, economic, or education-related vulnerabilities?	Income, ethnicity/race, age data	Census	Qualitative description (lit review and review of available stats)	High	

HIA Scoping Worksheet

Project:	Rock Prairie Dairy					
Health Determinant:	Ground Water Quality					
Geographic Scope:	Area drawing from aquifer potentially impacted by proposed project					
Existing Conditions Research Questions	Impact Research Questions	Indicators	Data Sources	Methods	Priority	Notes
Proximate Effects						
What is the existing ground water quality in the area?	How will this project affect ground water quality?	Nitrate, bacteria, herbicide, pharmaceutical levels	RCHD, DNR	Data review	HIGH	
Health Outcomes						
How does existing ground water quality affect health?	What ground water quality changes would be anticipated that would impact the health of those in the geographic scope?	Disease reporting, level of use of waterways	Modeling, RCHD, DNR	Lit, data review	HIGH	
Vulnerable populations						
How do demographics of populations using waterways within the geographic scope near the proposed farm compare to characteristics of people living elsewhere?	Will the proposed farm adversely impact the ground water quality for people with social, economic, or education-related vulnerabilities?	Income, ethnicity/race, age data	Census	Qualitative description (lit review and review of available stats)	High	

HIA Scoping Worksheet

Project:	Rock Prairie Dairy				
Health Determinant:	Air Quality				
Geographic Scope:	Geographic extent will vary. Generally areas near farm site and land application sites.				
Existing Conditions Research Questions	Impact Research Questions	Indicators	Data Sources	Methods	Priority
Proximate Effects					
What are the existing levels of air pollution?	How will this project affect air quality	H ₂ S, PM 2.5 (particulates), dust, general odor levels	EIS, DNR air monitoring data, modeling	Review of literature, employment data	HIGH
Health Outcomes					
What is the current level of respiratory disease?	What air quality changes would be anticipated that would impact the health of those in the geographic scope?	Hospitalizations, school days missed due to respiratory illness, odor complaints	Hospitalization data, school district, Health Department complaint data	Lit, data review	HIGH
Vulnerable populations					
How do demographics of populations living near the proposed farm compare to characteristics of people living elsewhere?	Will the proposed farm adversely impact the air quality for people with social, economic, or education-related vulnerabilities?	Income, ethnicity/race, age data	Census	Qualitative description (lit review and review of available stats)	High

HIA Scoping Worksheet

Project:	Rock Prairie Dairy					
Health Determinant:	Economic Impact					
Geographic Scope:	Rock County and surrounding communities					
Existing Conditions Research Questions	Impact Research Questions	Indicators	Data Sources	Methods	Priority	Notes
Proximate Effects						
What are the existing economic conditions?	How will this project affect the local economy?	Employment rate, tax revenue	WI employment rate reports	Review of literature, employment data	HIGH	Look for literature studying economic impact of CAFOs
Health Outcomes						
What are the current mental health/quality of life conditions that may be associated with economic conditions?	What economic impacts will occur that will impact our community? What impact did the owner's other farm have on the community in Nebraska?	People reporting depression, quality of life issues	Local studies, surveys	Literature review	HIGH	May be difficult to measure health outcomes
Vulnerable populations						
How do demographics of populations living near the proposed farm compare to characteristics of people living elsewhere?	Will the proposed farm adversely impact people with social, economic, or education-related vulnerabilities?	Income, ethnicity/race, age data	Census	Qualitative description (lit review and review of available stats)	High	

The pathway diagram was developed during the scoping phase of the HIA to help conceptualize what health outcomes might be investigated in the assessment. The pathway diagram was utilized as a tool for brainstorming potential health outcomes related to the dairy operation, however, there is not necessarily a direct causal relationship between boxes of the diagram.

Pathway Diagram

